FINAL
COMAL COUNTY
REGIONAL HABITAT CONSERVATION PLAN
ENVIRONMENTAL IMPACT STATEMENT

August 1, 2014

Type of Action: Administrative

Lead Agency: U.S. Department of the Interior
Fish and Wildlife Service

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Abstract: Comal County, Texas, is applying for an incidental take permit (Permit) under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended 16 USC § 1531, et seq. (ESA), to authorize the incidental take of two endangered species, the golden-cheeked warbler (*Dendroica chrysoparia*) and the black-capped vireo (*Vireo atricapilla*), referred to collectively as the "Covered Species." In support of the Permit application, the County has prepared a regional habitat conservation plan (Proposed RHCP), covering a 30-year period from 2012 to 2042. The Permit Area for the Proposed RHCP and the area of potential effect for this Environmental Impact Statement (EIS) is Comal County in central Texas.

The requested Permit would authorize the following incidental take and mitigation for the golden-cheeked warbler:

Take: As conservation credits are created through habitat preservation, authorize up to 5,238 acres (2,120 hectares) of golden-cheeked warbler habitat to be impacted over the 30-year life of the Proposed RHCP.

Mitigation: Establish approximately 6,548 acres (2,650 hectares) of preserves in Comal County to mitigate for 5,238 acres of impact at varying mitigation ratios.

The requested Permit would authorize the following incidental take and mitigation for the black-capped vireo:

Take: Up to 1,000 acres (405 hectares) of black-capped vireo habitat to be impacted over the life of the Proposed RHCP.

Mitigation: The County would provide mitigation for any impacts it authorizes to the black-capped vireo in one of the following ways:

- Acquisition of credits from a Service-approved conservation bank for the black-capped vireo, the service area of which includes Comal County or, in the event the service area does not include Comal County, if the Service has specifically approved the sale of credits to Comal County.
- Acquisition (in fee title or conservation easement) and operation, management, and monitoring in perpetuity of habitat for the black-capped vireo, including as a component of a preserve also providing habitat for the golden-cheeked warbler.
- On a case-by-case basis, acceptance of conservation bank credits held by an applicant and not previously used as mitigation for prior ESA authorizations.
- On a case-by-case basis, with prior Service approval, acceptance of conveyance of fee title or perpetual conservation easement on black-capped vireo habitat in lieu of participation fees under the RHCP.

In all events, no impacts to the black-capped vireo would be authorized through the RHCP unless and until sufficient black-capped vireo conservation credits have been obtained in one or more of the foregoing manners.

In addition, the Proposed RHCP provides for: 1) a prioritized research program for the Covered Species and other species of interest (Evaluation Species) in the County; 2) a program to raise public awareness about the Covered and Evaluation Species; and 3) a finance plan that includes an endowment that would fund management, in perpetuity, of preserves established and managed under the Proposed RHCP.

In developing the RHCP, a number of alternatives were considered. Three have been carried forward for impact analysis in this EIS

- Alternative A – No Action
- Alternative B – Proposed Comal County RHCP (Proposed Action)
- Alternative C – Reduced Take RHCP

The natural resource and socioeconomic impacts associated with implementing any of the three alternatives have been assessed and described in this EIS.

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EXECUTIVE SUMMARY

BACKGROUND

This Environmental Impact Statement (EIS) describes the potential impacts of the proposed issuance of an incidental take permit (Permit) to Comal County (County) and the implementation of the Comal County Regional Habitat Conservation Plan (RHCP), which collectively authorize incidental take of two endangered bird species under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, 16 USC § 1531, et seq. (ESA). The Federal lead agency with responsibility for issuing the Permit is the U.S. Fish and Wildlife Service (Service).

The Permit for which Comal County seeks approval by the Service would authorize incidental take of the endangered golden-cheeked warbler (*Dendroica chrysoparia*) and black-capped vireo (*Vireo atricapilla*) (collectively referred to herein as "Covered Species") due to otherwise lawful activities, such as clearing potential habitat for the purposes of land development.[1]

PURPOSE AND NEED FOR ACTION

The purpose of providing the requested Permit to Comal County is to authorize the take of federally listed species in the context of an RHCP. The need for this action is to respond to an application for the Permit from Comal County. In addition to providing context for the requested Permit, the purposes of the Comal County RHCP are to: 1) contribute to and facilitate the conservation of the Covered Species while preserving open space in the County; 2) help conserve and obtain information about the Evaluation Species[2] and provide that information to the Service; and 3) provide the affected landowners of Comal County a more efficient process for complying with the ESA compared to individual permitting and consultation processes with the Service.

ALTERNATIVES ELIMINATED FROM CONSIDERATION

The National Environmental Policy Act requires evaluation only of "reasonable alternatives" (40 CFR § 1502.14(a). In the NEPA context, reasonable alternatives are those that are practical or feasible both technically and economically (CEQ 40 FAQs Answers to 1-10 found at: http://ceq.hss.doe.gov/nepa/regs/40/1-10.HTM). During the development of the RHCP, two alternative proposals were considered, but eliminated from detailed analysis. They are described below and in more detail in Chapter 2.

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[1] In this document, the term "warbler" always refers to the golden-cheeked warbler, and the term "vireo" always refers to the black-capped vireo.

[2] "Evaluation Species" are non-listed species that have been petitioned for Federal listing or are sufficiently rare within the County that a reasonable possibility exists that they will be listed during the Permit term. They are not covered by the Permit.

Comal County Land Use Regulation-Based RHCP

Under this alternative, an RHCP would be developed based on land use regulation. Comal County would identify areas significant to the conservation of the Covered Species and through a land use regulation effort, limit development activities in those areas. This alternative would have reduced take of the listed species; and was considered primarily because precedents exist in other states for this approach, most recently by a proposed zoning-based, county-wide Multi-species Conservation Plan in Pima County, Arizona.

This alternative would provide benefits to Comal County in terms of streamlining the development process relative to compliance with the ESA, and it would provide a significant measure of protection for the Covered and Evaluation Species. However, the alternative was rejected because the County does not have sufficient authority under state law to implement land use regulation.

Comal County RHCP with Upfront Purchase of All Preserves

This alternative would be similar to the Proposed RHCP except all the preserve areas would be identified and acquired within six years of the plan's authorization.[3] Identifying and establishing all the preserves upfront might expedite conservation of endangered species in Comal County.

This alternative was rejected as impracticable, because the costs associated with acquiring all the needed land in such a short timeframe and before the plan generates substantial income to help defray costs would not be economically feasible for the County.

ALTERNATIVES CONSIDERED

Three alternatives were selected for analysis in this EIS:

- Alternative A – No Action
- Alternative B – Proposed Comal County RHCP (Proposed Action)
- Alternative C – Reduced Take RHCP

These three alternatives are described below and summarized in Table ES-1.

[3] According to state law acquisition of all habitat preserves identified in an RHCP must be completed no later than the sixth anniversary of the date the Federal permit was issued (Texas Parks and Wildlife Code § 83.018(c)).

Table ES-1. Comparison of alternatives considered.

Alternative Elements		Alternative A – No Action	Alternative B – Proposed RHCP	Alternative C – Reduced Take RHCP
Covered Species		All federally listed species in the County in individual sections 7 and 10(a) consultations.	Golden-cheeked warbler Black-capped vireo	Golden-cheeked warbler
Estimated Covered Take over Life of RHCP	Golden-cheeked Warbler	Sections 7 and 10(a) authorized incidental take unknown in frequency, but expected to occur.	Direct and Indirect Impacts: 5,238 acres.	Direct and Indirect Impacts: 2,095 acres.
	Black-capped Vireo	Sections 7 and 10(a) authorized incidental take unknown in frequency, but expected to occur.	Direct Impacts: 1,000 acres.	Not covered for take.
Mitigation or Conservation Measures	Golden-cheeked Warbler	For projects receiving coverage under section 7 or 10(a), consulting with the Service, for every acre of habitat disturbed at least 1 acre of habitat would be protected on a case-by-case basis.	To mitigate for 5,238 acres of impact at varying mitigation ratios, establish an estimated 6,548 acres of preserve(s)/ conservation bank(s) in the County. Impacts to warbler habitat would be primarily mitigated at a mitigation-to-take ratio of 1:1 (up to 3:1 in some instances; see Section 4.3.1.3 in RHCP).	Establish preserve(s)/conservation bank(s) in the County. Impacts to warbler habitat would be primarily mitigated at a 1:1 ratio.
	Black-capped Vireo	For projects receiving coverage under section 7 or section 10(a), mitigation would be determined on a case-by-case basis	To mitigate for 1,000 acres of impact, acquire credits from a Service-approved conservation bank; acquire, preserve, and manage in perpetuity black-capped vireo habitat; and acknowledge black-capped vireo conservation bank credits owned by an applicant. Impacts to vireo habitat would be primarily mitigated at a 1:1 ratio (up to 2:1 mitigation-to-take ratio in some instances; see Section 4.4.1.2 in RHCP).	Not covered for take; no mitigation required.
Research Program		None.	Fund and manage research $10,000/yr for a cumulative cost of $429,309.	Fund and manage research $8,000/yr for a cumulative cost of $343,447.
Public Awareness Program		None.	Fund and manage public awareness programs $5,000/yr for a cumulative cost of $214,655.	Fund and manage public awareness programs $4,000/yr for a cumulative cost of $171,724.
Endowment		None.	Establish a total endowment of $16,500,000 by end of Year 30.	Establish a total endowment of $6,600,000 by end of Year 30.
Finances	Costs	Costs of consultations and mitigation borne by project proponents on a case-by-case basis.	$133,913,468	$55,124,166
	Income		$135,087,982	$55,529,414

Alternative A – No Action

The No Action alternative assumes that the Service would not issue a regional permit for Comal County. Although development could occur on lands not occupied by endangered species, development activities that would cause take of listed species would require individual authorizations through section 7(a)(2) or section 10(a)(1)(B) of the ESA. Individual entities may also elect to avoid take on properties containing endangered species by avoiding direct and indirect impacts on the species (i.e., take avoidance).

Development projects, including County infrastructure projects, affecting endangered species habitat would have the potential to be covered by individual authorizations, provided that mitigation was included through preserve land dedication, payment of mitigation fees, or other suitable instruments negotiated between the Service and the project proponent. Processing individual section 7(a)(2) consultations and section 10(a)(1)(B) permits could cause delays in permit issuance by the agency or approval of a proposed project, as permit processing by the Service often takes one to two years, or more.

Alternative B – Proposed Comal County RHCP (Proposed Action)

Under Alternative B, the Service would approve the Proposed RHCP and issue a section 10(a)(1)(B) incidental take permit for Comal County for those landowners who choose to utilize the regional Permit. The Service would continue to process applications for individual section 10(a)(1)(B) incidental take permits for those who choose not to participate in the RHCP. The Permit would be held by the County and cover a 30-year period starting from the date of issuance. The Proposed RHCP would streamline ESA compliance by coordinating and standardizing mitigation efforts for incidental take of the Covered Species. Through the RHCP, Comal County would preserve and manage, in perpetuity, habitat for the Covered Species within Comal County (mitigation) and support research and public awareness programs (conservation measures). These programs would be designed to assess species status within the RHCP preserve system, evaluate the effectiveness of the RHCP, and heighten public awareness of the need to conserve endangered and rare species within the County. Specifics of Alternative B are provided below.

Golden-cheeked Warbler

Under Alternative B, the County would encourage landowners participating in the RHCP to avoid and minimize impacts to golden-cheeked warbler habitat by providing information on the location of potential habitat on the subject property and offering assistance on how impacts to that habitat might be avoided or reduced. Habitat preservation would also be encouraged through a public awareness program about the appropriateness and value of conserving the warbler and its habitat. Disturbance during the warbler's nesting season would be minimized through temporal and spatial restrictions on clearing activities that are made conditions of voluntarily participating in the RHCP. Large, contiguous blocks of warbler habitat would be set aside as preserves and managed for the benefit of the warbler in perpetuity.

The requested Permit would authorize the following incidental take and provide the following mitigation for the golden-cheeked warbler:

Take: As conservation credits are created through habitat preservation, authorize up to 5,238 acres (2,120 hectares) of golden-cheeked warbler habitat to be impacted over the 30-year life of the Proposed RHCP. This level of take is predicated on a plan participation rate of 50 percent. In the event that demand for participation in the Proposed RHCP is higher than anticipated, a future amendment of the Permit to authorize additional take and mitigation would be necessary.

Mitigation: Establish approximately 6,548 acres (2,650 hectares) of preserve(s) in the County to mitigate for 5,238 acres of impact at varying mitigation ratios.

Black-capped Vireo

No records exist to date for black-capped vireos in Comal County. Suitable habitat is present, however, and the species is reasonably certain to occur in the County. The requested Permit would authorize the following incidental take and mitigation for the black-capped vireo:

Take: Up to 1,000 acres (405 hectares) of black-capped vireo habitat may be impacted over the life of the Proposed RHCP.

Mitigation: The County would provide mitigation for any authorized impacts to the black-capped vireo in one of the following ways:

- Acquisition of credits from a Service-approved conservation bank for the black-capped vireo the service area of which includes Comal County or, in the event the service area does not include Comal County, if the Service has specifically approved the sale of credits to Comal County.
- Acquisition (in fee title or conservation easement) and operation, management, and monitoring in perpetuity of habitat for the black-capped vireo, including as a component of a preserve also providing habitat for the golden-cheeked warbler.
- On a case-by-case basis, acceptance of conservation bank credits held by an applicant and not previously used as mitigation for prior ESA authorizations.
- On a case-by-case basis, with prior Service approval, acceptance of conveyance of fee title or perpetual conservation easement on black-capped vireo habitat in lieu of participation fees under the RHCP.

In all events, no impacts to the black-capped vireo would be authorized through the RHCP unless and until sufficient black-capped vireo conservation credits have been obtained in one or more of the foregoing manners.

Participation

Participation in the Proposed RHCP would be voluntary. While the RHCP estimates that participation levels would range from 20 to 50 percent, for the purposes of this impact analysis, it is assumed that 50 percent of future development projects in golden-cheeked warbler habitat in

Comal County would participate in the RHCP. The rationale for this assumption can be found in Chapter 2, Section 2.3 of this document.

The Proposed RHCP would benefit the citizens of Comal County by creating a voluntary, fair, simple, and certain process for obtaining incidental take authorization. Costly project delays would be reduced for participating landowners. It is likely that this simplified process, the relatively low cost of permitting take compared with an individual HCP, and the regulatory certainty it provides would encourage more landowners to voluntarily seek authorization for incidental take than would be the case under the No Action alternative. Thus, an RHCP would provide assurances to participants and other local interests and conserve the endangered species habitat in Comal County in a manner consistent with local community values and resources.

Alternative C – Reduced Take RHCP

The Reduced Take RHCP would be the same as the Proposed RHCP except:

- fewer species (one rather than two) would be covered by the incidental take permit;
- the amount of covered take, and the mitigation required for the take, would be reduced; and
- the anticipated participation rate would be at 20 percent, the low end of the range identified above and discussed in Chapter 2, Section 2.3 of this document. Compared to the Proposed RHCP, a lower participation rate in this alternative is consistent with the reduced number of species and amount of take covered by the permit.

This alternative assumes that the Covered Species would be limited to the golden-cheeked warbler. The black-capped vireo would not be covered by the requested permit. This may be justified because of uncertainty regarding the occurrence of the species in Comal County; a relatively small amount of suitable black-capped vireo habitat is present in the County, and the bird has not been recorded there. As a result, nothing is known about the species' distribution and population size in Comal County.

Compared to the Proposed RHCP, the lower anticipated participation rate (20% rather than 50%) would reduce impacts of participating projects to golden-cheeked warbler habitat from 5,238 acres to 2,095 acres (848 hectares), a 60 percent reduction. Mitigation for 2,095 acres of impact would include the establishment of up to an estimated 2,619 acres (1,060 hectares) of preserves. Similar to Alternative B, the mitigation ratio in Alternative C would vary according to various conditions, including habitat quality, with an estimated 80 percent of participating projects mitigating at 1:1, 15 percent mitigating at 2:1, and 5 percent mitigating at 3:1. Once the mitigation credits (an estimated 2,619 credits) were exhausted, no additional take or mitigation would be authorized for the golden-cheeked warbler under the plan without an amendment to the RHCP. The research and public awareness programs identified in the Proposed Action would also occur under this alternative, except on a lower scale with less allotted funding (see Table ES-1).

SUMMARY OF PROJECT IMPACTS

Table ES-2 summarizes the environmental consequences of Alternative A (No Action), Alternative B (Proposed RHCP), and Alternative C (Reduced Take RHCP).

Assumptions Underlying Identification of the Affected Environment and the Impact Analysis

For the impact analysis in this EIS, the No Action alternative is defined as the conditions that can be expected if the Service does not implement the Proposed Action (approval of the Proposed HCP and issuance of the Permit to Comal County) or the alternative action (Alternative C). Under No Action, the existing trends of land development growth in Comal County would continue over the next 30 years, and authorization for impacts to threatened and endangered species would continue to be available under the ESA. The Proposed RHCP does not take the place of existing ESA compliance mechanisms. Rather, it provides a voluntary, alternative means of compliance with the ESA for landowners in Comal County. Issuing the requested Permit, therefore, is not an "indispensable prerequisite" or an "essential catalyst" for land development in the County, and only the most general causal relationship can be established between issuance of the Permit and potential impacts of development. Similarly, just as implementing an RHCP would not enable land development; failure to implement an RHCP would not impede development because alternative means of ESA compliance are available.

It is possible that the greater efficiency and lower cost of ESA compliance offered by the RHCP could affect the timing and configuration of specific developments. Under an RHCP, development may happen either somewhat faster than the No Action alternative, or there may be somewhat more or less impact to habitat than under the No Action alternative. Conversely, implementation of the RHCP will encourage increased compliance with the ESA by providing a more efficient alternative for ESA authorization. The existence of the RHCP may, in fact, reduce current levels of unpermitted and, therefore, unmitigated loss of Covered Species habitat. This increase in compliance and the associated mitigation may, in fact, offset any marginal increases in impact associated with the RHCP.

These differences between the No Action and Proposed Action development scenarios are likely to be minor for several reasons. First, the RHCP is unlikely to induce market demand or to in any other way be a "market maker" for development. It is unlikely that a developer would perceive of the RHCP alone as justifying moving into the market when economic, legal, and demographic factors do not support doing so. Second, even for those projects for which ESA compliance is a driver in terms of timing and configuration, not all will necessarily find the RHCP to be more desirable than the other development compliance options. Finally, for those few projects that perceive of ESA compliance timing and cost as defining the tipping point for when to develop and how much habitat to impact, not all of them will find the difference the RHCP makes in general to make the difference specifically for the project. For these reasons, it is logical to assume that the Proposed RHCP, compared to the No Action alternative, will have some impacts on timing of development within the County over the next 30 years, it is unlikely that overall expected development would be materially increased by the RHCP.

While Federal regulatory programs other than the ESA might trigger more comprehensive environmental assessment documentation in particular development project scenarios, it is unlikely that a county-wide EIS-level review would be compiled for any one project or in the aggregate. By contrast, this EIS provides a detailed impact assessment of relevant impacts for both the No Action and the Proposed Action throughout the County where the Covered Species may exist. This means that if the Proposed Action is implemented, the relevant impacts of *all* landowner ESA compliance options will have been considered through this EIS. Although this does not relieve landowners who choose options other than the RHCP from compiling necessary environmental impact assessments at the time they develop their land, it does provide assurance that the RHCP is implemented with a full understanding of the possible impact scenarios regardless of level of landowner participation in the RHCP, and this EIS will serve as a valuable reference point for developments that do not use the RHCP compliance option.

Unavoidable and Irreversible Impacts and Short-term Use of the Environment vs. Long-term Productivity

Unavoidable adverse impacts are effects that cannot be avoided due to constraints in alternatives. Although alternatives which avoid or minimize impacts to the human environment should be analyzed in an EIS, NEPA does not require that an agency reach a substantive result; rather, NEPA implementing regulations require that the federal action agency "use the NEPA process to identify and assess reasonable alternatives to the proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment." NEPA does not require that an alternative or alternatives that would avoid or minimize the impacts of a proposed action be chosen, only that such alternatives be analyzed (40 CFR § 1500.2(e)). It is not always possible to avoid adverse impacts from implementation of an alternative.

Since development in Comal County would continue as trends predict, all three alternatives discussed in this EIS would result in unavoidable adverse impacts that would include loss of vegetation, wildlife, and endangered species habitat in Comal County, as well as adverse impacts to water resources. Under the RHCP action alternatives, mitigation measures for the Covered Species should minimize lost habitat for those species (and associated vegetation communities and wildlife). Unavoidable adverse impacts would be offset by the preservation of larger blocks of unfragmented habitat (at least 500 acres [202 hectares] in each preserve) than would occur under the No Action alternative. As a result, both action alternatives would result in fewer unavoidable impacts than would No Action. The Proposed RHCP provides for more habitat protected in large preserves than does the Reduced Take RHCP (6,548 vs. 2,619 acres); therefore, the Proposed RHCP would result in fewer unavoidable impacts compared to the Reduced Take RHCP.

Under all alternatives, the loss of Covered Species preferred habitat in Comal County would result in irreversible habitat loss for both the golden-cheeked warbler and the black capped vireo. However, under the RHCP action alternatives, the mitigation lands would help preserve large, unfragmented blocks of habitat for these species; thus, species viability should not be adversely affected. Under both RHCP action alternatives, expenditures by the County for acquisition and

permanent management of mitigation properties would be irreversible. Expenditures for mitigation and monitoring activities for the duration of the Permit would be irretrievable.

All three alternatives would result in a long-term decrease in habitat for the Covered Species in Comal County because of human development; however, both RHCP action alternatives, especially the Proposed RHCP, are expected to conserve suitable habitat for these species in the long term and may, in fact, potentially further the species' recovery needs, particularly through the acquisition and management of large swaths of suitable species habitat in the County in perpetuity.

Table ES-2. Summary of environmental consequences of each alternative.

Impact Topic	Alternative A (No Action) *Land development would proceed in the County, with Endangered Species Act (ESA) compliance for development-related impacts accomplished through individual section 10(a)(1)(B) permits and section 7(a)(2) consultations.*	Alternative B (Proposed RHCP) *For purposes of analysis, assumption that land development would proceed in the County, with 50% of the development projects participating in the Proposed RHCP. For the remaining 50% of land development, ESA compliance for development-related impacts would be the same as under No Action.*	Alternative C (Reduced Take RHCP) *For purposes of analysis, assumption that land development would proceed in the County, with 20% of the development projects participating in the Reduced Take RHCP. For the remaining 80% of land development, ESA compliance for development-related impacts would be the same as under No Action.*
Water Resources	Future development on an estimated 80,427 acres would result in: 1) increased contamination of both surface water and groundwater; 2) reduced aquifer recharge due to increased impervious cover; and 3) an overall decrease in water availability as current water resources become fully allocated. Existing regulations would protect water resources to some extent, and some fragmented habitat would be set aside as mitigation in individual ESA compliance actions, but No Action may still result in minor adverse impacts to the quality of groundwater and surface water, and moderate adverse impacts to water availability.	Overall, adverse impacts on water resources would be similar to those under Alternative A. Specifically, potential adverse impacts on water resources of issuing the requested Permit and the resultant clearing of 6,238 acres of Covered Species habitat would be indirect and minor. An estimated 7,548 acres of habitat preserved as a result of the Proposed RHCP would be greater than the amount of habitat preserved under No Action and would have a minor, indirect, beneficial impact on water resources. In sum, compared to No Action, the Proposed RHCP is expected to result in a minor reduction in adverse impacts to water resources.	Overall, adverse impacts on water resources would be similar to those under Alternative A. Compared to Alternative B, adverse impacts would be reduced because only 2,095 acres of vegetation would be cleared as a result of issuing the incidental take permit. Potential beneficial impacts of preserving an estimated 2,619 acres of vegetation would be greater than under Alternative A but not as great as under Alternative B. In sum, compared to No Action, the Reduced Take RHCP is expected to result in a negligible reduction in adverse impacts to water resources.
Vegetation	The expected increase in development and urbanization would result in moderate, direct and indirect, adverse impacts on native vegetation. When landowners comply with the ESA, some areas of habitat would be preserved as mitigation on a case-by-case basis and would result in minor beneficial impact on vegetation in the County. The net impact to native vegetation is expected to be adverse and moderate.	Overall, adverse impacts on native vegetation would be similar to those under Alternative A. Specifically, potential adverse impacts on native vegetation of issuing the requested Permit and of clearing 6,238 acres of Covered Species habitat would be minor. An estimated 7,548 acres of habitat preserved as a result of the Proposed RHCP would be greater than the amount of habitat preserved under No Action and would have a minor beneficial impact on native vegetation. In sum, compared to No Action, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to native vegetation.	Overall, adverse impacts on native vegetation would be similar to those under Alternative A. Compared to Alternative B, adverse impacts would be reduced because only 2,095 acres of native vegetation would be cleared as a result of issuing the incidental take permit. Potential beneficial impacts of preserving an estimated 2,619 acres of native vegetation would be greater than under Alternative A but not as great as under Alternative B. In sum, compared to No Action, the Reduced Take RHCP is expected to result in a negligible reduction in adverse impacts to native vegetation.

Table ES-2. Summary of environmental consequences of each alternative, continued.

Impact Topic	Alternative A (No Action)	Alternative B (Proposed RHCP)	Alternative C (Reduced Take RHCP)
General Wildlife	The expected increase in development and urbanization has the potential to cause moderate, direct and indirect adverse impacts on most wildlife species, mainly by habitat conversion, fragmentation, or removal. An exception would be for wildlife species that thrive with human cohabitation (e.g. squirrels, raccoons), which may experience minor, indirect, beneficial impacts. Mitigation for development on endangered species habitat would result in minor, indirect, beneficial impacts on wildlife. The net impact to wildlife is expected to be adverse and moderate.	Overall, adverse impacts on wildlife would be similar to those under Alternative A. Specifically, potential adverse impacts on wildlife and their habitat of issuing the requested Permit and of clearing 6,238 acres of Covered Species habitat would be minor. An estimated 7,548 acres of habitat preserved as a result of the Proposed RHCP would be greater than the amount of habitat preserved under No Action and would have a minor beneficial impact on wildlife. In sum, compared to No Action, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to wildlife species.	Overall, adverse impacts on wildlife would be similar to those under Alternative A. Compared to Alternative B, adverse impacts would be reduced because only 2,095 acres of the natural environment would be lost as a result of issuing the incidental take permit. Thus, fewer adverse impacts on wildlife habitat would result. Potential beneficial impacts of preserving an estimated 2,619 acres of habitat would be greater than under Alternative A but not as great as under Alternative B. In sum, compared to No Action, the Reduced Take RHCP is expected to result in a negligible reduction in adverse impacts to wildlife species.
Golden-cheeked Warbler	Increased land development would result in moderate adverse impacts on the golden-cheeked warbler due to an estimated loss of 65,568 acres of potential habitat. When landowners comply with the ESA, mitigation for development on golden-cheeked warbler habitat would result in minor, indirect, beneficial impacts on the species. The net impact to the golden-cheeked warbler is expected to be adverse and moderate.	Overall, adverse impacts on the golden-cheeked warbler would be similar to those under Alternative A. Specifically, potential adverse impacts on the golden-cheeked warbler attributable to issuing the requested Permit and of clearing 5,238 acres of warbler habitat would be minor. 6,548 acres of preserves established as a result of the Proposed RHCP would be greater than the amount of golden-cheeked warbler habitat preserved under No Action and would have a minor beneficial impact on the species. In sum, compared to No Action, the Proposed RHCP is expected to result in a minor reduction in adverse impacts to the golden-cheeked warbler and its habitat.	Overall, adverse impacts on the golden-cheeked warbler would be similar to those under Alternative A. Adverse impacts would be reduced compared to those under Alternative B because only 2,095 acres of golden-cheeked warbler habitat would be cleared as a result of issuing the incidental take permit. Potential beneficial impacts of preserving an estimated 2,619 acres of golden-cheeked warbler habitat would be greater than under Alternative A but not as great as under Alternative B. In sum, compared to No Action, the Reduced Take RHCP is expected to result in a minor or negligible reduction in adverse impacts to the golden-cheeked warbler and its habitat.

Table ES-2. Summary of environmental consequences of each alternative, continued.

Impact Topic	Alternative A (No Action)	Alternative B (Proposed RHCP)	Alternative C (Reduced Take RHCP)
Black-capped Vireo	The anticipated increase in land development is expected to adversely impact some unknown portion of potential black-capped vireo habitat in the County, which is estimated to total only 492–3,591 acres. Given uncertainties about the presence of the black-capped vireo in the County and the small percentage of its total habitat that occurs there, the No Action alternative is unlikely to result in more than negligible-to-minor adverse impacts on this species.	Overall, adverse impacts on the black-capped vireo would be similar to those under Alternative A. The maximum amount of impact and mitigation (1,000 acres) authorized under the Proposed RHCP represents less than 0.07% of the potential black-capped vireo habitat in Texas and just 0.03% of potential black-capped vireo habitat in the United States. Therefore, the Proposed RHCP is expected to result in negligible adverse and beneficial impact to the black-capped vireo. In sum, compared to No Action, the Proposed RHCP is expected to result in a negligible reduction in adverse impacts to the black-capped vireo.	The black-capped vireo is not included as a Covered Species in Alternative C; therefore, potential impacts would be the same as under Alternative A.
Evaluation Species	Development on an estimated 80,427 acres and the associated impacts to water resources may lead to a decrease in the quality of Cagle's map turtle habitat and adversely affect the species. A decrease in water quality and quantity and impacts to caves may also adversely affect the obligate cave-dwelling Evaluation Species *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, *Phreatoceras taylori*, *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa*. When landowners comply with the ESA, some plots of habitat would be preserved as mitigation on a case-by-case basis and may result in minor beneficial impact on the Evaluation Species. The net impact to the Evaluation Species is expected to be adverse and moderate.	Overall, adverse impacts on the Evaluation Species would be similar to those under Alternative A. Specifically, authorized impacts to 6,238 acres of Covered Species habitat may result in minor, indirect adverse impacts to water resources and caves, and by extension, minor adverse impacts to the Evaluation Species. An estimated 7,548 acres preserved under this alternative may indirectly result in a minor improvement of water resources and preserve some caves. Research, database, and public awareness programs may also benefit these species. In sum, compared to No Action, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to these species.	Overall, adverse impacts on the Evaluation Species would be similar to those under Alternative A. Compared to Alternative B, adverse impacts would be reduced because only 2,095 acres of the natural environment would be lost as a result of issuing the incidental take permit. Thus, fewer adverse impacts on the species' habitat would result. Potential beneficial impacts of preserving an estimated 2,619 acres would be greater than under Alternative A but not as great as under Alternative B. Benefits derived from scaled-back research, database, and public awareness programs would also be somewhat reduced compared to Alternative B. In sum, compared to No Action, Alternative C would result in a negligible reduction in adverse impacts to the Evaluation Species.

Table ES-2. Summary of environmental consequences of each alternative, continued.

Impact Topic	Alternative A (No Action)	Alternative B (Proposed RHCP)	Alternative C (Reduced Take RHCP)
Other Protected Species	Increased development and encroachment into wildlife habitat may result in negligible- to-minor adverse impacts on the American peregrine falcon, arctic peregrine falcon, bald eagle, whooping crane, zone-tailed hawks, and Texas horned lizard. Development on an estimated 80,427 acres and the associated impacts to water resources may result in minor adverse impacts on the Cascade Caverns salamander, Comal blind salamander, Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter. Mitigation for development on endangered species habitat would result in negligible beneficial impacts to the Other Protected Species.	Overall, adverse impacts on the Other Protected Species would be similar to those under Alternative A. Specifically, authorized impacts to 6,238 acres of potential Covered Species habitat may slightly reduce the amount of habitat presently available for the avian species and the Texas horned lizard, but any adverse impact would be negligible. Adverse effects on water resources may result in negligible, indirect impacts to the aquatic species. Compared to No Action, the establishment and perpetual management of up to an estimated 7,548 acres of preserve is expected to result in a minor or negligible reduction in adverse impacts to the avian, amphibian, and aquatic Other Protected Species.	Overall, adverse impacts on the Other Protected Species would be similar to those under Alternative A. Regarding the other species in this category, compared to Alternative B, both adverse and beneficial impacts would be reduced because fewer acres of the natural environment would be lost or preserved under the authorization of the RHCP. Compared to No Action, Alternative C would result in a negligible reduction in adverse impacts to the Other Protected Species.
Socioeconomic Resources	Over the period 2009–2039, the average demographic and economic growth rate is expected to be somewhat slower than seen in the last decade. Rapid growth is expected to resume once the economy turns around; however, how soon this will occur and how vigorous the recovery will be are unknown. County revenues and services are expected to grow over the long term, but at a slower average rate than seen in the last decade. Landowners pursuing individual take permits could expect 1- to 2-year project delays, and costs for mitigating impacts on a case-by-case basis may accumulate to several millions of dollars, resulting in a moderate adverse impact to landowners. Processing individual permits in the County would have a minor adverse impact on the Service.	Demographic and economic growth would be the same as under Alternative A. The County would contribute an annual average of $1,440,000 to the RHCP (range: $0 to $2,883,869), causing the County to 1) divert funds from other uses or 2) raise property and/or sales tax rates. Either action would represent a minor adverse impact on the County. Elimination of a 1- to 2-year delay in permitting for 50% of projects and increased value of homes proximal to RHCP preserves would have minor beneficial impacts on the property tax base. Up to 7,548 acres of new green open space would become capital assets, representing a moderate beneficial impact to the County. Moderate beneficial financial impacts would accrue to RHCP participants who avoid the 1- to 2-year project delays expected under No Action. Over 30 years, the RHCP would generate a surplus of approximately $1,174,500.	Demographic and economic growth would be the same as under Alternative A. The County's average annual contribution to the RHCP would be reduced to $627,026 (range: $0 to $1,190,864), representing a minor adverse impact on the County. Elimination of a 1- to 2-year delay in permitting for 20% of projects and increased value of homes proximal to RHCP preserves would have minor beneficial impacts on the property tax base and moderate beneficial financial impacts to RHCP participants. Up to 2,619 acres of new green open space would become capital assets, a moderate beneficial impact to the County. Over 30 years, the Reduced Take RHCP would generate a surplus of approximately $769,265.

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CHAPTER 1 — PURPOSE AND NEED

1.1 INTRODUCTION

Comal County, Texas, is applying for an incidental take permit (Permit) under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, 16 USC § 1531 (ESA), to authorize the incidental take of two endangered bird species, the golden-cheeked warbler (*Dendroica chrysoparia*) and the black-capped vireo (*Vireo atricapilla*)(referred to collectively as the "Covered Species").

In support of the Permit application, the County has prepared a draft regional habitat conservation plan (RHCP), to cover a 30-year period. The area covered by the requested permit (Permit Area) and the RHCP is the entirety of Comal County, Texas (Figure 1-1).

In addition to the two Covered Species, nine Evaluation Species are addressed in the RHCP, but will not be covered by the requested Permit. These Evaluation Species are non-listed species that have been suggested for Federal listing in citizens' petitions to the Service or are sufficiently rare within the County that a reasonable possibility exists that they may be listed during the Permit term. The Evaluation Species are not covered by the Permit because too many uncertainties exist regarding their distribution, biology, and threats to their survival, including the potential impacts of actions covered by the Permit. Scientific information is lacking that could support the level of analysis required to meet the issuance criteria for incidental take authorization. However, the Comal County RHCP includes conservation measures, including dedication of RHCP funds towards the study of one or more of the Evaluation Species, which may benefit these species and help conserve them into the future. These conservation measures may also help facilitate obtaining incidental take coverage if these species become listed in the future and coverage for take is needed. Take of Evaluation Species could only be covered if the County applies for and the Service grants an amendment to the Permit. The Evaluation Species addressed in the RHCP are listed below.

Cagle's map turtle (*Graptemys caglei*)
a cave-obligate decapod (*Palaemonetes holthuisi*)
a cave-obligate amphipod (*Seborgia hershleri*)
a cave-obligate amphipod (*Texiweckelia relicta*)
a cave-obligate beetle (*Rhadine insolita*)
a cave-obligate harvestman (*Texella brevidenta*)
a cave-obligate spider (*Cicurina puentecilla*)
a cave-obligate spider (*Cicurina reclusa*)
a cave-obligate snail (nymph trumpet; *Phreatoceras taylori*)

As the RHCP program proceeds, the status of these species may be monitored and assessed, and the list of Evaluation Species may be updated. Over time, some species may be dropped from the list and others added.

Figure 1-1. Comal County, Texas, the Permit area for the proposed Comal County Regional Habitat Conservation Plan.

1.2 PURPOSE AND NEED

The Proposed Action is issuance by the Service of a county-wide section 10(a)(1)(B) permit approving the implementation of the Comal County RHCP (Proposed RHCP). Under the Proposed RHCP, proponents of a variety of projects that could take listed species, and which therefore must comply with the ESA, would have a voluntary means of achieving such compliance that may be more efficient, effective, and coordinated than would be the case under individual project approvals.

The purpose of the Proposed Action is to authorize take of federally listed species in the context of an RHCP. Some benefits of the implementation of the proposed Comal County RHCP include: 1) contributing to and facilitating the conservation of the Covered Species while preserving open space in the County; 2) helping conserve and obtain information about the Evaluation Species and providing that information to the Service; and 3) providing the affected landowners of Comal County a more efficient process for complying with the ESA compared to individual permitting and consultation processes with the Service.

The need for the action is Comal County's application for an incidental take permit. Section 10(a)(1)(B) of the ESA requires with respect to an application for an incidental take permit that the Service must issue such a permit if the Service finds, after opportunity for public comment, that the permit application and habitat conservation plan demonstrate that: 1) the taking will be incidental; 2) the applicant will minimize and mitigate the impacts of such taking to the maximum extent practicable; 3) the applicant will ensure that adequate funding will be available to implement the habitat conservation plan; 4) the taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild; and 5) the measures required by the Service as necessary or appropriate for the purposes of the habitat conservation plan will be met.

1.3 REGULATORY FRAMEWORK

1.3.1 Endangered Species Act

Section 9 of the ESA prohibits "take" of any federally listed endangered wildlife species (16 USC § 1538(a)). Take, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC § 1532(19)). Harm is defined in the Service's regulations as an act which actually kills or injures a listed species and may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding and sheltering" (50 CFR § 17.3). The Service defines "harass" as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it 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). If it is not possible to design an otherwise lawful land use activity so as to avoid take of a listed species, section 10(a)(1)(B) of the ESA (16 USC §1539(a)(1)(B)), authorizes the Service to issue an incidental take permit for non-Federal projects or activities not requiring Federal authorization or

funding. The permit allows the project proponent to take covered species, provided certain conditions are satisfied. These conditions include the preparation of a habitat conservation plan (HCP) outlining, among other things, the measures that the permittee will undertake to minimize and mitigate "to the maximum extent practicable" the impacts of the taking of the species.

1.3.1.1 The Concept and Benefits of a Regional Habitat Conservation Plan

Although the ESA does not specifically mention RHCPs, the *Endangered Species Habitat Conservation Planning Handbook* (HCP Handbook; USFWS and NMFS 1996) and the Addendum to the HCP Handbook (65 FR 35241) discusses the RHCP concept. In contrast to individual HCPs, an RHCP often covers a larger geographic area, numerous landowners, and multiple species. Local or regional governmental entities are often the applicant/permittee, and they commit to implement the mitigation plan contained in the RHCP. The Endangered Species HCP Handbook states as one of its "guiding principles" that the Service encourages state and local governments and private landowners to undertake regional and multi-species HCPs.

In addition to providing a participatory process for ESA compliance that is less burdensome for individual landowners, several other advantages of RHCPs have been identified by the Service (USFWS and NMFS 1996), each of which appears to be applicable to Comal County's proposed plan. These advantages are listed below, with the Service's language from the HCP handbook underlined. Each point has been expanded upon by the authors of the Proposed RHCP.

1. Maximize flexibility and available options in developing mitigation programs. Individual projects often face limited options when developing mitigation proposals because of individual applicants' limited financial resources or the lack of suitable habitat available for mitigation. Development of an RHCP facilitates a regional-scale approach to ESA permitting that leads to conservation of less fragmented tracts of habitat that are better for the species and potentially less costly to the applicants. The RHCP administrative entity enjoys improved mitigation "buying power" and can pool voluntary participant payments to acquire higher quality, contiguous tracts for conservation.
2. Reduce the economic and logistic burden of these programs on individual landowners. The RHCP approach introduces an economy of scale in terms of the basic logistical functions by establishing region-wide approach to impacts assessments and consolidating many of the administrative and other HCP processing steps into one permitting process.
3. Reduce uncoordinated decision making, which can result in incremental habitat loss and inefficient project review. The RHCP approach allows the Service to develop standardized criteria for plan participants, facilitating the Service's efforts to ensure that similarly situated projects are treated equally in terms of mitigation requirements.
4. Provide the permittee with long-term planning assurances and increase the number of species for which such assurances can be given. The regulatory certainty that will result from issuance of the Permit may reduce the legal and financial risks associated with public and private development and infrastructure planning.
5. Reduce the regulatory burden of ESA compliance for all affected participants. The Proposed RHCP will make it possible for each project that voluntarily participates in the

plan to obtain ESA authorization through a streamlined, efficient process potentially at less cost than obtaining individual section 10(a)(1)(B) permits and section 7(a)(2) consultations (see the HCP Handbook [USFWS and NMFS 1996]). While HCPs typically apply to projects without a Federal nexus, RHCP participation may streamline projects (including those of non-Federal governmental entities) that have other Federal nexi (e.g., a Clean Water Act section 404 permit application, Federal funding).

In addition to these benefits, the Proposed RHCP may also facilitate acquisition of Federal grants to Comal County through the Service's section 6 Habitat Conservation Plan Land Acquisition Program. Comal County has already been the beneficiary of the related Recovery Land Acquisition program. In 2007, Comal County applied for and received a $652,312.50 Recovery Land Acquisition Grant to purchase the 288.25-acre (117-hectare) Morton tract, which contains high-quality golden-cheeked warbler habitat and lies within a larger block of potential warbler habitat.[4] The County will preserve and manage the Morton tract (now the Morton Preserve) to benefit the golden-cheeked warbler and any other federally listed species potentially affected by activities on the property. Conservation of the Morton Preserve occurred apart from the County's request for an incidental take permit; however, the biological value of the Morton Preserve may be enhanced by the implementation of the conservation measures described in the draft RHCP.

1.3.2 National Environmental Policy Act

Issuance of a section 10(a)(1)(B) incidental take permit is considered a major Federal action and is therefore subject to requirements of the National Environmental Policy Act of 1969 (NEPA). The NEPA process ensures the analysis of all potential effects of the Federal action on the human environment through the preparation of an impact analysis document, in this case an EIS. The scope of the EIS covers the direct, indirect, and cumulative effects of incidental take and mitigation, as well as minimization measures proposed in the Comal County RHCP. NEPA requires that a reasonable range of alternatives be analyzed and that public participation is included in the planning and implementation of all actions.

1.3.3 Texas State Law Relevant to Regional Habitat Conservation Plans

Texas state law includes requirements for a local government's role in developing, adopting, approving, or participating in an RHCP (Senate Bill 1272, codified as Subchapter B, Chapter 83 of the Texas Parks and Wildlife Code). Chapter 83 requires the governmental entity participating in an RHCP to establish a Citizens Advisory Committee, appoint a Biological Advisory Team, comply with open records/open meetings laws, comply with public hearing requirements, provide a grievance process to Citizens Advisory Committee members, and acquire designated preserves by specific deadlines.

[4] Because the Morton tract (now the Morton Preserve) was acquired with ESA section 6 grant funds, it will not be used as mitigation or to generate mitigation credits in the RHCP.

Under Chapter 83, governmental entities participating in an RHCP are prohibited from:

- Imposing any sort of regulation related to endangered species (other than regulations involving groundwater withdrawal) unless that regulation is necessary to implement an RHCP for which the governmental entity was issued a Federal permit (Texas Parks and Wildlife Code § 83.014(a)).
- Discriminating against a permit application, permit approval, or request for utility service to land that has been designated a habitat preserve for an RHCP (Texas Parks and Wildlife Code § 83.014(b)).
- Limiting water or wastewater service to land that has been designated as habitat preserve (Texas Parks and Wildlife Code § 83.014(c)).
- Requiring a landowner to pay a mitigation fee or set aside, lease, or convey land as habitat preserve as a condition to the issuance of a permit, approval, or service (Texas Parks and Wildlife Code § 83.014(d)).

In addition to the above prohibitions, Chapter 83 stipulates that the mitigation included in an RHCP, including any participation fee and the size of the habitat preserve, must be based on the amount of harm to each endangered species the plan will protect. However, after notice and hearing, an RHCP may include such measures if they are based on the Service's recovery criteria for the species covered by the plan (Texas Parks and Wildlife Code § 83.105).

Chapter 83 also stipulates that governmental entities participating in an RHCP must demonstrate that adequate sources of funding exist to acquire the land for designated habitat preserves within four years, or the voters must have authorized bonds or other financing in an amount equal to the estimated cost of acquiring all of the land needed for habitat preserves within four years (Texas Parks and Wildlife Code § 83.018). The four-year deadline is calculated from the time that a particular parcel is designated as proposed habitat preserve, a provision that gives governmental entities flexibility to acquire preserves as the plan is implemented.

1.4 DECISION NEEDED

The Service will decide whether to issue the Permit, which authorizes take of the Covered Species associated with the implementation of the Comal County RHCP. The Service's findings will be released in a record of decision.

CHAPTER 2 — ALTERNATIVES

2.1 ALTERNATIVES DEVELOPMENT

Federal regulations require the EIS to examine all reasonable alternatives to the Proposed Action, including "No Action" (40 CFR § 1502.14). The "No Action" analysis is needed to provide a benchmark against which the environmental effects of the action alternatives can be measured. Reasonable alternatives include those that are practical or feasible from a technical and economic standpoint and using common sense. Furthermore, reasonable alternatives, with the exception of No Action, must fulfill the purpose and need for an action to warrant definition as reasonable and worthy of detailed environmental impact analysis.

Three alternatives meet these criteria and were selected for analysis in this EIS:

- Alternative A – No Action
- Alternative B – Proposed Comal County RHCP (Proposed Action)
- Alternative C – Reduced Take RHCP

2.2 ALTERNATIVE A – NO ACTION

Under the No Action alternative, a county-wide RHCP would not be implemented, and a county-wide section 10(a)(1)(B) incidental take permit would not be issued. Compliance with the ESA in Comal County would continue to be conducted on a piecemeal basis. Non-Federal entities may elect to avoid take by avoiding endangered species habitat during the planning and construction phases of development projects (i.e., take-avoidance), or they may work with the Service to prepare individual HCPs for section 10(a)(1)(B) incidental take permits when take cannot be avoided. While habitat for federally listed species would likely be preserved as a result, this would be accomplished on a project-by-project basis, and would more likely result in relatively small and isolated tracts of undisturbed habitat.

Take-avoidance approaches have both advantages and disadvantages for the landowner. Simply avoiding take spares the landowner from participating in the long, complicated, and often costly HCP process. However, avoiding take may be extremely expensive or even infeasible if project objectives are to be met. The landowner is also vulnerable, having no legal protection if the project is later determined to cause a taking of a listed species, since there has been no Federal authorization for take. Securing an individual section 10(a)(1)(B) permit provides legal protection for incidental take, but the application process is lengthy (an estimated one to two years on average), often causing significant project delays, and preparation of the HCP and mitigation for the taking can be costly. While consultation under section 7(a)(2) could be a quicker option for incidental take authorization, such authorization could only be obtained for private entities if other Federal authorization or funding were necessary, and such authorization may not extend to all portions of the project that may impact listed species or listed species habitat.

2.3 ALTERNATIVE B – PROPOSED COMAL COUNTY RHCP (PROPOSED ACTION)

Under Alternative B, the Service could approve the Proposed RHCP and issue a section 10(a)(1)(B) incidental take permit to Comal County. The Permit would be held by the County and cover a 30-year period starting from the date of issuance. The RHCP, which would be implemented by Comal County, would likely streamline authorization of incidental take in areas of potential Covered Species habitat resulting from activities described in Chapter 3 of the RHCP. Participation in the RHCP would be voluntary; the Service would continue to process applications for individual section 10(a)(1)(B) incidental take permits for those who choose not to participate in the RHCP.

The Proposed RHCP would likely streamline ESA compliance by coordinating and standardizing mitigation efforts for incidental take of the Covered Species. Moreover, the RHCP may decrease fragmentation of Covered Species habitat by preserving larger, more contiguous areas of habitat than would be expected from small, individual efforts. Through the RHCP, Comal County would preserve and manage, in perpetuity, habitat for the Covered Species within Comal County and support research and public awareness programs. These programs would be designed to assess species status within the RHCP preserve system, evaluate the effectiveness of the RHCP, and heighten public awareness of the need to conserve endangered and rare species within the County. Essential features of the RHCP are discussed below.

Minimization Measures for the Covered Species: Clearing activities in, or within 300 feet (91.4 meters) of, Covered Species habitat, as determined by the landowner and the RHCP administrator from on-site assessments, would be conducted only during the time of year when the species are not present, unless a breeding season survey performed according to Service protocols by an ESA section 10(a)(1)(A)-permitted biologist indicates that no golden-cheeked warblers or black-capped vireos are present within 300 feet of the desired activity. Construction activities within, or within 300 feet of, Covered Species habitat may be conducted during the time of year when either species are present, as long as such construction follows permitted clearing conducted outside the relevant Covered Species' breeding season in a reasonably prompt and expeditious manner indicating a continuous activity.

Golden-Cheeked Warbler: Under Alternative B, incidental take would be authorized for impacts to as many as 5,238 acres (2,120 hectares) of golden-cheeked warbler habitat over the 30-year life of the Proposed RHCP. This acreage estimate is based on the assumption that 50 percent of the impacts to golden-cheeked warbler habitat in Comal County would be authorized through the RHCP. The County would mitigate for impacts to golden-cheeked warbler habitat by establishing a system of permanent preserves within the County that would serve as a conservation bank for impacts covered by the RHCP. Conservation credits from the bank would be sold to RHCP participants as mitigation for project impacts to the golden-cheeked warbler. The mitigation ratio would vary according to various conditions, including habitat quality, with an estimated 80 percent of participating projects mitigating at a ratio of 1:1, 15 percent mitigating at 2:1, and 5 percent mitigating at 3:1. Based on this premise, it is estimated that

approximately 6,548 acres (2,650 hectares) of preserves could be established to mitigate for 5,238 acres of impact to golden-cheeked warbler habitat.

Black-Capped Vireo: To date, no records for this species exist for Comal County; however, it is reasonably certain that black-capped vireos do occur there because suitable habitat is present (although estimates of the amount of habitat are relatively small), and black-capped vireos have been recorded in neighboring counties. When a proposed participant project is likely to impact the black-capped vireo or its habitat, incidental take would be authorized for impacts to as many as 1,000 acres (405 hectares) of black-capped vireo habitat over the 30-year life of the Proposed RHCP. The County will mitigate those impacts in one of the following ways:

- Acquisition of credits from a Service-approved conservation bank for the black-capped vireo the service area of which includes Comal County or, in the event the service area does not include Comal County, if the Service has specifically approved the sale of credits to Comal County.
- Acquisition (in fee title or easement) and operation, management, and monitoring in perpetuity of habitat for the black-capped vireo, including as a component of a preserve also providing habitat for the golden-cheeked warbler.
- On a case-by-case basis, acceptance of conservation bank credits held by an applicant and not previously used as mitigation for prior ESA authorizations.
- On a case-by-case basis, with prior Service approval, acceptance of conveyance of fee title or perpetual conservation easement on black-capped vireo habitat in lieu of participation fees under the RHCP.

In all events, no impacts to the black-capped vireo will be authorized through the RHCP unless and until sufficient black-capped vireo conservation credits have been obtained in one or more of the foregoing manners.

Participation: Participation in the Proposed RHCP would be voluntary and is estimated to range from 20 to 50 percent (see Chapter 2, Section 2.3 for the rationale for this estimate). To ensure that the amount of take covered by the Permit is not underestimated, the RHCP assumes that future participation will be at the high end of that range; that is, 50 percent. In the event that demand for participation in the Proposed RHCP is higher than 50 percent, a future amendment of the Permit to authorize additional take and mitigation may be necessary.

The level of expected voluntary participation in the Proposed RHCP is impossible to predict with precision at this time because few data are available from previous efforts. The one example available is the Balcones Canyonlands Conservation Plan in Travis County, but the circumstances surrounding that plan are very different from those in Comal County. Landowner enrollment in the Travis County plan has averaged less than 10 percent participation (pers. comm., Kevin Connally, Balcones Canyonlands Conservation Plan, to SWCA, 2008). Comal County expects the Proposed RHCP to attract more participants than Travis County's plan for several reasons.

First, Travis County has had a low participation rate in part because prolonged controversy stretched plan development over a very long period; the entire process from initiation to the final authorization took nearly a decade to complete. This was a period of very rapid growth, and many landowners had pursued and acquired individual section 10(a)(1)(B) permits before the regional plan could be finalized. In contrast, the Comal County RHCP is being started earlier in the population growth curve for the planning region and is generating less controversy. Comal County also has the advantage of learning from the Travis County experience and anticipates a much shorter timeframe from plan initiation to authorization.

Other factors that will encourage more participation from Comal County landowners in the RHCP than was realized in Travis County is the long average time for completion of individual section 10(a)(1)(B) permits today, compared to a decade ago. Individual permits today often take over two years from permit application to actual permit issuance. Given this long timeframe, landowners in Comal County are less likely to pursue individual permits than did their counterparts in Travis County several years ago. With the RHCP in place, participant applications are likely to be approved in three months or less. Avoiding lengthy project delays is expected to be a strong incentive for landowner participation in the Comal County RHCP. In addition, the landowner community is far more aware of ESA requirements and the need for compliance than was apparent a decade ago. Finally, the costs for participation in this RHCP are expected to be generally less than the costs of obtaining individual permits. Given these circumstances, it is not unreasonable to assume that the RHCP participation rate in Comal County will exceed that seen in Travis County.

Anticipating the level of participation is an important, but not critical, factor in estimating the amount of impact, or "take," that will be authorized by the proposed incidental take permit and mitigated by the RHCP conservation measures. As stated earlier in this chapter, to ensure that the proposed measures are adequate to mitigate the level of take eventually authorized under the Permit, this RHCP assumes a participation rate of 50 percent.

Demand for participation in the Proposed RHCP may exceed that contemplated for the Proposed Alternative. This may occur for two reasons. First, it is possible that the estimate of future development within potential habitat is conservative. For example, the model used to make that estimate may not account for larger-scale clearing of ranches in anticipation of development even where that development is not imminent. Similarly, the model allocates impacts with the construction of new buildings, but the practical reality is that the impact associated with a large number of structures often happens over a brief period of time, even though actual construction may continue for years (exterior and interior finishing, landscaping, etc.). Second, it is possible that participation rates will be higher than the 50 percent projected for RHCP planning purposes. For these reasons, an explicit component of the Proposed RHCP is the possible future amendment of the Permit to authorize additional take and mitigation as may be necessary to meet actual demand. Such a Permit amendment could be sought by the County during the term of the original Permit at its discretion as events warrant. Such a Permit amendment would be a major amendment requiring additional analysis under NEPA, and an additional opportunity for public comment. With respect to any such future amendment, the County would be responsible for conducting any required analyses. The Service would provide technical assistance and expeditious processing.

Financial Plan: According to the financial plan[5] (see Chapter 7 of the RHCP), over the 30-year life of the Proposed RHCP, funding would come primarily from participation fees, including sale of conservation credits ($88,230,447); endowment investment return ($3,575,000); and direct County contributions ($43,282,535). Costs would be incurred to administer the RHCP ($2,973,463), acquire preserve land ($107,083,312), manage the preserves ($6,474,852), establish an endowment to support preserve management in perpetuity ($16,500,000), and fund research and public awareness programs ($643,964). Income would total $135,087,982 and costs would total $133,913,468, for a positive balance of approximately $1,174,500.

2.4 ALTERNATIVE C – REDUCED TAKE RHCP

The Reduced Take RHCP would be the same as the Proposed RHCP except:

- fewer species (one rather than two) would be covered by the incidental take permit;
- the amount of covered take, and the mitigation required for the take, would be reduced; and
- the anticipated participation rate would be at 20 percent, the low end of the range identified above and discussed in Section 2.3 of this document. Compared to the Proposed RHCP, a lower participation rate in this alternative is consistent with the reduced number of species and amount of take covered by the permit.

This alternative assumes that the Covered Species would be limited to the golden-cheeked warbler. The black-capped vireo would not be covered by the requested permit. This may be justified because of uncertainty regarding the occurrence of the species in Comal County; a relatively small amount of suitable black-capped vireo habitat is present in the County, and the bird has not been recorded there. As a result, very little is known about the species' distribution and population size in Comal County.

Mitigation for 2,095 acres (848 hectares) of impact would include the establishment of up to an estimated 2,619 acres (1,060 hectares) of preserves. Similar to Alternative B, the mitigation ratio in Alternative C would vary according to different conditions, including habitat quality, with an estimated 80 percent of participating projects mitigating at 1:1, 15 percent mitigating at 2:1, and 5 percent mitigating at 3:1. Once the mitigation credits (an estimated 2,619 credits) were exhausted, no additional take or mitigation would be authorized for the golden-cheeked warbler under the plan without an amendment to the RHCP and permit. The research and public awareness programs identified in the Proposed Action would also occur under this alternative, except on a lower scale with less allotted funding (see following section).

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[5] All financial projections provided in the Proposed RHCP or authorized under the RHCP are estimates intended to demonstrate that the plan is financially feasible. The financing plan presented in the Proposed RHCP is illustrative and is not substantially prescriptive of the timing, size, or nature of actions that may be taken or authorized under the RHCP. Specific elements of the overall financing plan may change over the 30-year plan period, and the County will re-evaluate the financing plan annually to ensure adequate funding and appropriate disposition of excess revenues to meet the requirements of its incidental take permit, should such permit issue.

Financial Plan: The Reduced Take RHCP would rely on the same funding mechanisms and incur the same types of costs as the Proposed RHCP, only at reduced levels.[6] Income is estimated as follows: participation fees, including sale of conservation credits ($35,288,644); endowment investment return ($1,430,000); and direct County contributions ($18,810,770). Costs would be incurred to administer the RHCP ($2,402,558), acquire preserve land ($42,826,255), manage the preserves ($2,589,879), establish an endowment to support preserve management in perpetuity ($6,600,000), and fund research and public awareness programs ($515,171). Income would total $55,529,414 and costs would total $55,124,166, for a positive balance of $405,248.

2.5 ALTERNATIVES NOT SELECTED FOR ANALYSIS

NEPA requires rigorous and objective evaluation only of reasonable alternatives that are practical or feasible from the technical and economic standpoint (40 CFR § 1502.14(a)). This section describes alternatives that were eliminated from detailed study under this standard and briefly discusses the reasons for their having been eliminated. Elements common to each of the alternatives not carried forward for detailed analysis include:

1. Plan Area: Comal County (359,328 acres; 145,415 hectares).
2. Permit Term: 30 years (2010–2040).
3. Species Included: Covered Species, Evaluation species.
   - Covered Species are the only species for which incidental take would be authorized. All action alternatives include the golden-cheeked warbler and some include the black-capped vireo as Covered Species.
   - Evaluation species include petitioned karst species and Cagle's map turtle; some limited RHCP funds would be expended on tracking and evaluating status of Evaluation Species.
4. Preserve Acquisition Strategy and Criteria
   - Preserve acquisition could be a combination of fee simple acquisition and/or conservation easement(s).
   - Minimum preserve size: 500 acres.
   - Perpetual management and monitoring of all preserves based on Service-approved operation, management, and monitoring plans.
5. Cost Recovery
   - Costs of the RHCP would be generated through a possible combination of participation fees, tax benefit financing, private contributions, tax appreciation notes, and open space acquisition bonds.

[6] Like the funding plan described in the Proposed RHCP Alternative, the funding plan included in the Reduced Take RHCP Alternative is intended to be illustrative and is not substantially prescriptive of the timing, size, or nature of actions that may be taken or authorized under the Reduced Take RHCP.

6. Mitigation and Participation Fees
    - Mitigation fees would be based on the amount of species habitat impacted by a project and would be determined by a Service-authorized County representative; actual per-acre fees to be determined and may increase or decrease as the market allows; County may accept preserve land in lieu of fees if appropriate and in line with goals and objectives of the RHCP.

2.5.1 Maximum Mitigation with Predetermined Preserves

This alternative was designed to reduce impacts to the listed species and the short- and long-term financial obligations of the County for the administration and implementation of the RHCP. Compared with the Proposed RHCP, the alternative would provide similar benefits to Comal County in terms of streamlining the development process relative to compliance with the ESA, it would provide a greater measure of protection (larger preserve system) for the Covered Species, and would authorize more take of the golden-cheeked warbler.

In this alternative, a "target area" for preserve acquisition would be identified in the RHCP and Comal County would agree, up-front, to acquire or otherwise protect and manage in perpetuity approximately 10,500 acres (4,249 hectares) of golden-cheeked warbler preserves (while habitat acquisition would be primarily focused on high-quality golden-cheeked warbler habitat, black-capped vireos would likely benefit as well). This amount of preserved habitat would fully mitigate (at a 1:1 ratio) the take of the golden-cheeked warbler, county-wide, over the 30-year life of the RHCP in all habitat areas that were not included in the 10,500-acre preserve system. Once the RHCP was in place, under this alternative, development would be allowed outside the designated preserve area without the need for individual take permits under the ESA.

The premise of this alternative recognizes that, by protecting an appropriate amount of high-quality habitat for the golden-cheeked warbler up-front, the impacts caused by development in the remainder of the permit area would be adequately minimized and mitigated. In addition, this alternative recognizes that the upfront purchase of preserves would be more cost effective than if the preserves were purchased over time.

As with the Proposed RHCP, this alternative would seek a permit allowing for up to 1,000 acres of black-capped vireo habitat to be impacted over the life of the RHCP. To mitigate for take associated with this impact, a mitigation program would be established in which participation fees would be collected prior to land disturbance for anticipated impacts to black-capped vireo habitat. Opportunities would be assessed annually, including within designated golden-cheeked warbler preserves, for using these accumulated funds to acquire, create, restore, enhance, and manage protected black-capped vireo habitat at a 1:1 mitigation ratio.

Alternative Summary:

Preserve System Size:	10,500 acres of golden-cheeked warbler habitat at 30-year permit term
Take Authorized:	All take of golden-cheeked warbler occurring outside of designated RHCP preserves; up to 1,000 acres for the black-capped vireo
Acquisition Schedule:	Four years[7]
Initial Acquisition Costs:	$157,500,000 (10,500 acres @ $15,000/acre)

Alternative 2 was rejected for the following reasons:

- At the present time it is not feasible to identify all the preserve land needed to meet the goals of the alternative within the time frame designated for preserve acquisition;
- The costs associated with acquiring all the needed land and mitigation credits in such a short timeframe and before the RHCP generates substantial income to help defray costs would not be economically feasible for the County.

2.5.2 Moderate Mitigation with Predetermined Preserves

This alternative would include the purchase up-front, and perpetual protection of approximately 5,250 acres (2,125 hectares) of high quality golden-cheeked warbler habitat. This amount of preserved habitat would authorize 5,250 acres of incidental golden-cheeked warbler take at a 1:1 mitigation ratio. Black-capped vireo take would be authorized and mitigated with a conservation bank similar to that described for the Proposed RHCP and the Maximum Mitigation with Predetermined Preserves Alternative. This alternative would require lower expenditures in the first four years of the RHCP than the Maximum Mitigation with Predetermined Preserves Alternative, and allows the County to more closely balance its need to acquire preserve lands based on the demand for incidental take authorization. While this alternative would not be as expensive as the Maximum Mitigation with Predetermined Preserves Alternative due to the lesser amount of eventual preserve acreage anticipated, accelerating land prices throughout the 30-year life of the RHCP would still result in higher land acquisition costs compared to purchasing preserves upfront.

As with the Maximum Mitigation with Predetermined Preserves Alternative, this alternative would seek a permit allowing for up to 1,000 acres of black-capped vireo habitat to be taken over the life of the RHCP. To mitigate for this take, a mitigation program would be established in which participation fees would be collected prior to land disturbance for anticipated impacts to black-capped vireo habitat. Opportunities would be assessed annually for using these accumulated funds to acquire, create, restore, enhance, and manage protected black-capped vireo habitat at a 1:1 ratio.

[7] State law includes a provision that predetermined preserves in HCPs must be purchased no later than within four years of the permit being issued (Texas Parks and Wildlife Code, § 83.018(c)).

Alternative Summary:

Preserve System Size:	5,250 acres of golden-cheeked warbler habitat at 30-year permit term
Take Authorized:	5,250 acres for the golden-cheeked warbler; up to 1,000 acres for the black-capped vireo
Acquisition Schedule:	1,000 acres initial acquisition (2011), 4,250 acres (1,720 hectares) added to preserve system by 2015
Initial Acquisition Costs:	$15,000,000 in 2011 (1,000 acres @ $15,000/acre); up to $85,000,000 more by 2013 (4,250 acres @ $20,000/acre)

This alternative was rejected because the costs associated with acquiring all the needed land and mitigation credits in such a short timeframe and before the RHCP generates substantial income to help defray costs would not be economically feasible for the County.

2.5.3 Land Use Zoning-Based RHCP

Under this alternative, an RHCP would be developed based on land use regulation. The County would identify areas significant to the conservation of the Covered Species, and through a land use regulation effort, limit development activities in those areas. This alternative was designed to reduce take of the listed species; however, it was considered primarily because precedents exist in other states for this approach, most recently by a proposed zoning-based, county-wide Multi-species Conservation Plan in Pima County, Arizona (RECON 2006). This regulation-based alternative would be modeled on the Pima County Multi-species Conservation Plan, which is summarized below.

Pima County has a zoning ordinance in place that regulates land use in all unincorporated areas of that County within its jurisdiction, over 600,000 acres (242,800 hectares). The existing zoning pertains unless a developer submits a request to change the zoning on an area or to increase the density above that for which it is already zoned. In that case, if the area falls within a new county-wide Conservation Land System, new conditions apply. The Conservation Land System, which was developed by Pima County in collaboration with Federal, state, and municipal land management entities, classifies some 2 million acres (809,000 hectares) within that County into seven categories, each with accompanying conservation guidelines. In the most restrictive categories (Biological Core Management Areas, Special Species Management Areas, and Important Riparian areas), from 80 to 95 percent of the total acreages in those categories must be conserved or enhanced as wildlife habitat, depending on the classification. Development on any given property is restricted to the least sensitive portions of that property.

Under this alternative, Comal County would establish a land use regulation program, including expanded authority for issuing land use-related discretionary permits and a system for monitoring compliance and enforcing sanctions for violations. Adherence to regulations designed to protect conservation values—specifically those pertaining to the species covered by the RHCP—would provide a mitigation framework for take authorized by the requested incidental take permit. Participation in the RHCP would not be voluntary because the land use

regulations would apply to all property within the County's jurisdiction. Compared to the Proposed RHCP, the amount of covered take, the mitigation required for the take, and the costs associated with mitigation would likely be reduced (depending on the outcome of the land use regulation process); annual expenditures for administration and implementation of the RHCP would likely increase due to the initial efforts to develop the regulations and to monitoring of land use compliance; and the anticipated participation rate would be higher as adherence to the land use regulations would be required.

This alternative would provide benefits to the County in terms of streamlining the development process relative to compliance with the ESA, and it would provide a significant measure of protection for the Covered and Evaluation Species. However, the alternative was rejected because, at this time, the County does not have sufficient authority under state law to regulate land use for conservation purposes. In Texas, a county has only the authority expressly granted it by the state constitution or state statutes. No county in Texas has general ordinance-making authority, although in several cases, the state legislature has authorized a county or counties to enact rules or ordinances in regard to a specific issue. For example, certain counties may adopt zoning ordinances in limited areas around particular features, such as Padre Island beachfront or specific lakes (Texas Local Government Code, Chapter 231). The regulatory authority granted to all counties in the state is limited to automotive wrecking and salvage yards (Texas Transportation Code § 396.041), wild animals (Local Government Code § 240.002), mass gatherings (Health and Safety Code, Chapter 751), and residential subdivision plats[8] in unincorporated areas (Local Government Code, Chapter 232). Specifically, a subdivision plat must be approved by the County Commissioners Court and filed with the county clerk as a permanent real property record, where it may be used for land title research, land sales, or property tax purposes. Before approving a plat, a Commissioners Court may require rights-of-way on subdivision roads, reasonable specifications on road construction and drainage infrastructure, and purchase contracts to specify the availability of water (Local Government Code § 232.003). Clearly, this limited authority does not include the right to establish land use regulation to protect conservation values.

2.5.4 County-only RHCP Alternative

Under this alternative, the RHCP would cover only listed species impacts associated with activities of Comal County, such as road construction and maintenance and flood-control projects. While Comal County will occasionally require ESA authorization for its infrastructure projects, it was determined that the long-term demand associated with County-only projects will be insufficient to establish a meaningful preserve system for the covered species. For example, the County recently provided mitigation for activities relating to a flood-control project on a tributary to Dry Comal Creek, but it was able to provide satisfactory mitigation on-site and with a relatively small number of acres. In addition, this alternative would not materially reduce the workload of the Service relating to processing ESA authorizations within the County, nor would this alternative have the effect of encouraging broader compliance by providing more efficient

[8] A plat is a legal document that includes a map of the subdivided property and public improvements, such as streets or drainage infrastructure.

ESA compliance alternatives to other governmental and non-governmental entities within the County. For the foregoing reasons, this alternative was rejected for further analysis.

2.6 COMPARISON OF ALTERNATIVES CARRIED FORWARD FOR DETAILED ANALYSIS

Table 2-1 compares the major elements of:

- Alternative A – No Action
- Alternative B – Proposed Comal County RHCP (Proposed Action)
- Alternative C – Reduced Take RHCP

Table 2-1. Comparison of alternatives considered.

Alternative Elements		Alternative A – No Action	Alternative B – Proposed RHCP	Alternative C – Reduced Take RHCP
Covered Species		All federally listed species in the County in individual sections 7 and 10(a) consultations.	Golden-cheeked warbler Black-capped vireo	Golden-cheeked warbler
Estimated Covered Take over Life of RHCP	Golden-cheeked Warbler	Sections 7 and 10(a) authorized incidental take unknown in frequency, but expected to occur.	Direct and Indirect Impacts: 5,238 acres.	Direct and Indirect Impacts: 2,095 acres.
	Black-capped Vireo	Sections 7 and 10(a) authorized incidental take unknown in frequency, but expected to occur.	Direct Impacts: 1,000 acres.	Not covered for take.
Mitigation or Conservation Measures	Golden-cheeked Warbler	For projects consulting with the Service, for every acre of habitat disturbed at least 1 acre of habitat would be protected on a case-by-case basis.	To mitigate for 5,238 acres of impact at varying mitigation ratios, establish an estimated 6,548 acres of preserve(s)/conservation bank(s) in the County. Impacts to warbler habitat would be primarily mitigated at a mitigation-to-take ratio of 1:1 (up to 3:1 in some instances; see Section 4.3.1.3 in RHCP).	Establish preserve(s)/conservation bank(s) in the County. Impacts to warbler habitat would be primarily mitigated at a 1:1 ratio.
	Black-capped Vireo	For projects consulting with the Service, for every acre of habitat disturbed an acre of habitat would be protected on a case-by-case basis.	To mitigate for 1,000 acres of impact, acquire credits from a Service-approved conservation bank; acquire, preserve, and manage in perpetuity black-capped vireo habitat; and acknowledge black-capped vireo conservation bank credits owned by an applicant. Impacts to black-capped vireo habitat would be primarily mitigated at a 1:1 ratio (up to 2:1 mitigation-to-take ratio in some instances; see Section 4.4.1.2 in RHCP).	Not covered for take; no mitigation required.
Research Program		None.	Fund and manage research $10,000/yr for a cumulative cost of $429,309.	Fund and manage research $8,000/yr for a cumulative cost of $343,447.
Public Awareness Program		None.	Fund and manage public awareness programs $5,000/yr for a cumulative cost of $214,655.	Fund and manage public awareness programs $4,000/yr for a cumulative cost of $171,724.
Endowment		None.	Establish a total endowment of $16,500,000 by end of Year 30.	Establish a total endowment of $6,600,000 by end of Year 30.
Finances	Costs	Costs of consultations and mitigation borne by project proponents on a case-by-case basis.	$133,913,468	$55,124,166
	Income		$135,087,982	$55,529,414

CHAPTER 3 — AFFECTED ENVIRONMENT

3.1 GENERAL DESCRIPTION OF COMAL COUNTY

Comal County comprises approximately 366,945 acres (148,497 hectares) in central Texas (see Figure 1-1).[9] While the entire county will be covered by the requested Permit,[10] potential habitat for the listed and other rare/endemic species in the County occurs primarily west of Interstate 35 in the Balcones Canyonlands Level IV ecoregion (Figure 3-1).[11] This ecoregion encompasses the area of potential effect for the impact analysis presented in Chapter 4.

Elevation within Comal County ranges from approximately 600 to 1,500 feet (183 to 457 meters) above mean sea level and, in general, gradually increases from east to west. Lowest elevations occur in the east and southeast, in the Northern Blackland Prairie ecoregion, where the topography is mostly flat to gently rolling (Figure 3-1). The highest elevations occur on hilltops in the central and western portions of the County in the Balcones Canyonlands ecoregion. Topography in that ecoregion is gently rolling to hilly, with steep slopes present on the margins of some stream valleys where erosion has downcut local bedrock. Sharply dividing the two ecoregions is the Balcones Escarpment, a narrow, rugged belt of hills created by a series of parallel faults.

Comal County occurs within a temperate, humid, subtropical region. Winters tend to be mild, with an average minimum in January of 39°F (3.8°C), and an average maximum temperature in July of 95°F (35°C) (Comal County 2008). Annual rainfall in the County is approximately 32.8 inches (83.3 centimeters) (TPWD Undated-a). Prevailing winds are from the south-southwest. Major weather threats include extended dry periods, flash flooding, and tornados.

Land use in Comal County is primarily undeveloped woodland, with cropland mainly concentrated in the south-southeast. Urban areas occur primarily in the northern and southeastern portions of the County. In 2006, the estimated population of Comal County was 101,181 (FedStats 2007), with 106,080 projected for 2007 (Texas State Data Center and Office of the State Demographer 2007). As of January 1, 2009, the population of Comal County was estimated by Texas State Data Center to be 112,190 (Texas State Data Center and Office of the State Demographer 2010). The largest communities are New Braunfels (58,159), Canyon Lake (19,559), and Bulverde (5,060). Comal County is included in the San Antonio Metropolitan Statistical Area (San Antonio MSA), which covers eight counties in the south-central region of Texas.

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[9] This total acreage includes 355,148 acres (143,723 hectares) of land and 11,797 acres (4,774 hectares) of water.

[10] The permit area includes portions of the County that currently are not known to contain federally listed species or their habitat. This was done to facilitate any needed amendments to the RHCP and the requested Permit should such species or their habitat occur in those areas in the future.

[11] Level IV ecoregions are subdivisions of larger Level III ecoregions. Comal County falls within the Balcones Canyonlands subdivision of the Edwards Plateau Level III ecoregion, and within the Northern Blackland Prairie subdivision of the Texas Blackland Prairie Level III ecoregion.

Figure 3-1. The Comal County Permit area, including the major ecoregions.

3.2 IDENTIFICATION OF THE AFFECTED ENVIRONMENT (IMPACT TOPICS)

The description of the affected environment establishes the current environmental conditions considered by the Service to be affected by the alternatives, including the Proposed Action (USFWS 2007a). Guidance provided in a Department of the Interior agency directive concerning NEPA analysis states that the affected environment should describe only those resources that may cause impact or be affected if the Proposed Action or alternatives are implemented (U.S. National Park Service 2001). If specific resources would not be affected or impacts would be negligible (impact is at a low level of detection), they should be listed as "issues and impact topics considered but dismissed," but not described or analyzed in detail in the Affected Environment and Environmental Consequences chapters of the EIS.

In identifying which resources have the potential to be affected by the alternatives it is important to keep in mind that NEPA regulations require that No Action be used as the basis of comparison to judge the potential impacts of the action alternatives. If no difference is anticipated between the future condition under No Action and the action alternatives, then there is no impact to analyze. It is imperative, therefore, to clearly understand and articulate the assumptions used in defining No Action. In the case of this EIS, it is understood that human population growth and associated commercial and residential development will proceed in Comal County whether or not an RHCP is implemented. This is because landowners with endangered species issues will have the ability to develop their property and remain in compliance with the ESA through alternative means (avoidance, ESA section 7 consultation, or individual HCPs), regardless of whether the Service issues the Permit and approves implementation of the Proposed RHCP. Landowners may also develop their property without regard for potential endangered species habitat, and thereby risk violation of section 9 of the ESA. Issuing the requested Permit is not an "indispensable prerequisite" or an "essential catalyst" for economic development in the County;[12] only the most general causal relationship can be established between issuance of the Permit and potential impacts of development.[13] This critical consideration limits the affected environment to those resources for which a causal relationship can be reasonably established between such resources and the take authorized by the requested Permit, the proposed mitigation, and funding and management of the RHCP.

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[12] In *City of Davis v. Coleman*, the court found that effects of a proposed action must be included in the environmental review when the action is an "indispensable prerequisite" or an "essential catalyst" to those effects (521 F.2d 661 (9th Cir. 1975) (City of Davis)). By inference, it is reasonable to assume that if a proposed action, in this case, issuance of an incidental take permit to Comal County is *not* an "indispensable prerequisite" or an "essential catalyst" to effects (in this case, general effects of land development in Comal County), then the resources affected by general land development in the County need not be analyzed in this EIS.

[13] It is possible that the greater efficiency and lower cost of ESA compliance offered by the RHCP could affect the timing and/or footprint of specific development projects. Development may happen either somewhat faster than under the No Action alternative, or the footprint of development may be different than under the No Action alternative. Conversely, implementation of the RHCP will encourage increased compliance with the ESA by providing a more efficient alternative for ESA authorization. The existence of the RHCP may, in fact, increase compliance and, therefore, decrease unmitigated loss of Covered Species habitat.

Accordingly, and consistent with Council on Environmental Quality (CEQ) regulations, in this section impacts are discussed in proportion to their significance. Section 3.2.1 identifies those resources and issues that may be affected by the Proposed RHCP and its alternatives, and which are described in detail in this chapter. Section 3.2.2 identifies resources and issues not likely to be affected and provides only enough discussion to show why more study is not warranted (40 CFR §1502.2(b)).

3.2.1 Impact Topics Identified for Detailed Analysis

The alternatives described in Chapter 2 of the EIS have the potential to affect various impact topics or components of the human environment beyond a negligible level. Those impact topics or components of the human environment are listed below. It should be noted that, while the Permit area covers all of Comal County, the area of potential effect for physical and biological resources focuses on potential Covered Species habitat, where take of Covered Species under the Permit, and avoidance, minimization, and mitigation measures are expected to occur. The topics described in detail in this chapter and analyzed in detail in Chapter 4 are:

- *Water Resources*: Potential impacts to water resources in the area of potential effect are analyzed in detail in this EIS because the removal of Covered Species habitat authorized by the Permit and the preservation of habitat in large parcels may affect water resources beyond the negligible level.
- *Vegetation*: Vegetation would potentially be affected because take of the Covered Species authorized under the Proposed RHCP would be expressed as a specified number of acres of suitable habitat lost or modified, and because mitigation for that take would be the preservation in perpetuity of at least an equivalent amount of suitable habitat prior to authorization of any take.
- *General Wildlife*: Wildlife occupying the covered lost or modified habitat and habitat preserved as mitigation would potentially be affected by the action alternatives.
- *Covered Species, Evaluation Species, and Other Protected Species*: The Covered Species and other Federal and state-protected species occupying habitat affected by the RHCP, and habitat preserved as mitigation, would potentially be affected by the action alternatives. The RHCP Evaluation Species occupying the same habitats may also be affected.
- *Socioeconomic Resources*: While implementation of the action alternatives is not expected to affect the amount of economic development in Comal County, it may affect the pacing of that development. It is also expected to affect County finances and the cost of compliance with the ESA for project proponents and the Service.

3.2.2 Issues and Impact Topics Considered but Dismissed from Detailed Analysis

The CEQ regulations at 40 CFR § 1500 require that certain topics be addressed in an EIS. These "mandatory topics" were reviewed during preparation of this EIS to assess the likelihood that they may potentially be affected by the Proposed Action and its alternatives. Of these mandatory topics, only "endangered species" are being carried forward for detailed analysis, as noted above.

The remaining mandatory topics are listed below, along with an explanation of how they are addressed in this document or why they have been dismissed from further analysis.

- Energy Requirements and Conservation Potential.

  The energy requirements of projects that will be undertaken by future RHCP participants should generally be consistent with the energy requirements of urban and suburban development, including housing, commercial centers, offices, public buildings, and public infrastructure. It is not anticipated that future energy consumption or potential energy saving measures associated with projects undertaken by future RHCP participants will vary materially from those of other similar undertakings within the County or region. In addition, projects undertaken by future RHCP participants are anticipated to account for only a small percentage of the anticipated total growth and development within the County.

- Depletable Resource Requirements and Conservation Potential.

  The only resources known to be subject to depletion as a result of the Proposed Action are golden-cheeked warbler habitat and black-capped vireo habitat. These resources are addressed in detail in the vegetation and Covered Species sections of this document.

- Prime and Unique Agricultural Lands.

  The Proposed Action is limited to authorization of take that may result from removal of or indirect impacts to potential Covered Species habitat. Such habitat —woodlands (golden-cheeked warbler) and shrublands (black-capped vireo habitat)—neither of which qualify as Prime and Unique Agricultural Lands.

- Public Health and Safety.

  Should the Service issue an incidental take permit to Comal County authorizing take of the Covered Species, the only activities authorized through that permit are clearing of Covered Species habitat. Neither the RHCP nor the Permit would authorize development. Clearing woodlands (golden-cheeked warbler) and/or shrublands (black-capped vireo) is unlikely to affect public health and safety. All actions authorized under the Permit and RHCP must comply with all applicable laws.

- Important Scientific, Archeological, and Other Cultural Resources, Including Historic Properties Listed or Eligible for the National Register of Historic Places.

  Generally, Texas governmental entities, including Comal County, are subject to the Texas Antiquities Code (Texas Natural Resource Code, Title 9, Chapter 191), which provides certain protections for cultural resources in the State. According to the Texas Antiquities Code, Texas Historical Commission staff must review any action that has the potential to disturb historic and archeological sites on land owned or controlled by a state agency or a state political subdivision, such as Comal County. In addition, any project that has is permitted, funded, or carried out by an agency of the Federal government, will be subject to applicable Federal law such as the National Historic Preservation Act of 1966. This law requires federally-funded and permitted projects that may affect designated or potentially eligible historic and cultural resources to consult with the State's Historic Preservation Office. In addition, any important scientific, archeological,

and other cultural resources that occur on lands set aside as RHCP preserves would likely protected, by virtue of being in the preserve, from the impacts of development. If any activities were to take place on preserve lands, impacts to important scientific, archeological, and other cultural resources would be avoided. The actual location and footprint of projects that may participate in the RHCP cannot be determined and thus no on-the-ground assessment of archeological and cultural resources is possible. On the ground assessments will be conducted on individual projects when and as required by applicable laws and regulations.

- Wetlands and Floodplains.

  The Proposed Action (the Service's issuance of an incidental take permit to Comal County) is limited to the authorized removal of woodlands (golden-cheeked warbler) and shrublands (black-capped vireo habitat), neither of which are likely to include wetlands and floodplains as Covered Species habitat is unlikely to occur those areas. Moreover, should any project participating in the Comal County RHCP involve regulated impacts to wetlands, that project would be required by the Clean Water Act to obtain a section 404 permit. Wetland impacts of any such project would be analyzed in accordance with the Clean Water Act at the time of the section 404 permit application. Similarly, the Federal Emergency Management Agency (FEMA) regulates construction within designated floodplains.

An additional CEQ mandatory impact topic, Ecologically Critical Areas, Wild and Scenic Rivers, or Other Unique Natural Resources, would not be affected. No resources officially designated as Ecologically Critical or Wild and Scenic Rivers occur within Comal County. However, three stream segments within the County have been identified as ecologically significant by the Texas Parks and Wildlife Department (TPWD). Comal Springs in the City of New Braunfels, while located in an urban setting and extensively modified from their natural condition, are the largest concentration of springs in Texas and as such may be considered a unique natural resource. Springs in general and Comal Springs in particular, and the three ecologically significant stream segments, are included in the analysis of potential impacts to water resources in Chapter 4.

And lastly, because participation in the Proposed RHCP would be completely voluntary, its implementation is not expected to introduce Conflicts with Land Use Plans, Policies, or Control. The RHCP would neither require, nor be enforced by, municipal or county land use ordinances, and it is consistent with Texas state law, including what is known as Senate Bill 1272, codified as Subchapter B, Chapter 83 of the Texas Parks and Wildlife Code (see Chapter 1, Section 1.3.3 of this EIS for an explanation of the Proposed RHCP's relation to Senate Bill 1272).

Although not required for consideration by CEQ regulations, all EISs must address Environmental Justice. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," provides that "each Federal agency shall make achieving Environmental Justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Order 12898, February 11, 1994, Section 1.1). Minority and low-

income populations do reside in Comal County; however, the exact location and nature of future activities covered by the requested Permit cannot be predicted, and whether such activities would have disproportionately high and adverse human health or environmental effects on these populations cannot be determined with any degree of precision. Notwithstanding this generalization, it can be said that the physical impacts of issuance of an incidental take permit and implementation of the RHCP will be limited to potential golden-cheeked warbler or black-capped vireo habitat (woodlands and shrublands), which are unlikely to be inhabited by minority populations. Golden-cheeked warbler and black-capped vireo habitat is likely to be, at most, lightly occupied by people, as dense occupation renders habitat unsuitable for both Covered Species. U.S. Census Bureau data shows that the vast majority of people, including low-income and minority populations, in Comal County reside within the City of New Braunfels and other, more densely populated areas (U.S. Census Bureau 2001). Therefore, the RHCP is unlikely to affect low-income and minority populations. Notwithstanding the foregoing analysis, and as with the CEQ mandatory topics discussed above, similar impacts of development on minority and low-income populations are likely to occur whether or not the requested Permit is issued.

Several other resources have been eliminated from detailed analysis in this EIS. While relevant environmental regulations do not require that these resource topics be analyzed within NEPA documents, these topics are sometimes analyzed; therefore, we have chosen to mention them in the Comal County EIS. Each of these resources may be affected by individual development activities conducted by RHCP participants and covered by the requested incidental take permit. However, as explained above in Section 3.2, issuance of the Permit cannot be shown to cause such impacts, even indirectly, because the same activities could, and would likely, proceed under all the alternatives, including No Action. For this reason, when compared to No Action, which is the baseline for measuring impacts, any potential impact of issuing the requested incidental take permit would not rise above the insignificant level for the following resources:

- Air Quality
- Natural Sound (noise)
- Geology (potential impact to significant karst recharge features, including caves,[14] are covered under the impact analysis for water resources)
- Paleontological Resources

3.3 WATER RESOURCES

Water resources in Comal County fall within the South Central Texas Regional Planning Area (also known as Region L), one of the 16 planning regions established by the Texas Water Development Board. The most recent water plan for the region was prepared in 2006 by the South Central Texas Regional Water Planning Group, which acts as the steering and decision-making body of the regional planning effort.

[14] Caves are defined by the Texas Speleological Society as naturally occurring, humanly enterable cavities in the earth, at least 5 meters in length and/or depth, in which no dimension of the entrance exceeds the length of depth of the cavity.

3.3.1 Groundwater

Two major aquifers underlie parts of Comal County: the Southern Segment/San Antonio Segment of the Edwards Aquifer, and the Trinity Aquifer. Both the Edwards and Trinity aquifers are karstic, fractured rock aquifers associated with the Balcones Fault Zone. Aside from discharge from wells, groundwater outflow in Comal County occurs at two main locations: Comal Springs and Hueco Springs.

3.3.1.1 Edwards Aquifer

The Southern Segment of the Edwards Aquifer is the southernmost of the aquifer's three segments. It stretches from the groundwater divide near Kyle, Texas (north of Comal County), to Del Rio in McKinney County. The water-bearing limestones that compose the Southern Segment of the Edwards Aquifer within Comal County are the Lower Cretaceous Age Edwards Limestone (or "Edwards Group") and the overlying Georgetown Formation. The Southern Segment of the Edwards Aquifer hydrologic system is divided into three major units that are recognized as separate regulatory management areas by the Texas Commission on Environmental Quality (TCEQ)(Figure 3-2).

- Edwards Aquifer Contributing Zone
- Edwards Aquifer Recharge Zone
- Edwards Aquifer Confined Zone

The Contributing Zone is the catchment area for the Edwards Aquifer.[15] It consists of surface watersheds that supply runoff downstream to the Recharge Zone. The Contributing Zone comprises approximately 52 percent of the land surface within Comal County (see Figure 3-2). The Recharge Zone consists of bedrock exposures where surface water has opportunities to enter the aquifer directly through caves, fractures, or other permeable features in the rock. The Recharge Zone spans the central portion of the County, trending in a northeast-southwest direction, generally parallel to Interstate 35, and occupies approximately 33 percent of the County (see Figure 3-2). Groundwater within the Recharge Zone follows discrete flow paths along the fault-induced structural grain before leaking into the Confined Zone, which occupies the remainder of the County.

The Confined Zone consists of down-faulted sections of the aquifer where the Edwards Group is covered by low-permeability rock units. These confining strata restrict recharge from the surface as well as the upward movement of groundwater, causing the Edwards Aquifer in this zone to be fully saturated and under artesian pressure. Flowing artesian wells and springs are present where hydraulic pressure is sufficient to force water up through faults and wells to the surface. Where and when hydraulic pressure is inadequate to raise groundwater to the surface in artesian wells, the water is pumped to the surface.

[15] In Comal County, the Contributing Zone for the Edwards Aquifer is also the Recharge Zone for the Trinity Aquifer, which is exposed at the surface in this area.

Figure 3-2. Edwards Aquifer Contributing, Recharge, and Confined Zones in Comal County.

Within the Confined Zone, near the eastern boundary of the County, the aquifer is bounded by a "bad water" interface that separates total dissolved solids (TDS) values less than 1,000 mg/L (freshwater) on the west side from TDS values greater than 1,000 mg/L (saline water) on the east side (Edwards Aquifer Authority 2003). Across this interface the groundwater quality abruptly deteriorates. Lowered water levels resulting from groundwater pumpage and/or decreased aquifer recharge may cause the bad water interface to shift westward, resulting in deterioration of water quality in the freshwater section of the aquifer.

The Edwards Aquifer is honeycombed and cavernous in nature, resulting in yields of moderate to large quantities of water to wells, with some wells producing in excess of 16,000 gallons (61 kiloliters) per minute, or 25,810 acre-feet (3,184 hectare meters)(South Central Texas Regional Water Planning Group 2006). Because this limestone aquifer is highly permeable and porous, it is very transmissive and responds quickly to recharge events and droughts. The aquifer is characterized by rapid water level fluctuations during relatively short periods of time.

Edwards Aquifer Recharge – Most recharge to the Edwards Aquifer is from direct infiltration via precipitation and streamflow loss, through features such as faults, fractures, and karst features (caves, solution cavities, sinkholes, etc.). Estimated average annual recharge to the Southern Segment of the Edwards Aquifer is 689,500 acre-feet (85,049 hectare meters)(Slattery 2004). Covering recharge features may decrease the amount of water replenishing the aquifer, while allowing water-borne pollutants to enter recharge features may degrade the quality of water stored in the aquifer (Austin Geological Society 1985, Dorsey and Slagle 1987, Senger et al. 1990). Impervious cover, such as pavement and buildings, prevents rainfall from infiltrating into the soil; hence, less flow is available to recharge groundwater (Simmons and Reynolds 1982).

The State of Texas has not enacted laws or regulations limiting the amount or configuration of impervious cover over the Edwards Aquifer; however, the Edwards Aquifer Rules (30 Texas Administrative Code, Chapter 213), which are described below in Section 3.3.3.1, include requirements to identify and avoid sensitive recharge features (e.g., caves and sinkholes) where rapid recharge to the aquifer may occur. Sealing of sensitive features reduces the quantity of clean runoff entering the aquifer and should be avoided, but if a project proponent demonstrates that no reasonable and practicable alternative exists, the TCEQ will allow the feature to be sealed.

Edwards Aquifer Discharge – Most discharge from the Edwards Aquifer occurs as pumpage from industrial, irrigation, and public-supply wells and springflow. In 2006, it was estimated that average annual discharge from springflow was 488,500 acre-feet (60,255 hectare meters) and discharge from wells was 398,900 acre-feet (49,203 hectare meters), for a total of 886,000 acre-feet (109,286 hectare meters) of annual discharge (Edwards Aquifer Authority 2006). In 2007, the state legislature authorized the withdrawal of 572,000 acre-feet (70,555 hectare meters) from the aquifer (Votteler 2008), so the total discharge in that year likely exceeded 886,000 acre-feet.

As the volume of water held in the aquifer increases, the hydraulic pressure forcing water to the surface in the Confined Zone increases, and the flow discharged at springs and artesian wells increases. The reverse is true as well. As the volume of water in the aquifer decreases, hydraulic

pressure decreases, and the discharge at springs and artesian wells decreases. Water levels and artesian pressure in the Edwards Aquifer in the Comal and Bexar County area are monitored by the Edwards Aquifer Authority, the San Antonio Water System, and the U.S. Geological Survey at an index well (J-17 well) in San Antonio (Eckhardt Undated-a).[16] The water level rises or falls in the well in response to the pressure being exerted by water higher up in the Edwards Formation to the west. Historical data collected at the J-17 well illustrate the rapid water level fluctuations during relatively short periods that characterize the Edwards Aquifer. Water levels at the well have ranged from 612 feet above mean sea level (msl) during the 1950s drought to 703 feet msl after record-breaking rainfall in the early 1990s (Eckhardt Undated-a). A strong relationship exists between the level of the J-17 well and flows at Comal Springs, the major natural discharge feature in the County and one of the largest spring complexes in the southwestern United States. Most of the water that becomes Comal springflow originates with recharge far to the west and moves past the J-17 well as it flows eastward toward the springs. Flows at Comal Springs become intermittent when the level of the J-17 well drops below 620 feet msl. All flow at Comal Springs ceases when the water level in the J-17 well reaches 618 feet msl. During a drought in the 1950s, Comal Springs was dry from June to November of 1956 (Eckhardt Undated-a).

During the 1950s, water withdrawal from the Edwards Aquifer was about 320,000 acre-feet (39,471 hectare meters); the current 10-year median volume exceeds 400,000 acre-feet (49,339 hectare meters) per year (Schindel and Illgner 2005). Concern over the potential effects of the growing withdrawal of aquifer water and resulting litigation led the Texas Legislature to pass the Edwards Aquifer Authority Act in 1993. This statute created the Edwards Aquifer Authority, which is charged with limiting the amount of water that can be withdrawn. That amount was limited to 450,000 acre-feet (55,507 hectare meters) per year until 2008, and 400,000 acre-feet per year after that. Several exceptions were written into the law, however, and, as noted above, 572,000 acre-feet of withdrawals were authorized in 2007 (Votteler 2008).

To deal with occasions when aquifer water levels drop to potentially perilous levels, the Edwards Aquifer Authority has implemented a demand management/critical period management program (Schindel and Illgner 2005). Pumping rates must be reduced by stipulated percentages when water levels decline below specified levels in aquifer index wells, or discharge drops below specified levels at certain springs. Triggering criteria have been defined in three stages, with Stage 1 requiring the lowest percentage reduction in withdrawals and Stage 3 requiring the highest. To give an example, Stage 1 critical period must be declared when any one of the following occurs: the 10-day average of aquifer level readings at the J-17 well drops below 660 feet above mean sea level, or the 10-day average flow of spring discharge drops below 96 cubic feet/second (2.7 cubic meters/second) at the San Marcos Springs or below 225 cubic feet/second (6.4 cubic meters/second) at Comal Springs (Edwards Aquifer Authority 2008). A Stage 1 critical period requires a 20 percent reduction in pumping until the Edwards Aquifer Authority lifts the restriction.

[16] The J-17 well is one of two reference wells used to monitor water pressure in the Edwards Aquifer, but the only one pertinent to Comal County.

3.3.1.2 Trinity Aquifer

Stratigraphically, the Trinity Aquifer is composed of three layers, each with distinctly different hydrologic properties. The Upper Trinity, which occurs in the Upper Glen Rose Limestone, yields only small quantities of water, which is generally of pour quality due to the presence of evaporate beds (South Central Texas Regional Water Planning Group 2006.). Water from the Upper Trinity is typically used for livestock. The Middle Trinity occurs in the Cow Creek Limestone, the Hensell Sand, and the Lower Glen Rose Limestone and is a regionally important aquifer. The Lower Trinity is insubstantial in terms of natural discharge and human use and is too deeply buried beneath the rock strata of the Upper and Middle Trinity Aquifers to be significantly affected by human activities. The geologic units that comprise the Upper and Middle Trinity Aquifer outcrop in the western half of Comal County, where they function as a Recharge Zone for the Trinity Aquifer and a Contributing Zone for the Edwards Aquifer (see Figure 3.2). In the southeastern half of the County, these geologic units dip below the rock strata of the Edwards Aquifer. Similar to the Edwards Aquifer, recharge to the Trinity Aquifer occurs as direct infiltration via precipitation and streamflow loss, through features such as faults, fractures, and karst features. Unlike the Edwards Aquifer, the Trinity Aquifer is relatively slow to recharge (Eckhardt Undated-b). Mace et al. (2000) estimate that the Trinity Aquifer recharges at a rate of 6.6 percent of mean annual precipitation, while Ockerman (2002) has estimated recharge of the Southern Segment of the Edward Aquifer to be 20–25 percent of mean annual precipitation.

In order of volume, discharge from the Upper and Middle Trinity Aquifers in the Texas Hill Country is through: 1) discharge to streams and springs, 2) lateral subsurface flow and diffuse upward leakage to the Edwards Aquifer, 3) pumping of the aquifer for human use, and 4) vertical leakage to the Lower Trinity Aquifer (Mace et al. 2000). Historical water withdrawals for human use from the Trinity Aquifer have resulted in significant declines in the water level (HDR Engineering Inc. 2001). According to the South Central Texas Regional Water Planning Group (2006), the aquifer is being stressed due to rapid growth in the number of wells being drilled to supply new homes and commercial establishments. Trinity well yields are now rarely more than 161 acre-feet/year (20 hectare meters/year) in the south-central Texas region. No overarching entity comparable to the Edwards Aquifer Authority has been established for the Trinity Aquifer. However, due to the demands being placed upon the Trinity Aquifer, the Texas Water Development Board has designated much of the area underlain by the Trinity Aquifer in the Hill Country a Priority Groundwater Management Area. This designation allows local entities, such as counties, to establish groundwater conservation districts within that area. To date, Comal and Travis Counties are the only counties in the Hill Country Priority Groundwater Management Area not to have approved a groundwater conservation district to exert some control over use and protection of the Trinity Aquifer (League of Women Voters 2005).

3.3.2 Surface Water

The majority of Comal County is within the Guadalupe River Basin, while the southwestern part of the County falls within the San Antonio River Basin. Both basins generally drain toward the east, and both rivers are dependent on aquifer discharge. Comal and San Marcos Springs are the major tributaries of the Upper Guadalupe River, on the average providing approximately 30

percent of the river's base flow (Guadalupe Basin Coalition 2007). In drought conditions, they supply much more of the river's flow. For example, at one point in 2006, the two springs provided an estimated 86 percent of the water flowing past the river gauge at Victoria, Texas. Comal Springs alone accounted for 59 percent of the flow at that gauge and nearly 80 percent of the flow of the river in New Braunfels (Guadalupe Basin Coalition 2007). Radically reduced or cessation of springflow at Comal Springs has a profound effect on surface flow in the Guadalupe River.

Three stream segments within Comal County have been identified as ecologically significant by the Texas Parks and Wildlife Department: 1) Carpers Creek from the confluence with the Blanco River upstream to its headwaters; 2) Comal River (the 2.5 mile-long outflow of Comal Springs) from the confluence with the Guadalupe River upstream to Klingemann Street in New Braunfels (TNRCC[17] classified stream segment 1811); 3) Guadalupe River from the confluence with the Comal River upstream to the Kendall/Kerr County Line, with the exception of Canyon Reservoir (TNRCC classified stream segment 1812 and part of 1806); and Honey Creek from the confluence with the Guadalupe River upstream to its headwaters in northwest Comal County. The South Central Texas Water Planning Group (2006) determined that the Region L recommended water management strategies would not be inconsistent with the existing uses and ecological functions of these stream segments.

The largest springs in Comal County are Comal Springs in New Braunfels and Hueco Springs, a few miles north of New Braunfels. Both springs are major natural discharge points for waters of the Edwards Aquifer. Comal Springs has a long-term average discharge of approximately 280 cubic feet/second (7.9 cubic meters/second)(South Central Texas Regional Water Planning Group 2006). Hueco Springs has a long-term average discharge of 40 cubic feet/second (1.1 cubic meters/second). Most of the spring waters in Comal County pass through underground caverns. These caves and associated springs provide habitat for several unusual species, including karst invertebrates and salamanders.

Canyon Reservoir, within the Guadalupe River Basin, is the largest lake in the County at 8,230 acres (conservation pool level), or 3,331 hectares. The reservoir has authorized diversions averaging 90,000 acre-feet (11,101 hectare meters/year) per year (South Central Texas Regional Water Planning Group 2006).

3.3.3 Water Quality

3.3.3.1 Groundwater Quality

The chemical quality of the water in the Edwards aquifer is typically fresh, although hard, with dissolved solids concentrations averaging less than 500 milligrams/liter (Ashworth and Hopkins 1995). Water quality from the Trinity Aquifer is acceptable for most municipal and industrial purposes; however, concentrations of certain constituents in some areas exceed drinking water standards (Brazos G Regional Water Planning Group 2006). Bush et al. (2000) detected

[17] TNRCC is the abbreviation of "Texas Natural Resource Conservation Commission," the previous name of the Texas Commission on Environmental Quality (TCEQ).

numerous organic chemicals in the Edwards Aquifer, fewer in the Trinity Aquifer, but most concentrations were very low relative to drinking-water standards and guidelines.

The State of Texas has not developed specific standards for pollutant discharge to groundwater; however, state policy requires that "...groundwater be kept reasonably free of contaminants that interfere with present and potential uses of groundwater....[and that] discharges of pollutants, disposal of wastes, or other activities subject to regulation by state agencies be conducted in a manner that will maintain present uses and not impair potential uses of groundwater or pose a public health hazard" (Texas Water Code § 26.401). Groundwater contamination, as defined by the Texas Groundwater Protection Committee, is "...the detrimental alteration of the naturally occurring physical, thermal, chemical, or biological quality of groundwater reasonably suspected of having been caused by the activities of entities under the jurisdiction of the various state agencies" (Texas Groundwater Protection Committee 2006). These state agencies systematically monitor groundwater quality at selected sites (e.g., underground storage tanks, landfills) throughout the state to determine if levels of specific contaminants vary from baseline conditions for that site. In their *Joint Groundwater Monitoring and Contamination Report – 2005*, the Texas Groundwater Protection Committee (2006) reported that 6,132 groundwater contamination cases were documented or under enforcement statewide during the 2005 calendar year.

Edwards Aquifer water quality protection in Comal County is largely governed by the Edwards Aquifer Rules (30 Texas Administrative Code, Chapter 213), which regulate activities having the potential for polluting the Edwards Aquifer and associated surface waters. Subchapter A of the Rules applies to all construction-related or post-construction activity within the Recharge Zone and to certain activities within the Transition Zone, and to other activities that may potentially contaminate the aquifer and hydrologically connected surface streams. The "Transition Zone" is a band bordering the Recharge Zone to the south and southeast. Within this band, the Edwards Aquifer is mostly confined by overlying rock formations and hence falls within the Confined Zone as depicted in Figure 3-2. Within the Transition Zone, permeable features in the overlying rock provide a possible avenue for surface water, and potentially contamination, to enter the Edwards Aquifer.

The Edwards Aquifer Rules stipulate that before certain types of construction can proceed in the Recharge or Transition Zones, an Edwards Aquifer Protection Plan must be submitted to the TCEQ. The plan must include: 1) a Geological Assessment identifying sensitive features (e.g., caves, solution cavities, sinkholes) that could allow movement of contaminants to the aquifer, and 2) a water pollution abatement plan that identifies Best Management Practices to prevent or minimize pollution of the aquifer. Other plans that may be required include an organized sewage collection system plan, an underground storage tank facility plan for static hydrocarbon and hazardous substance storage, and an aboveground storage tank facility plan for static hydrocarbon and hazardous substance storage. Some types of facilities are prohibited altogether from being built in the Recharge or Transition Zones, such as Type 1 municipal solid waste landfills and waste disposal wells. Direct discharge of wastewater into streams in the Recharge (but not Contributing) Zone is also prohibited. Exemptions include, but are not limited to, construction of single-family residences on lots larger than 5 acres (2 hectares); agricultural activities; and oil and gas exploration, development, and production.

Subchapter B of 30 Texas Administrative Code, Chapter 213, applies to construction-related or post-construction activity in the Edwards Aquifer *Contributing Zone*. Activities that disturb the ground or alter a site's topographic, geologic, or existing recharge characteristics may require sediment controls or a Contributing Zone Plan to protect water quality during and after construction, although this Subchapter only applies to developments of 5 acres or larger.

The TCEQ guidance for complying with the Edwards Aquifer Rules (Barrett 2005) stipulates the use of setbacks (natural buffers) to prevent groundwater degradation associated with sensitive features. The natural buffer should extend a minimum of 50 feet away from the feature in all directions; however, if the boundary of the local drainage area to the feature lies more than 50 feet from the feature, the buffer should extend to that boundary or 200 feet, whichever is less. In addition, cave openings large enough to accommodate a person should be secured with cave gates to reduce dumping of trash and toxic materials. Normally, cave openings should not be secured in such a way as to prevent surface runoff from entering the feature, but TCEQ may authorize the closure of karst features on a case-by-case basis.

3.3.3.2 Surface Water Quality

Under the Federal Clean Water Act, Texas has developed and is required to enforce a comprehensive set of water quality standards, including chemical, physical, and biological criteria. These include stream standards, effluent standards for wastewaters, and drinking water standards, which also cover groundwater used as a public water supply. The stream standards (Texas Surface Water Quality Standards, Title 30, Chapter 307 of the Texas Administrative Code) establish explicit water quality goals throughout the state. Beginning in 2000, TCEQ began conducting water quality assessments in one basin group annually, following a rotating cycle of five years. The water quality inventory is the basis of the Clean Water Act 303 (d) list (the 303(d) List), which identifies all "impaired" water bodies that do not meet the water quality criteria established to support designated uses. According to the 2008 Texas Water Quality Inventory and the 303(d) List, portions of two waterways within Comal County were impaired (TCEQ 2008). Within the Proposed RHCP area of potential effect, Canyon Lake (Segment Areas 1805_01, 1805_02, 1805_03, and 1805_04) is listed as impaired due to mercury in edible tissue. Also, Upper Cibolo Creek west of Bracken (Segment Area 1908_02) is listed as impaired due to bacteria.

TCEQ's Texas Pollution Discharge Elimination System (TPDES) permitting program is designed to minimize sedimentation and contamination in surface waters by regulating the handling of storm water runoff from construction sites. TPDES is authorized by the Federal Environmental Protection Agency as part of its National Pollution Discharge Elimination System (NPDES) for regulating point source pollution to Waters of the United States. To be covered under the TPDES Construction General permit, anyone disturbing 1 acre (0.4 hectare) or more of land or are part of a larger common plan of development which will disturb 1 acre or more of land, must prepare and implement a Storm Water Pollution Prevention Plan before discharging storm water to any surface water in the State of Texas. The plan must include a description of the intended sequence of major activities that disturb soils for major portions of the site; estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation or other activities; and the best management practices that will be used to

minimize pollution in runoff before, during, and after construction. In addition to developing and implementing a Storm Water Pollution Prevention Plan, developments of 5 acres or more are also required to submit a Notice of Intent to begin construction and pay an annual TPDES participation fee, as well as submit a Notice of Termination after the completion of construction.

Municipalities and other governmental entities may adopt a Regional Storm Water Management Program, which provides for planning, design, construction, and operation of regional storm water control facilities as an alternative to individual on-site detention controls. Financing is through fees paid by developers who participate in a shared-cost program. Participation is limited to approved watersheds and projects that will not adversely affect other properties due to increased runoff from the proposed development.

Many municipalities, including New Braunfels in Comal County, have also adopted drainage and erosion control ordinances to protect water quality. Texas Water Code and Texas Local Government Code allow for the application of municipal ordinances protecting water quality to apply to all developments within the municipal jurisdiction as well as the extraterritorial jurisdictions. The ordinances provide requirements for controlling increased stormwater runoff and pollutant loadings resulting from new developments expected to occur outside of preserve areas. These requirements generally include maintaining natural buffers along waterways, limits on impervious cover, establishment of water quality detention or filtration ponds, slope protection, limits on stormwater flow volumes, and buffers or setbacks around critical environmental features.

3.4 VEGETATION

As shown in Figure 3-3, vegetation communities in Comal County have been assigned to two ecoregions. Most of the County falls within the Balcones Canyonlands, but a small portion on the southeastern side of the County falls within the Northern Blackland Prairie (Griffith et al. 2004).

Within the portion of Comal County falling within the Balcones Canyonlands, vegetation was mapped by McMahan et al. (1984) as Live Oak-Ashe Juniper Parks and Live Oak-Ashe Juniper Woods interspersed with Live Oak-Mesquite-Ashe Juniper Parks (Figure 3-3). Within the Northern Blackland Prairie, vegetation was mapped primarily as Cropland.

In general, vegetation consists of a mosaic of woodlands of varying density, brushy rangelands, grasslands, and pastures. Common or characteristic tree and shrub species found in these vegetation types include Ashe juniper (*Juniperus ashei*), plateau live oak (*Quercus fusiformis*), honey mesquite (*Prosopis glandulosa*), post oak (*Q. stellata*), blackjack oak (*Q. marilandica*), Texas oak (*Q. buckleyi*), shin oak (*Q. sinuata* var. *breviloba*), cedar elm (*Ulmus crassifolia*), Texas sugarberry (*Celtis laevigata*), agarita (*Mahonia trifoliolata*), Texas persimmon (*Diospyros texana*), sumac (*Rhus* spp.) and saw greenbrier (*Smilax bona-nox*). Grasses occurring in rangelands, pastures, and clearings within woodlands include Texas wintergrass (*Nassella leucotricha*), little bluestem (*Schizachyrium scoparium*), purple three-awn (*Aristida purpurea*), Texas grama (*Bouteloua rigidiseta*), curlymesquite (*Hilaria belangeri*).

Figure 3-3. Vegetation communities in Comal County.

Where frequent spring flow or streams occur, typical vegetation includes black willow (*Salix* nigra), cottonwood (*Populus deltoids*), sycamore (*Platanus occidentalis*), pecan (*Carya illinoinensis*), American elm (*U. americana*), and bald cypress (*Taxodium distichum*).

Grasslands and savanna type vegetation were formerly more widespread on the Edwards Plateau than they are today. Over the last 150–200 years, because of overgrazing and fire suppression, there has been a large-scale conversion from grasslands and savannahs to scrub forest (Scholes and Archer 1997). The density and aerial cover of Ashe juniper (commonly called mountain cedar) in particular has increased (Owens and Lyons 2004). Once largely limited to rocky outcrops, Ashe juniper now covers almost 6.7 million acres (2.7 million hectares) on the Edwards Plateau, forming dense climax stands that suppress the growth and resist invasion of understory species.

3.5 GENERAL WILDLIFE

Table 3-1 identifies 20 rare but non-listed wildlife species that have the potential to occur in Comal County, and Table 3-2 provides a partial list of wildlife species that commonly occur throughout the County.

Table 3-1. Rare wildlife species potentially occurring in Comal County according to the Texas Parks and Wildlife Department (2008).

Mammals	
Cave myotis bat (*Myotis velifer*)	Plains spotted skunk (*Spilogale putorius interrupta*)
Reptiles and Amphibians	
Cascade Caverns salamander (*Eurycea latitans*)	Spot-tailed earless lizard (*Holbrookia lacerata*)
Comal blind salamander (*Eurycea tridentifera*)	Texas garter snake (*Thamnophis sirtalis annectens*)
Comal Springs salamander (*Eurycea* sp.)	Texas horned lizard (*Phrynosoma cornutum*)
Edwards Plateau spring salamander (*Eurycea* sp.)	
Fish	
Guadalupe bass (*Micropterus treculii*)	Guadalupe darter (*Percina sciera apristis*)
Invertebrates	
Comal Springs diving beetle (*Comaldessus stygius*)	Long-legged cave amphipod (*Stygobromus longipes*)
Creeper (squawfoot) (*Strophitus undulatus*)	Pistolgrip (*Tritogonia verrucosa*)
False spike mussel (*Quincuncina mitchelli*)	Rock pocketbook (*Arcidens confragosus*)
Golden orb (*Quadrula aurea*)	Texas fatmucket (*Lampsilis bracteata*)
Horseshoe liptooth (*Daedalochila hippocrepis*)	

Table 3-2. Wildlife species that commonly occur throughout Comal County.

Mammals (source: Kutac and Caran 1994)

- Black-tailed jackrabbit (*Lepus californicus*)
- Brazilian free-tailed bat (*Tadarida brasiliensis*)
- Common gray fox (*Urocyon cinereoargenteus*)
- Common raccoon (*Procyon lotor*)
- Coyote (*Canis latrans*)
- Eastern cottontail (*Sylvilagus floridanus*)
- Fox squirrel (*Sciurus niger*)
- Hispid cotton rat (*Sigmodon hispidus*)
- Hispid pocket mouse (*Chaetodipus hispidus*)
- Nine-banded armadillo (*Dasypus novemcinctus*)
- Striped skunk (*Mephitis mephitis*)
- Virginia opossum (*Didelphis virginiana*)
- White-footed mouse (*Peromyscus leucopus*)
- White-tailed deer (*Odocoileus virginiana*)

Permanent Resident Birds (source: Lockwood and Freeman 2004)

- Great blue heron (*Ardea herodias*)
- Bewick's Wren (*Thryomanes bewickii*)
- American crow (*Corvus brachyrhynchos*)
- Blue jay (*Cyanocitta cristata*)
- Brown-headed cowbird (*Molothrus ater*)
- Carolina chickadee (*Poecile carolinensis*)
- Carolina wren (*Thryothorus ludovicianus*)
- Cooper's Hawk (*Accipiter cooperii*)
- Eastern bluebird (*Sialia sialis*)
- Eastern meadowlark (*Sturnella magna*)
- Field Sparrow (*Spizella pusilla*)
- Great horned owl (*Bubo virginianus*)
- Greater roadrunner (*Geococcyx californianus*)
- Great-tailed grackle (*Quiscalus mexicanus*)
- House finch (*Carpodacus mexicanus*)
- Ladder-backed woodpecker (*Picoides scalaris*)
- Loggerhead shrike (*Lanius ludovicianus*)
- Mourning dove (*Zenaida macroura*)
- Northern cardinal (*Cardinalis cardinalis*)
- Northern mockingbird (*Mimus polyglottos*)
- Red-shouldered Hawk (*Buteo lineatus*)
- Red-tailed hawk (*Buteo jamaicensis*)
- Red-winged blackbird (*Agelaius phoeniceus*)
- Turkey vulture (*Cathartes aura*)

Migratory Breeding Season Birds (source: Lockwood and Freeman 2004)

- Barn swallow (*Hirundo rustica*)
- Blue-gray gnatcatcher (*Polioptila caerulea*)
- Chimney swift (*Chaetura pelagica*)
- Cliff swallow (*Petrochelidon pyrrhonota*)
- Common nighthawk (*Chordeiles minor*)
- Dickcissel (*Spiza americana*)
- Great crested flycatcher (*Myiarchus crinitus*)
- Green heron (*Butorides virescens*)
- Lark sparrow (*Chondestes grammacus*)
- Painted bunting (*Passerina ciris*)
- Purple martin (*Progne subis*)
- Scissor-tailed flycatcher (*Tyrannus forficatus*)
- Summer tanager (*Piranga rubra*)
- Western kingbird (*Tyrannus verticalis*)
- White-eyed vireo (*Vireo griseus*)
- Yellow-billed cuckoo (*Coccyzus americanus*)

Winter Resident Birds (source: Lockwood and Freeman 2004)

- American goldfinch (*Carduelis tristis*)
- American kestrel (*Falco sparverius*)
- Cedar waxwing (*Bombycilla cedrorum*)
- Duck, several species
- House wren (*Troglodytes aedon*)
- Lincoln's sparrow (*Melospiza lincolnii*)
- Ruby-crowned kinglet (*Regulus calendula*)
- Savannah sparrow (*Passerculus sandwichensis*)
- Sharp-shinned hawk (*Accipiter striatus*)
- Song sparrow (*Melospiza melodia*)
- Spotted sandpiper (*Actitis macularia*)
- Spotted towhee (*Pipilo maculatus*)
- Vesper sparrow (*Pooecetes gramineus*)
- White-crowned sparrow (*Zonotrichia leucophrys*)
- White-throated Sparrow (*Zonotrichia albicollis*)
- Wilson's snipe (*Gallinago delicata*)
- Yellow-bellied sapsucker (*Sphyrapicus varius*)
- Yellow-rumped warbler (*Dendroica coronata*)

Amphibians and Reptiles (sources: Kutac and Caran 1994, Dixon 2000)

- Blanchard's cricket frog (*Acris crepitans blanchardi*)
- Blotched water snake (*Nerodia erythrogaster*)
- Diamondback water snake (*Nerodia rhombifer*)
- Great Plains narrow-mouth toad (*Gastrophryne olivacea*)
- Green anole (*Anolis carolinensis*)
- Ground skink (*Scincella lateralis*)
- Gulf Coast toad (*Bufo valliceps*)
- Rio Grande leopard frog (*Rana berlandieri*)
- Texas rat snake (*Elaphe obsoleta*)
- Texas river cooter (*Pseudemys texana*)
- Texas spiny lizard (*Sceloporus olivaceus*)
- Western coachwhip (*Masticophis flagellum testaceus*)
- Western diamondback rattlesnake (*Crotalus atrox*)
- Yellow mud turtle (*Kinosternon flavescens*)

3.6 COMAL COUNTY RHCP COVERED SPECIES

The Covered Species include two endangered bird species: the golden-cheeked warbler and black-capped vireo. The following paragraphs summarize the Covered Species' status, distribution, and habitat requirements. Each species is described in greater depth in Chapter 3 of the RHCP.

3.6.1 Golden-cheeked Warbler (*Dendroica chrysoparia*)

The golden-cheeked warbler was emergency listed May 4, 1990, and gained permanent Federal listing status as endangered on December 27, 1990 (55 FR 53153). This migratory songbird species winters in southern Mexico and northern Central America and breeds in the Edwards Plateau and Cross Timbers Level III ecoregions of central Texas, including Comal County. Most golden-cheeked warblers arrive in central Texas in early to mid-March and start returning to their wintering grounds in July.

3.6.1.1 Golden-cheeked Warbler Habitat

Recent studies demonstrate that golden-cheeked warbler habitat requirements vary depending on landscape-level factors such as tree species composition and structure, patch size, slope, adjacent land use, and distance from larger blocks of regularly occupied habitat (Dearborn and Sanchez 2001, Miller et al. 2001, Magness et al. 2006, DeBoer and Diamond 2006). Golden-cheeked warbler breeding habitat typically consists of relatively dense and mature woodland composed of a combination of Ashe juniper and hardwood tree species, especially deciduous oaks. Other hardwood tree species often found in warbler breeding habitat include escarpment black cherry (*Prunus serotina* var. *eximia*), Arizona black walnut (*Juglans major*), cedar elm, and Texas ash (*Fraxinus texensis*). Ashe juniper can account for 10 to 90 percent of trees present in warbler habitat, and hardwoods can account for 10 to 85 percent of trees present; woodlands utilized regularly by warblers also typically have canopy cover greater than 50 percent and tree height greater than 10 feet (3 meters) (USFWS 1996a, Alldredge et al. 2002). Typically, the species will defend territories of 4 to 8 acres (1.6–3.2 hectares) in higher quality habitat, but may establish territories of 16 to 20 acres (6.5–8.1 hectares) or larger in lower quality habitat (USFWS 1996a).

In Comal County, the range of the golden-cheeked warbler is limited to Ashe juniper woodlands in hilly areas where the Edwards Formation and other, underlying formations are exposed. Hilly areas where the Edwards Formation is absent have drier substrate conditions and do not support good habitat. Where land is flat and only the Edwards Formation is exposed, water drains too deeply for tree roots to access it, causing vegetation to be more xeric than that preferred by golden-cheeked warblers. Also, flat terrain is more apt to be cleared to create grazing land. Because of the difficulty in clearing trees, steep terrain is more likely to remain wooded.

SWCA (2007) estimated the amount of available golden-cheeked warbler breeding habitat in Texas. Five known habitat characteristics were used to narrow the total amount of wooded landscape visible in aerial photography to those woodlands likely to constitute golden-cheeked

warbler breeding habitat. The entire range of the species in Texas was estimated to contain 1,363,807 acres (551,913 hectares) of potential habitat, and the recovery region in which Comal County is located (Recovery Region 6) was estimated to contain 244,106 acres (98,786 hectares) of potential habitat. Because the SWCA method closely adheres to widely accepted definitions of golden-cheeked warbler habitat (USFWS 1996a, Alldredge et al. 2002, TPWD 2006), these acreage estimates are used in this EIS as the baseline for purposes of measuring potential impacts. Using SWCA's estimates also provides a more conservative approach compared to using habitat models that employ fewer habitat characteristics and thus identify more woodland as suitable habitat (see the following paragraph, for example). Overestimating the amount of available habitat may underestimate impacts. Using a more conservative approach to habitat assessment minimizes that risk.

An example of a broad-brush approach to modeling potential golden-cheeked warbler habitat is Model C in Diamond 2007, which identifies most forest/woodland landscape as potential golden-cheeked warbler habitat. According to this model, an estimated 4,378,418 acres (1,771,883 hectares) of golden-cheeked warbler habitat may occur across the species' breeding range in Texas; 769,581 acres (311,438 hectares) of habitat may occur in Recovery Region 6; and 125,086 acres (50,620 hectares) of habitat may occur in Comal County.

3.6.1.2 Habitat Availability in Comal County

Using SWCA (2007) estimates, the RHCP identifies 65,581 acres (26,540 hectares) of woodland in Comal County as potential golden-cheeked warbler habitat (Figure 3-4). Taking the analysis one step further, it is possible to determine the probability of golden-cheeked warbler occupancy as a function of certain vegetative characteristics within that habitat. Magness et al. (2006) found that that the higher the percent woodland composition of the landscape within a 400-meter radius, and the greater the patch size of the largest woodland (also within a 400-meter radius), the greater the probability of habitat occupancy. At the 60 percent woodland composition (mature oaks and junipers), the probability of golden-cheeked warbler occupancy was approximately 20 percent. At 80 percent woodland composition, the probability of golden-cheeked warbler occupancy increased to approximately 50 percent.

Following the techniques of Magness et al. (2006), the RHCP estimates that approximately 13,594 acres (5,501 hectares) of the total potential warbler habitat have at least 80 percent woodland composition and at least a 50 percent probability of warbler occupancy. Approximately 19,163 acres (7,755 hectares) is 60 to <80 percent woodlands and has a 20 to <50 percent probability of golden-cheeked warbler occupancy. Approximately 32,824 acres (13,283 hectares) of potential golden-cheeked warbler habitat is 50 to <60 percent woodlands and has a <20 percent probability of warbler occupancy. Thus, while any patch of woodland greater than 10 acres (4 hectares) in Comal County *could* support the golden-cheeked warbler, for approximately half (32,824 acres) of the identified potential habitat, there is less than a 20 percent probability that golden-cheeked warblers will regularly occur. In the remaining 32,757 acres (13,256 hectares) there is a 20 to at least 50 percent probability of regular occupancy.

Figure 3-4. Golden-cheeked warbler (GCW) occurrences and distribution of potential golden-cheeked warbler habitat in Comal County, Texas.

3.6.1.3 Golden-cheeked Warbler Population Estimates

Notwithstanding the application of the Magness et al. (2006) techniques, an accurate population estimate cannot be reasonably derived for the golden-cheeked warbler in Comal County based simply on the acreage and probability of occurrence. However, a rough estimate of population numbers can be broadly predicted. For example, it is well known that golden-cheeked warbler occupancy levels will vary by habitat quality (Beardmore 1994, DeBoer and Diamond 2006), and Pulich (1976), specifically addressing this issue, found that golden-cheeked warbler territory size generally varied from 20 to 80 acres (8–32 hectares) per pair. Following the range of density estimates derived by Pulich (1976) and assuming 65,581 acres of golden-cheeked warbler habitat, it is possible there could be 820–3,279 breeding pairs of golden-cheeked warblers each year in the woodland habitats of Comal County. Assuming an average of 50 acres (20 hectares) per pair (20+80/2), golden-cheeked warbler habitat in Comal County may support 1,312 territories.

As noted above, the entire breeding range of the golden-cheeked warbler contains an estimated 1,363,807 acres of potential habitat (SWCA 2007). Assuming an average of 50 acres per pair, that amount of habitat could support approximately 27,000 territories. Recovery Region 6 includes an estimated 244,106-769,581 acres of potential golden-cheeked warbler habitat, supporting approximately 4,900 territories. Thus, the Comal County component of the overall population is relatively small, perhaps supporting 4.9 percent of the entire breeding population and 26.8 percent of the breeding population of Recovery Region 6. These estimates do not include isolated patches smaller than 11 acres (SWCA 2007).

3.6.1.4 Threats to Golden-cheeked Warbler

The greatest threats to the continued existence of the golden-cheeked warbler are loss of habitat and urban encroachment within its breeding habitat (Wahl et al. 1990, USFWS 1992, Coldren 1998). Other factors include the loss of deciduous oaks (used for foraging) to oak wilt, brood parasitism by brown-headed cowbirds, and predation by Texas rat snakes (*Elathe obsoleta lindheimeri*), and predation by and competition with blue jays (*Cyanocitta cristata*) and other urban–tolerant birds (USFWS 1992). Human agricultural activities have also eliminated a considerable amount of habitat along the Balcones Escarpment, especially in a growth corridor along Interstate 35 southward through Bexar County (USFWS 2005a).

3.6.1.5 Golden-cheeked Warbler Recovery Plan

The Service prepared a Recovery Plan for golden-cheeked warblers in 1992, which divided the breeding range into eight recovery regions. Comal County lies within Recovery Region 6, along with all of Bexar and Kendall Counties, and portions of Bandera, Hays, Gillespie, and Blanco Counties (see RHCP Figure 3-3).[18]

[18] The golden-cheeked warbler Recovery Plan is under review by the Service, and a revised plan may be approved during the Permit term.

The Recovery Plan identified preservation and protection of one viable golden-cheeked warbler population in each of the eight recovery regions as a primary criterion for delisting of the species. "Viable population" is not defined in the Recovery Plan, although the plan does suggest a viable population of golden-cheeked warblers could range from 500 pairs to a few thousand individuals. More recently, the Service has indicated a viable population of golden-cheeked warblers may need to be as large as 3,000 pairs (USFWS 1996a, Alldredge et al. 2002).

Based on the above, a viable population of golden-cheeked warblers appears to be present in Recovery Region 3 on Fort Hood, where the population is thought to comprise over 4,500 singing males (Peak 2003, USFWS 2005b). Protected populations of golden-cheeked warblers are also present in Recovery Region 5 on the Balcones Canyonlands National Wildlife Refuge, where the golden-cheeked warbler population is estimated to range from 800 to 1,000 pairs (C. Sexton, U.S. Fish and Wildlife Service, pers. comm. to SWCA, 2007) and on the Balcones Canyonlands Conservation Plan lands where hundreds more golden-cheeked warblers are known to breed each year (J. Kuhl, Travis County, pers. comm. to SWCA, 2007). In late 2009, the Service convened a new recovery team for the warbler. Additionally, the Service is currently conducting a 5-Year Review of the warbler (C. Williams, U.S. Fish and Wildlife Service, pers. comm. to Smith|Robertson, 2010).

3.6.2 Black-capped Vireo (*Vireo atricapilla*)

The Service listed the black-capped vireo as endangered on October 6, 1987 (52 FR 37420), and recommended that the black-capped vireo be reclassified as threatened in their 5-Year Review of the species, dated June 19, 2007 (USFWS 2007b). The black-capped vireo occurs in western, central, and north-central Texas, a few localities in central Oklahoma, and in the states of Coahuila, Nuevo Leon, and Tamaulipas, Mexico (USFWS 1991, Farquhar and Gonzalez 2005). In central Texas, distribution of the black-capped vireo is restricted to habitats occurring west of the Balcones Escarpment. Black-capped vireos arrive in central Texas from late March to mid-April and generally return to their wintering grounds on the Pacific slope of western Mexico in September (Graber 1957, Marshall et al. 1984).

3.6.2.1 Black-capped Vireo Habitat Requirements

Typical breeding habitat for the black-capped vireo consists of semi-open to relatively dense shrubland with vegetation cover down to ground level (Graber 1961). Grzybowski et al. (1994) characterized black-capped vireo habitat as having shrub cover of at least 35 percent and shrubby foliage present from ground level up to 6.6 feet (2 meters) in height. Maresh (2005) documented a wider range of habitat usage, finding black-capped vireo territories in communities with woody cover ranging from less than 10 percent to woodland with greater than 90 percent canopy closure and canopy height greater than 19.7 feet (6 meters). However, Maresh reaffirmed that areas occupied by black-capped vireos consistently contained shrubby vegetation within 2 meters of the ground.

In central Texas, black-capped vireo habitat is usually dominated by shin oak or evergreen sumac (*Rhus virens*); other species often occurring in black-capped vireo habitat include Texas red oak, plateau live oak, fragrant (*R. aromatica*), prairie, or flameleaf sumac (*Rhus lanceolata*),

poison ivy (*Toxicodendron radicans*), Texas persimmon, agarita, redbud (*Cercis canadensis*), and Ashe juniper (Maresh 2005, Travis County 1999). Black-capped vireo breeding habitat in central Texas is typically early to mid-successional. Therefore, black-capped vireo habitat currently present in the region has potential to become unsuitable for the species with time as shrubs become taller and are replaced by trees, which usually then create too much shade for understory foliage to be maintained at a level suitable for black-capped vireos. Breeding habitat for the black-capped vireo can be maintained naturally by wildfire, or artificially by mechanical clearing or with prescribed burns.

3.6.2.2 Habitat Availability in Comal County

Currently, no records of black-capped vireo occurrence exist for Comal County, although suitable habitat is present. Extrapolating from the results of a roadside survey of two 30-mile transects in areas thought "most likely" to support black-capped vireos, Maresh and Rowell (2000) estimated that 3,591 acres (1,453 hectares) of black-capped vireo habitat exist in Comal County. The reliability of this estimate has been questioned by Wilkins et al. (2006), who concluded that the analysis lacked statistical rigor and likely overestimated the amount of suitable black-capped vireo habitat. Wilkins et al. (2006) warn that the results are of limited value for comparison purposes and should be interpreted with caution. More recently, Fuller et al. (2008) used a niche model to estimate the amount of black-capped vireo habitat in Comal County. They concluded that approximately 492 acres (199 hectares) of "good" black-capped vireo habitat exist in the County. This acreage total includes only the top 50 percent of sites identified as being suitable black-capped vireo habitat (i.e., the 50 percent of sites that best matched the environmental parameters associated with records of black-capped vireo occurrence).

Because Fuller et al. (2008) did not include all "suitable habitat" in their estimate, and because Maresh and Rowell (2000) likely overestimated the amount of black-capped vireo habitat in the County, the actual amount of potential black-capped vireo habitat in Comal County probably falls between 492 and 3,591 acres. SWCA did not attempt to delineate black-capped vireo habitat using GIS due to the difficulty inherent in attempting to identify black-capped vireo habitat from aerial photography.

3.6.2.3 Black-capped Vireo Population Estimates

A meaningful population estimate cannot be reasonably estimated for the black-capped vireo in Comal County based on the various estimates of potential habitat. While no black-capped vireos have been recorded in the County to date, it is highly probable that black-capped vireos are likely to occur in some of the areas identified as potential habitat.

Recent studies indicate that the total breeding population of this species in Texas, Oklahoma, and Mexico is substantially larger than was known at the time of listing, with over 6,000 pairs now known, compared to fewer than 200 pairs when the species was listed two decades ago (USFWS 2007b). Existing data indicate that differences in numbers today compared to a decade ago can be attributed to increased survey efforts, as well as habitat restoration and other efforts that have led to documented increases in natural reproduction (USFWS 2007b).

3.6.2.4 Threats to Black-capped Vireo

Primary threats to the black-capped vireo identified in the species' Recovery Plan (USFWS 1991) include direct and indirect impacts of human land use on breeding habitat, loss or deterioration of breeding habitat through natural processes, and low reproductive success. Low reproductive success was attributed to high rates of nest parasitism by brown-headed cowbirds and to nest predation by red imported fire ants (*Solenopsis invicta*) and other species. An important finding of the Service's 2007 5-Year Review was that the invasion of native juniper species appears to be one of the most prevalent problems in maintaining existing suitable habitat for the black-capped vireo throughout most of its range. Proliferation of the junipers can be directly linked to fire suppression and overgrazing. At the time of the species' listing in 1987, high stocking rates of domestic livestock and high populations of white-tail deer were thought to be significant threats to black-capped vireo habitat (USFWS 2007b). High ungulate populations tend to decrease the quality of black-capped vireo breeding habitat by removing the shrubs they require for nesting and, secondarily, high domestic livestock populations are associated with high numbers of the brown-headed cowbird.

Conclusions of the 5-Year Review (USFWS 2007b) indicate that, range-wide, species threats have diminished and black-capped vireo populations have increased. Since the listing of the black-capped vireo, there has been a trend toward significant declines in ungulate populations throughout the black-capped vireo range in Texas (USFWS 2007b). For example, during the period 1987–2002, on the Edwards Plateau, goat and cattle numbers have declined by almost 35 percent and 10 percent, respectively. Over the same period, some evidence indicates that white-tailed deer numbers have increased.

3.6.2.5 Black-capped Vireo Recovery Plan

The Service prepared a Recovery Plan for the black-capped vireo in 1991 (USFWS 1991). The Recovery Plan divided the breeding range of the black-capped vireo into six regions. The northwestern half of Comal County lies within Recovery Region 3, along with all of Kendall, Bandera, Real, Kerr, Blanco, Gillespie, Mason, Menard, and Kimble Counties, and portions of Bexar, Medina, Uvalde, Kinney, Edwards, Sutton, Schleicher, Concho, McColloch, San Saba, and Llano Counties.

In 1996 it was recommended that the six recovery regions for the black-capped vireo be revised to four (USFWS 1996b), although this recommendation has not been adopted formally through issuance of a revised or amended Recovery Plan. "Viable population" is defined in the Recovery Plan as 500 to 1,000 breeding pairs of black-capped vireos (USFWS 1991). A population and habitat viability assessment performed for the black-capped vireo indicated that the black-capped vireo has a very low probability of going extinct even in a population of 200 to 400 breeding pairs if fecundity of $\geq$1.25 female offspring per female is achieved, either naturally or through management (USFWS 1996b). As of 2005, viable populations of black-capped vireos, as defined by the Recovery Plan, were present in Oklahoma (Wichita Mountains Wildlife Refuge, with more than 1,250 pairs; USFWS 2005b) and Texas (Fort Hood in Recovery Region 2, with an estimated 13,000 pairs; USFWS 2005c).

Because of gaps in knowledge of the biology, ecology, and population status of the black-capped vireo at the time of its preparation, the Recovery Plan does not identify criteria for delisting of the species. Instead, it states that the black-capped vireo will be considered for downlisting to threatened when: 1) all existing populations are protected and maintained; 2) at least one viable breeding population exists in Oklahoma, Mexico, and four of the six recovery regions delineated in Texas; 3) sufficient and sustainable area and habitat on the winter range exists to support the breeding populations; and 4) the previous three criteria have been maintained for at least five consecutive years and available data indicate that they will continue to be maintained. As noted above, the Service recommended that the black-capped vireo be reclassified as threatened in their 5-Year Review of the species (USFWS 2007b).

3.7 COMAL COUNTY RHCP EVALUATION SPECIES

The proposed Comal County RHCP addresses a second category of species called "Evaluation Species." These nine species would not be covered by the requested Permit; however, they are rare and/or endemic and without adequate conservation measures they may be listed in the future. These species were identified for inclusion in the RHCP by the Comal County RHCP Biological Advisory Team. Mitigation measures for the Covered Species are likely to benefit some or all Evaluation Species and may preclude listing; however, should any of these species become federally listed, they would still not be covered by the requested Permit. Included in the list of Evaluation Species are one turtle species and eight species of obligate cave-dwelling invertebrate organisms. The one turtle species is Cagle's map turtle. The eight obligate cave-dwelling invertebrate species are:

a cave-obligate decapod (*Palaemonetes holthuisi*)
a cave-obligate amphipod (*Seborgia hershleri*)
a cave-obligate amphipod (*Texiweckelia relicta*)
a cave-obligate beetle (*Rhadine insolita*)
a cave-obligate harvestman (*Texella brevidenta*)
a cave-obligate spider (*Cicurina puentecilla*)
a cave-obligate spider (*Cicurina reclusa*)
a cave-obligate snail (nymph trumpet; *Phreatoceras taylori*)

3.7.1 Cagle's Map Turtle (*Graptemys caglei*)

The Service received a petition to list Cagle's map turtle on April 8, 1991 (Killebrew 1991). In response to that petition, the Service designated the turtle as a candidate species on January 22, 1993, indicating that listing of the species was warranted, but precluded at that time because the Service lacked the resources to propose the species for listing (58 FR 5701). On November 16, 2000, the TPWD listed Cagle's map turtle as a state threatened species (Texas Register, Title 31, Chapter 65). On September 12, 2006, after reviewing the turtle's status, the Service announced that, because of stable population size, increased protection, and no foreseeable threats from reservoir construction, the listing of Cagle's map turtle was no longer warranted (71 FR 53767).

The historical range of Cagle's map turtle formerly encompassed the watersheds of the Guadalupe and San Antonio Rivers of south-central Texas (Dixon 2000, Conant and Collins 1991), but the species may now be extirpated in the San Antonio drainage (Vermersch 1992). Habitat for this turtle consists of limestone or mud-bottomed streams with moderate current and pools of varying depths, although it may also be found in slow-moving water behind impoundments (Vermersch 1992).

The primary threat to Cagle's map turtle is loss and degradation of riverine habitat resulting from construction of dams and reservoirs, although the species is also vulnerable to over-collecting for the pet trade, zoos, museums, and scientific research (Killebrew 1991). The naturally limited distribution of this turtle makes the species more vulnerable to extinction than other wider-ranging species. Location and suitability of nesting sites may be impacted by alteration of a river system and such impacts may, in turn, affect hatch rates and sex ratios (Wibbels et al. 1991).

3.7.2 Obligate Cave-Dwelling Evaluation Species

Table 3-3 provides information about eight species of cave-dwelling invertebrates addressed in the Comal County RHCP as "Evaluation Species." These organisms fall into two groups: aquatic species and terrestrial species. All are troglobitic; that is, they are adapted to subterranean habitats and cannot survive on the surface.

Table 3-3. Obligate cave-dwelling invertebrate species addressed in the Comal County RHCP as "Evaluation Species."

Species[1]	Organism Type	Notes
Aquatic Invertebrates		
Palaemonetes holthuisi	decapod	Known only from Ezell's Cave, Hays County (Reddell 1994)
Seborgia hershleri	amphipod	Known from an unnamed spring along the Devil's River, Val Verde County (Holsinger 1992)
Texiweckelia relicta	amphipod	Known from the artesian well at the aquatic Station, Texas State University, San Marcos, Hays County (Holsinger and Longley 1980)
Phreatoceras taylori	snail	No information available
Terrestrial Invertebrates		
Rhadine insolita	beetle	Known from Fischer Cave, Comal County
Texella brevidenta	harvestman	Known from Honey Creek Cave, Comal County (Ubick and Briggs 1992)
Cicurina puentecilla	spider	Known from Natural Bridge Caverns, Comal County (Paquin and Hedin 2004)
Cicurina reclusa	spider	Known from Kappelman Salamander Cave, Comal County (Reddell and Cokendolpher 2004)

[1] All species in this table were included in a listing petition that was submitted to the Service by the Forest Guardians (2007). In its 90-Day Findings relative to that petition (74 FR 419, 74 FR 66866), the Service found that insufficient information was presented in the petition or readily available in their files to warrant listing any of these species.

These species are either known to occur or are likely to occur in Comal County. All eight species were included in a listing petition that was submitted to the Service by the Forest Guardians (2007). In its 90-Day Finding relative to that petition (74 FR 419), the Service found that insufficient information is available to warrant listing six of the species (identified in Table 3-3 with an asterisk). The Service has yet to issue a finding for the remaining two species: *Palaemonetes holthuisi* and *Texiweckelia relicta*. In fact, very little is known about any of the eight species.

3.7.2.1 Aquatic Troglobites (Stygobites)

The decapod, amphipods, and snail (*Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori*) are subterranean aquatic invertebrates that inhabit groundwater environments associated with the Edwards Aquifer. Such obligate cave-dwelling aquatic invertebrates are known as "stygobites" or "aquatic troglobites." While little is known about these particular species, other subterranean aquatic invertebrates from similar habitats in Comal County (e.g., Peck's cave amphipod) have been studied (Barr 1993), and certain information gained from those studies pertains to the Evaluation Species as well. The primary habitat for stygobites is a zone of permanent darkness in the aquifer. The precise depth and subterranean extent of their ranges cannot be known; these species may be confined to small areas surrounding the spring openings or caves, or they may be distributed over a much wider area in the aquifer. It is generally recognized that stygobites tend to have a much larger range than their terrestrial counterparts because their habitat is interconnected below the water table (Lamoreux 2004). Terrestrial troglobite habitat, on the other hand, tends to be segmented by the interplay between topography and the water table. More habitat generally means that the organisms occupying that habitat are less vulnerable to single impact events.

An integral connection exists between the water in the San Antonio segment of the Edwards Aquifer and the water in the caves, springs, and artesian wells that serves as habitat for subterranean aquatic species in Comal County. As a result, as with all stygobites in the County, threats to *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* include a reduction or loss of water of adequate quantity and quality due to drought and/or human withdrawal of water from the aquifer (Eckhardt Undated-b, TPWD Undated-b).

3.7.2.1 Terrestrial Troglobites (Karst Invertebrates)

The remaining four Evaluation Species (*Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa*) are terrestrial troglobites, or karst invertebrates, known from caves and other karst features[19] in Comal County (see Table 3-3). As with the aquatic invertebrates discussed above, very little is known about these particular species. Similar species on the Edwards Plateau, however, have been studied and sufficient information is known about some of them to support listing as endangered species under the ESA; e.g., karst invertebrates in Bexar County (USFWS 2003) and Travis and Williamson Counties (USFWS 1988, 1993, 1994). Much of this information pertains to the Evaluation Species as well

[19] A karst feature is a geologic feature such as a cave and sinkhole formed directly or indirectly in calcium carbonate rock by solution.

Karst invertebrates, whether in Williamson, Travis, Hays, Comal, or Bexar Counties, require environmental conditions present only in caves. These conditions include stable temperatures close to the mean surface temperature, constant near-saturation humidity, low evaporation rates, and the absence of photosynthetic nutrient production (Barr 1968, Culver 1982). Because they lack photosynthesis and primary producers, cave ecosystems rely on nutrient input from the surface. Nutrients are introduced into the subsurface in the form of plant detritus washed in by surface waters, micro- and macro-organisms that enter caves under their own power, and the eggs and waste of trogloxene species[20] such as cave crickets (*Ceuthophilus* spp.).

Karst invertebrates are vulnerable to impacts of land development, including loss or damage of cave habitat due to construction activities, chemical contamination introduced into the cave from groundwater and/or surface drainages, destruction of surface habitat, and red imported fire ants that may feed on dead troglobites, cave crickets, and other species within caves (Elliott 1992, USFWS 1994). The troglobitic species in central Texas are thought to be highly susceptible to extinction because they often occupy isolated caves and have restricted distributions (Elliott and Reddell 1989).

3.8 OTHER PROTECTED SPECIES

In addition to the Comal County RHCP Covered Species and Evaluation Species discussed above, the TPWD (2008) and the Service identify 19 Federal or state protected wildlife species as having potential to occur in Comal County. These species and their regulatory status are listed in Table 3-4 and discussed briefly below.

3.8.1 Black Bear (*Ursus americanus*)

Only one of the 16 subspecies of black bear is federally listed, the Louisiana black bear (*Ursus americanus luteolus*); however, all subspecies of black bear within the historic range of *U. a. luteolus* are considered threatened under the ESA due to a similarity of appearance to *U. a. luteolus* (57 FR 588). The historic range of the Louisiana black bear included all Texas counties east of and including Cass, Marion, Harrison, Upahur, Rusk, Cherokee, Anderson, Leon, Robertson, Burleson, Washington, Lavaca, Victoria, Refugio, and Aransas (Hall 1981). Comal does not fall within this range; therefore, in the highly unlikely event a black bear should occur in the County, it would not be federally protected. All black bears in Texas are listed as threatened by the TPWD.

There is no evidence to suggest black bears are present Comal County now or will be present in the foreseeable future. While the black bear was once widespread throughout Texas it is now restricted to remnant populations in mountainous areas of the Trans-Pecos region (Campbell 2003) and to counties in northeast Texas, where bears were once extirpated but now appear to be moving in from neighboring states (TPWD 2005).

[20] Trogloxenes are species that have adapted to the cave environment sufficiently that they complete part of their life cycle in cave, but must return to the surface to feed and thus retain adaptations for surface life.

Typical habitat for black bear species includes mixed deciduous-coniferous forests with a thick understory (Campbell 2003). Dense vegetation, fallen trees, or hollow logs are required for den-sites for the birth of young and for over-wintering.

Table 3-4. Species with Federal- or state-protected status that occur or have the potential to occur in Comal County.

Species	Federal Status	Texas State Status
Mammals		
Black bear (*Ursus americanus*)	T/SA	T
Jaguarundi (*Puma yagouaroundi*)	E	E
Red wolf (*Canis rufus*) (extirpated from Texas)	E	E
Birds		
American peregrine falcon (*Falco peregrinus anatum*)	Delisted	E
Arctic peregrine falcon (*Falco peregrinus tundrius*)	Delisted	T
Bald eagle (*Haliaeetus leucocephalus*)	Delisted	E
Whooping crane (*Grus americana*)	E	E
Zone-tailed hawk (*Buteo albonotatus*)		T
Reptiles		
Texas horned lizard (*Phrynosoma cornutum*)		T
Amphibians		
Cascade Caverns salamander (*Eurycea latitans* complex)		T
Comal blind salamander (*Eurycea tridentifera*)		T
San Marcos salamander (*Eurycea nana*)	T	T
Texas blind salamander (*Typhlomolge rathbuni*)	E	E
Fish		
Fountain darter (*Etheostoma fonticola*)	E	E
San Marcos gambusia (*Gambusia georgei*) (may be extinct)	E	
Crustaceans		
Peck's cave amphipod (*Stygobromus pecki*)	E	E
Insects		
Comal Springs dryopid beetle (*Stygoparnus comalensis*)	E	
Comal Springs riffle beetle (*Heterelmis comalensis*)	E	
Plants		
Texas wild-rice (*Zizania texana*)	E	

Key: E = Endangered, T = Threatened, T/SA = Threatened due to similarity of appearance

3.8.2 Jaguarundi (*Puma yagouaroundi*)

The jaguarundi was historically known to occur in Cameron and Willacy Counties. The last confirmed capture of a jaguarundi in Texas occurred in 1969 in Willacy County. In 1986, a road-killed specimen was recovered from Cameron County, indicating the species may continue to be present in low densities in Cameron and Willacy Counties (Campbell 2003). Habitat requirements for the jaguarundi are poorly understood, but are thought to include dense thickets of mixed thornshrub species (TPWD 2007). Comal County lies outside the known range for this species and lacks suitable habitat; therefore, jaguarundis are not expected to occur there.

3.8.3 Red Wolf (*Canis rufus*)

The red wolf once ranged throughout the southeastern United States and along the Gulf Coast of Texas and Louisiana, but the Service declared this species extinct in the wild in 1980 (USFWS 2009). The only red wolves known to be in the wild at this time were raised in a captive breeding program and released as part of an experimental population in North Carolina and Tennessee. It is believed that red wolves no longer occur anywhere in Texas, including Comal County, although they are still listed as a threatened species by the TPWD (2007).

3.8.4 American Peregrine Falcon (*Falco peregrinus anatum*)

The American peregrine falcon has been listed as a Texas endangered species since 1974, but was removed from the Federal List of Endangered and Threatened Wildlife in August 1999 (64 FR 46541). In Texas, this species is a year-round resident in the Trans-Pecos region, but may appear in Comal County as a migrant (Campbell 2003). This species is known to occupy a wide range of habitats (TPWD 2007).

3.8.5 Arctic Peregrine Falcon (*Falco peregrinus tundrius*)

The arctic peregrine falcon was listed as a Texas endangered species May 1975, and was reclassified as threatened species in March 1987. The species was removed from the Federal List of Endangered and Threatened Wildlife in October 1994 (59 FR 50796). Like the American peregrine falcon, the arctic peregrine falcon would occur in Comal County only as a migrant (Campbell 2003).

3.8.6 Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is a Texas threatened species, but it was removed from Federal List of Endangered and Threatened Wildlife in July 2007 (72 FR 37346). Pursuant to the ESA, the Service will effectively monitor the species in cooperation with the states for a minimum of five years after delisting. In Texas, breeding bald eagles occur primarily in the eastern half of the state and in coastal counties, while non-breeding or wintering populations are located primarily in the Panhandle, central, and east Texas (Campbell 2003). The bald eagle is most likely to appear in Comal County as a migrant, primarily near rivers and large lakes.

3.8.7 Whooping Crane (*Grus americana*)

Currently a Texas endangered species, the whooping crane was federally listed as endangered in June 1970 (35 FR 8491). Critical habitat for the species was designated in May 1978 (43 FR 20938) and includes wintering range in the Aransas National Wildlife Refuge and vicinity on the Texas Gulf coast. Whooping cranes migrate throughout the central portion of the state to the central coast during October–November and again in April (TPWD 2007). They use a variety of habitats during migration.

3.8.8 Zone-tailed Hawk (*Buteo albonotatus*)

Zone-tailed hawks are uncommon and local in hills and mountains of northern Baja California, central Arizona, southern New Mexico, and southwest Texas, south through mainland Mexico and into northern South America (Oberholser 1974). They are rarely encountered north of Mexico in the winter, but occur in southwest Texas during the breeding season from March to July, and possibly into October. Zone-tailed hawks are occasional summer residents in the western and southern portions of the Edwards Plateau (Peterson 1960). They may occasionally occur in Comal County, but are likely to be rare because the County is on the eastern periphery of their range. Primary habitat for this species includes rough, deep, rocky canyons and stream sides in semi-arid mesa, hill, and mountain terrain, where its typical diet is small mammals, lizards, frogs, fish, and occasional birds (Oberholser 1974).

3.8.9 Texas Horned Lizard (*Phrynosoma cornutum*)

The Texas horned lizard ranges throughout much of the state, where it can be found in open, arid, and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush, or scrubby trees (TPWD 2007). This species is much more common in West Texas, the South Texas Brush Country, and the Lower Rio Grande Valley than in central or eastern Texas (Linam 2008). During the 10 years (1997–2006) of the Texas Horned Lizard Watch (a volunteer program sponsored by the TPWD), this species was reported only three times in Comal County (Linam 2008). Texas horned lizards burrow into soil, take shelter in rodent burrows, or hide under rocks when inactive. Habitat potentially suitable for the Texas horned lizard does occur in Comal County, so the species may be present.

3.8.10 Cascade Caverns Salamander (*Eurycea latitans* complex)

This aquatic salamander has been reported from springs in Comal, Bexar, Kendall, Bandera, and Kerr Counties (NatureServe Explorer 2008). In Comal County, this species has been observed in Kneedeep Cave Spring, Honey Creek Spring, and Rebecca Creek Spring. Cascade Caverns salamanders are known only from caves that contain water and from spring outflows, where they have been found under rocks and leaves and in gravel substrate (AmphibiaWeb 2009).

3.8.11 Comal Blind Salamander (*Eurycea tridentifera*)

Comal blind salamanders are restricted to underground waters of several caves in central Texas, where their habitat is vulnerable to alteration. They range along the southeastern margin of the Edwards Plateau in the Cibolo Sinkhole Plain region of Comal, Bexar, and perhaps Kendall Counties. Caves where they have been found include Badweather Pit, Honey Creek Cave, Ebert Cave, Comal Springs, Pedernales Spring 1 and Spring 2, and caves at Camp Bullis (Chippendale et al. 1994, 2000 as cited in NatureServe 2003).

3.8.12 San Marcos salamander (*Eurycea nana*)

The San Marcos salamander was federally listed as threatened with critical habitat on July 14, 1980 (45 FR 47355). It is known only from the San Marcos Springs area in Hays County, Texas (USFWS 1996c). Critical habitat was designated for this species in Hays County at Spring Lake and its outflow, the San Marcos River, downstream approximately 164 feet (50 meters) from the Spring Lake Dam (45 FR 47355). Habitat consists of flowing spring water over a substrate of sand, gravel, boulders, or bedrock, most commonly in association with aquatic moss and filamentous algae (USFWS 1996c). While this species is unlikely to occur in Comal County, it is not an impossibility given the proximity to San Marcos and the presence of similar habitats in the County.

3.8.13 Texas blind salamander (*Typhlomolge rathbuni*)

The Texas blind salamander was federally listed as endangered on March 11, 1967 (32 FR 4001). It is an obligate troglobitic species found in the subterranean waters of the Edwards Aquifer in Hays County, Texas (USFWS 1996c). This species is not known to occur outside of the San Marcos area of Hays County; however, because of the proximity of San Marcos to Comal County and the ability of the salamander to move through water-filled caverns in the aquifer, the Texas blind salamander could (but is not likely to) occur in Comal County.

3.8.14 Fountain Darter (*Etheostoma fonticola*)

The fountain darter was federally listed as endangered on October 13, 1970 (35 FR 16047). On July 14, 1980, critical habitat for the species was designated in Hays County to include Spring Lake and its outflow, the San Marcos River, downstream approximately 0.5 miles below the Interstate Highway 35 bridge (45 FR 47355). The fountain darter is a small fish known to occur only in the headwaters of the San Marcos River in the City of San Marcos in Hays County and in the headwaters of the Comal River in the City of New Braunfels, Comal County. Both rivers originate at major springs (Comal Springs and San Marcos Springs) fed by flow from the Edwards Aquifer. This fish is typically found in mats of filamentous green algae. Adults generally inhabit areas with flowing water, and the young mostly occur in areas with slow-moving water and plentiful vegetation (TPWD 2007). In the 1950s, the Comal River population of fountain darters was eliminated when its habitat was reduced to isolated pools by a severe drought (USFWS 1984). The river was restocked with fountain darters from the San Marcos River.

3.8.15 San Marcos gambusia (*Gambusia georgei*)

The San Marcos gambusia was federally listed as endangered on July 14, 1980 (45 FR 47355). Critical habitat was designated at the same time in Hays County, Texas, in the San Marcos River from the Highway 12 bridge downstream to approximately 0.5 mile below the Interstate Highway 35 bridge (45 FR 47355). The San Marcos gambusia was last collected in the wild in 1983 and may be extinct (TPWD 2009). It is unlikely to occur in Comal County.

3.8.16 Peck's Cave Amphipod (*Stygobromus pecki*)

Peck's cave amphipod is a crustacean that occupies subterranean habitats of the Edwards Aquifer near spring openings in Comal County. The extent of their subterranean distribution is unknown; however, they have been collected only at Comal Springs and at Hueco Springs, approximately four miles north of Comal Springs. Individuals present in the springs may be capable of re-entering subterranean habitat but are not believed to survive for long outside of the aquifer. Little is known about the species life history; typically, other species of amphipods are associated with benthic surfaces, rocks, interstitial spaces, and vegetation where they scavenge for detritus (Barr 1993).

3.8.17 Comal Springs Dryopid Beetle (*Stygoparnus comalensis*)

The Comal Springs dryopid beetle is only known to occur at Comal Springs in Comal County and Fern Bank Springs in Hays County. Most specimens have been collected in drift nets placed over spring openings and are believed to have been displaced from the aquifer by spring flow (TPWD Undated-b).

3.8.18 Comal Springs Riffle Beetle (*Heterelmis comalensis*)

The Comal Spring riffle beetle is only known to occur at Comal and San Marcos Springs. The species has been collected from riffles in spring runs with gravel substrate and water depths of typically one to four inches. Population densities are reported to be greatest from February to April (TPWD Undated-b).

3.8.19 Texas wild-rice (*Zizania texana*)

Texas wild-rice was federally listed as endangered on April 26, 1978 (43 FR 17910). On July 14, 1980, critical habitat for the species was designated to include Spring Lake and its outflow, the San Marcos River, downstream to that river's confluence with the Blanco River (45 FR 47355). Texas wild-rice appears to be restricted to a single population in the upper two miles of the San Marcos River in Hays County (USFWS 1996c) and is unlikely to be present in Comal County.

3.9 SOCIOECONOMIC RESOURCES

3.9.1 Economic and Population Trends

Comal County lies within the San Antonio Metropolitan Statistical Area (MSA), which includes all of Atascosa, Bandera, Bexar, Comal, Guadalupe, Kendall, Medina, and Wilson Counties. The San Antonio MSA is one of the fastest growing areas in the country. According to the U.S. Census Bureau (2007) total population in the San Antonio MSA approached 2.0 million residents in 2007, a 16.3 percent increase since 2000. San Antonio's economy is a mix of business services, with a rapidly growing biomedical and biotechnology sector and a diversified manufacturing sector. Economic drivers include tourism, military (with several bases located

within the MSA), international trade as a result of the proximity to Mexico and the NAFTA corridor, manufacturing, and healthcare/biosciences (Live Oak Capital LTD. 2007).

Until recently, the San Antonio MSA was considered relatively "recession proof," in part because of the large military presence in the County (Zumbrun 2008). The income derived from military installations, personnel, and retirees (and the Defense Department's civilian work force) tends to be stable, fluctuating little with changes in the larger economy. A substantial and growing healthcare sector also provides a buffer to economic downturns. Despite a national recession that began in December 2007, the area's economy continued to grow through 2008, although the rate of growth slowed in 2008 and stalled in 2009 (My SA News 2009). Following national trends, the area's economy is now slowly recovering (Sabér Research Institute 2012).

In 2007, the area job base expanded 2.0 percent (Live Oak Capital LTD. 2007), but job expansion slowed in 2008 to an annual growth rate of 0.2 percent (Texas Workforce 2009a). By the end of 2008, the San Antonio MSA was losing jobs. In January 2009, total Nonagricultural Employment dropped by 19,000. Over the same period, unemployment in the San Antonio MSA grew from an annual rate of 4.1 percent in 2007, to 4.7 percent in 2008, to 6.3 percent in January 2009 (Texas Workforce Commission 2009b). Unemployment reached a high of 8.1 percent in July 2011; the trend then reversed, dropping to 6.7 percent by August 2012 (U.S. Bureau of Labor Statistics 2012).

The economic reversals have hit Comal County as well. The government of the City of New Braunfels announced in March 2009 that it is proposing several cost-cutting measures to forestall a potential budget deficit of $1.3 million (Cobb 2009). New Braunfels includes approximately half of the County's population and is the County's economic hub. As of March, city revenue from construction permits were 50 percent lower than budgeted expectations, and sales tax revenue had grown only one percent compared to the budgeted six percent. Since then, the local economy has improved. Compared to the first half of 2011, New Braunfels hotel occupancy tax revenues increased by 30 percent in the first half of 2012, sales tax revenues increased by 9.4 percent, residential building permits increased by 15 percent, and commercial building permits increased by 16.5 percent (New Braunfels 2012).

Comal County Population. Comal County's population growth has been dramatic over the past decade, with significant migration into the region. More than one in five current residents have moved to the County since 2000 (Texas Perspectives, Inc., unpublished data). In 2007, the population for Comal County was estimated at approximately 104,751 residents, an increase of 34 percent since 2000 (compared to 14 percent for Texas as a whole) (U.S. Census Bureau 2009). Population growth and development has occurred mostly along the Interstate 35 corridor in and near the city of New Braunfels; however, new and existing subdivisions are expanding throughout the County. Figure 3-5 illustrates subdivision development in the County since 2000. According to the County Engineer's office, 17,371 new lots have been platted or are still active since the year 2000. The largest of these include Mystic Shores on the upper end of Canyon Lake with 2,800 lots, Vintage Oaks in the central portion of the County with 2,103 lots, and River Chase, located in eastern Comal County with 1,697 lots.

Figure 3-5. Approved subdivisions in Comal County and potential golden-cheeked warbler habitat.

Comal County Employment. The County's employment base expanded between 2000 and 2008, adding over 10,299 jobs, or a 35 percent increase (Texas Workforce 2009c). In the fourth quarter of 2008, employment reached 39,815 workers. Retail Trade, Accommodation and food services, and construction services made up 40 percent of employment in Comal County. Consistent with a strong, growing job base, Comal County's unemployment rate has generally been low. The unemployment rate for Comal County in 2007 was 3.7 percent (Texas Association of Counties 2007). However, reflecting the downturn in the national economy, unemployment increased in the County to an average of 4.1 percent in 2008 and 5.8 percent in January of 2009. Comal County's unemployment statistics parallel those of the San Antonio MSA, but are consistently lower, suggesting a somewhat healthier local job market compared to other parts of the MSA.

Comal County Per Capita Income. Comal County's per capita personal income in 2006 (the most recent data available) was $35,754, approximately 1.9 percent above the Texas average of $35,101 (U.S. Bureau of Economic Analysis 2007a, 2007b). Between 2000 and 2006, per capita personal income in the County grew 22.7 percent (from $29,132), while per capita income in the state as a whole grew 24 percent (from $28,310) (Texas Workforce Commission 2009d).

3.9.2 Comal County and San Antonio MSA Real Estate Sector

As noted above, a number of large master-planned communities and commercial developments have been built in Comal County in recent years. According to the Texas A&M University Real Estate Center (2009a), 13,201 single-family dwellings were added between 2000 and 2007, with 1,856 added in 2007. In 2000, the average value of a new single-family home was $118,200, compared to 213,000 in 2007. The median sale price of new and existing houses in 2007 was $168,500 (Texas A&M University Real Estate Center 2008). Areas of recent growth are evident in several parts of the County (see Figure 3-5).

Current housing market trends in Comal County are similar to those throughout the San Antonio MSA. Until late in 2008, the market did not follow national trends of rapidly falling home prices, decreasing sales, and increasing mortgage foreclosures. However, home sales in greater San Antonio ended 2008 with existing single-family home sales down by about 19 percent (Texas A&M University Real Estate Center 2009b), and new home prices are no longer increasing (Texas Perspectives, Inc., unpublished data). In another sign of real estate entrenchment, foreclosures on home mortgages in Comal County rose 20 percent from 442 in 2007 to 530 as of September 2008 (Cobb 2008). In San Antonio, foreclosures on homes priced under $200,000 rose 22 percent in the first quarter of 2009, compared with the same period in 2008. Foreclosure postings for homes priced over $200,000 rose from 40 to 71 percent, depending on the price bracket of the home (Hiller 2009). Still, Forbes magazine and the Mortgage Bankers Association recently cited the San Antonio area as having one of the country's strongest real estate markets (Texas A&M University Real Estate Center 2009b).

3.9.3 Comal County Finances and Services

The following information on Comal County's financial activity was derived from the *Comal County, Texas Comprehensive Annual Report 2007* (Comal County 2008) issued by the Comal County Auditor's Office.

Expenditures to Support Services. Expenditures to support services rendered by the government of Comal County are classified into eight major categories. These categories, and their percentage of total expenditures in 2007 ($41,397,659), are general government (17%), justice system (12%), public safety (25%), community and economic development (1%), corrections and rehabilitation (18%), health and human services (7%), infrastructure and environment (19%), and debt service (1%). General government includes the administrative offices of the Commissioners, County Auditor, County Clerk, County Treasurer, and Elections. The justice system includes the administrative services of the district court, district attorneys, county court-at-laws, and justices of the peace. The public safety sector includes the Department of Public Safety, Sheriff's Department, Emergency Management, Constables, and other law enforcement costs. Corrections and rehabilitation includes adult probation, juvenile probation, and jail expenditures. Health and human services represent public health, environmental health, veterans' services, and animal control. The infrastructure and environmental services includes recycling, environmental services, and transportation services. Most expenditures are managed through the County's General Fund; however, the County also maintains a Road and Bridge Fund, a Capital Projects Fund, and a Debt Service Fund, as well as numerous smaller funds.

County Revenues. A percentage breakdown of County revenue sources in 2007 is shown in Figure 3-6. County revenues come primarily from property taxes (also called ad valorem taxes). In 2007, property taxes accounted for 49 percent ($23,890,240) of total revenues ($48,470,754). Other sources of income in 2007 included sales and use taxes ($6,810,372, 14%); other taxes (3,007,357, 6%); charges for services (8,423,612, 17%); grants and contributions ($4,878,362, 10%); and other revenues (2,060,211, 4%). In 2007, Comal County operated with a surplus, with revenues exceeding expenditures by $7,073,095.

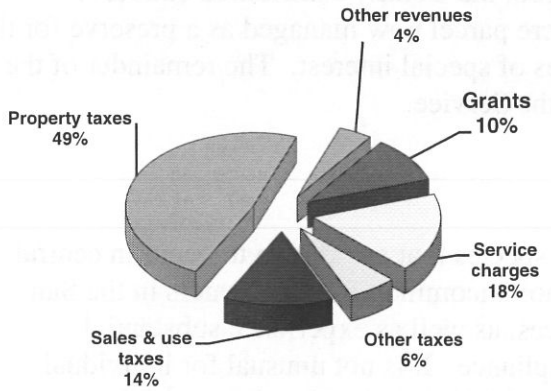

Figure 3-6. Distribution of Comal County revenue sources in 2007.

Table 3-5 shows the total taxable assessed value (tax base) in the County, tax rates, and total property tax for the years 2003 to 2007. Taxable property values in the County in 2007 totaled approximately $9.5 billion, an increase of 85 percent over the 2003 values of 5.1 billion. The total property tax rate grew from 0.288640 per $100 value in 2003 to $0.317993 per $100 value in 2007. Over the same five years, property tax revenues grew from $16.3 million to almost $23.9 million, an increase of 46.5 percent.

Table 3-5. Comal County taxable assessed value (tax base) and tax rates 2003–2007 (dollar values rounded to nearest thousand).

Year	Total Taxable Assessed Value	Total Direct Tax Rate	Property Tax Revenue
2003	$5,124,397,000	0.288640	$16,309,000
2004	$5,476,060,000	0.288640	$17,939,000
2005	$5,755,640,000	0.303647	$19,176,000
2006	$8,961,344,000	0.315201	$22,073,000
2007	$9,481,377,000	0.317993	$23,890,000

Source: Comal County 2008.

Outstanding Direct Obligations. The County has the authority to raise funds and incur debt by means of General Obligation Bonds, Certificates of Obligation, and Notes Payable. These instruments are generally issued as 25-year serial bonds, except for refunding issues, with equal amounts of principal maturing each year. Certificates of Obligation are issued by the vote of Commissioners Court as allowed under the Certificates of Obligation Act. The County issues Notes Payable in anticipation of the collection of taxes, usually retirable only from tax collections. The County currently has two series of Certificates of Obligation and two series of Notes Payable outstanding (Table 3-6).

Table 3-6. Comal County outstanding debt obligations.

Obligation	Original Amount	Interest Rate
Certificate of Obligation: Series 1998	$6,000,000	4.45%–4.8%
Certificate of Obligation: Series 2007	$20,190,000	4.25%–5.75%
Notes Payable: Series 2002	$2,400,000	3.5%–4.0%
Notes Payable: Series 2003	$1,700,000	2.35%–3.10%

County Expenditures for Conservation Efforts. In 2008, the County contributed $350,077 toward the purchase of the Morton Tract, a 288.25-acre parcel now managed as a preserve for the endangered golden-cheeked warbler and other species of special interest. The remainder of the cost ($652,312) was covered by a grant award from the Service.

3.9.4 Landowner/Service ESA Compliance

Due to the unusually high number of federally listed species that are known to occur in central Texas, especially on the Balcones Escarpment, it is not uncommon for landowners in the San Antonio MSA to expend significant financial resources, as well as experience substantial development project delays, when seeking ESA compliance. It is not unusual for individual incidental take permits to cost hundreds of thousands of dollars in legal and consultation fees to verify presence or absence of listed species, negotiate levels of take and mitigation requirements, complete NEPA documentation and submit a permit application to the Service. Adding to individual project costs and delays, it can take up to two years for the Service to process each

individual permit request. In addition to the consultation costs, the project proponent must also assume the costs of implementing the agreed upon mitigation measures. While financial expenditures and time lost in ESA permitting vary widely, it is often the post-permit uncertainty involved in executing a development plan that can most frustrate a landowner. To date, most individual section (1)(a)(B) incidental take permits and section 7(a)(2) consultations in the San Antonio MSA have been for development projects in Bexar County. No section 10(a)(1)(B) permits have been issued for any land development project in Comal County to date, and section 7(a)(2) consultations have been rare; however, several federally listed species and their habitat occur in Comal County, and landowners who alter that habitat without Service-issued permits are at risk of violating section 9 of the ESA (see Chapter 1, Section 1.3.1).

The landowner is not the only entity affected economically during the processing of incidental take permits. With each development project for which ESA compliance is sought, the Service is required to devote significant personnel time negotiating and processing individual section 10(a)(1)(B) incidental take permits and section 7(a)(2) consultations. It is estimated that the USFWS Southwest Region dedicates an estimated one-quarter to one-half of a full-time equivalent (FTE) staff position per year for each habitat conservation plan (B. Seawell, U.S. Fish and Wildlife Service, pers. comm. to SWCA, 2007). Since 1996 (when the Travis County Balcones Canyonlands Conservation Plan became effective and actually reduced the number of individual permits needed in Travis County), over 150 applications for ESA section 10(a)(1)(B) incidental take permits and dozens of requests for section 7(a)(2) consultations have been submitted to the Service in central Texas. As noted above, few to none of these applications have been for projects in Comal County (USFWS 2007c).

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CHAPTER 4 — ENVIRONMENTAL CONSEQUENCES

4.1 ASSESSMENT OF IMPACT

Each of the three alternatives identified in Chapter 2 has been evaluated for its potential effects on the impact topics (resources) described in Chapter 3. For each resource, impacts are identified as being direct or indirect, beneficial or adverse. These terms are defined below.

Direct Impact: An effect that is caused by an action and occurs in the same time and place.

Indirect Impact: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.

Beneficial Impact: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse Impact: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Significance of impact as used in NEPA requires considerations of both context and intensity (40 CFR § 1508.27). In the impact analysis provided for each impact topic in this chapter, the context for that analysis is provided initially by a bulleted list of what would constitute a "significant" impact to that resource. The context of the assessment is then expanded upon in the narrative. The level of intensity of an impact is expressed as negligible, minor, moderate, or major. Because level of intensity definitions vary by impact topic, these definitions are provided separately for each topic near the beginning of the corresponding subsections.

Following the resource-by-resource analyses of direct and indirect impacts, this chapter presents analyses of cumulative impacts, unavoidable adverse impacts, irreversible and irretrievable commitment of resources, and short-term use of the environment vs. long-term productivity.

4.1.1 Assumptions Underlying the Impact Analysis

For the impact analysis in this EIS, the No Action alternative is defined as the conditions that can be expected if the Service does not implement the proposed action (issuance of the Permit to be supported by the Proposed RHCP) or the alternative action (Reduced Take RHCP). Under No Action, land development in Comal County is expected to continue over the next 30 years and be authorized under existing state and local laws and regulations.

It is important to note that, historically, thousands of acres of woodland habitat, including habitat potentially supporting golden-cheeked warbler habitat, have been removed in Comal County and range-wide. To date, no section 10(a)(1)(B) permits have been issued for any land development project in the County, and section 7(a)(2) consultations have been rare. It is possible that ESA compliance will increase in the future as the County's and state's focus on protecting listed species increases and if the Service acquires the means to increase enforcement of the ESA.

Nonetheless, absent an RHCP, a relatively low level of ESA compliance is likely to continue into the future, although ESA compliance mechanisms other than an RHCP will continue to be available. Under No Action, when compliance does occur through individual HCPs and section 7(a)(2) incidental take statements, mitigation for the golden-cheeked warbler and black-capped vireo would not likely be coordinated at a regional scale or provide the same conservation benefit as the proposed RHCP.

As stated previously in Chapter 3, Section 3.2, it is important to emphasize that this RHCP does not take the place of existing ESA compliance mechanisms whether or not they are exercised. Rather, it provides a voluntary, alternative means of compliance with the ESA for many landowners in Comal County. Issuing the requested Permit, therefore, is not an "indispensable prerequisite" or an "essential catalyst" for land development in the County, and only the most general causal relationship can be established between issuance of the Permit and potential impacts of development. Similarly, just as implementing an RHCP would not enable land development; failure to implement an RHCP would not impede development because alternative means of ESA compliance are available.

It is possible that the greater efficiency and lower cost of ESA compliance offered by the RHCP could affect the timing and footprint of specific developments. For example, a landowner holding off from developing this year because of the costs of preparing an individual HCP (legal and consulting, etc.) may decide to develop sooner were the RHCP option to become available. Another landowner concerned that the time it takes to get an incidental take permit may cause the development to miss the market, or will stretch carrying costs too far, may determine that the RHCP alleviates those concerns sufficiently to justify moving forward. And yet another landowner who is contemplating an avoidance strategy because it looks cheaper and faster than getting an HCP may determine that the RHCP option is sufficiently cost effective as to justify causing some minor habitat impacts. In all of those scenarios, development may happen somewhat faster than it would under the No Action alternative. Conversely, implementation of the RHCP may encourage increased compliance with the ESA by providing a more efficient alternative for ESA authorization. The existence of the RHCP may, in fact, reduce current levels of unpermitted and, therefore, unmitigated loss of Covered Species habitat. This increase in compliance and the associated mitigation may, in fact, offset any marginal increases in impact associated with the RHCP, should they occur.

These differences between the No Action and Proposed Action development scenarios are likely to be minor for several reasons. First, the RHCP is unlikely to induce market demand or to in any other way be a "market maker" for development. Rather, the differences identified above operate at the margin of the economics of specific development projects that are being contemplated because of a complex matrix of economic, legal, and demographic factors affecting the market. It is unlikely that a developer would perceive of the RHCP alone as justifying moving into the market when those other factors do not support doing so. Very few development projects, in other words, rest exclusively on the speed and cost of ESA compliance as the justification for whether to engage in the development project. Second, even for those projects for which ESA compliance is a driver in terms of timing and footprint, not all will necessarily find the RHCP to be more desirable than the other development compliance options. Finally, for those few projects that perceive of ESA compliance timing and cost as defining the

tipping point for when to develop and how much habitat to impact, not all of them will find the difference the RHCP makes in general to make the difference specifically for the project. Overall, therefore, few projects are likely to find that the RHCP makes all the difference in terms of when and where to develop. For these reasons, it is logical to assume that the RHCP, compared to the No Action alternative, will have minor impacts on County-wide timing of development over the next 30 years.

It is important to bear in mind that this EIS assesses the relevant environmental impacts for the No Action alternative at a level that substantially exceeds what would in fact be compiled were the No Action alternative to be implemented. This is true for the following reasons: 1) most small-scale HCPs are approved with Environmental Assessments rather than an EIS; 2) section 7(a)(2) consultations do not cover the breadth of topics covered in this EIS; 3) landowners who avoid impacts to endangered species are not subject to NEPA review; and, of course, 4) landowners who do not comply with the ESA are not subject to NEPA review. While Federal regulatory programs other than the ESA might trigger more comprehensive environmental documentation in particular development project scenarios, it is unlikely that a county-wide EIS-level review would be compiled for any one project or in the aggregate. By contrast, this EIS provides a broad impacts assessment of relevant impacts for both the No Action and the Proposed Action throughout the County where the listed species of concern exist. Although this does not relieve landowners who choose options other than the RHCP from compiling necessary environmental impact assessments at the time they develop their land, it does provide assurance that the RHCP is implemented with a full understanding of the possible impact scenarios regardless of level of landowner participation in the RHCP, and this EIS will serve as a valuable reference point for developments that do not use the RHCP compliance option.

In the following analysis, it is assumed that approximately 283,995 acres (114,929 hectares) of vacant land are available and suitable for development and approximately 80,427 acres (32,548 hectares), or 28 percent of that land will be impacted by clearing of potential habitat over the next 30 years (see Table 3.2 in the Proposed RHCP). It is also assumed that of the 80,427 acres cleared, 10,476 acres (4,239 hectares) will be in potential golden-cheeked warbler habitat. These assumptions were arrived at using methodology set forth in Section 2.2.3 of the RHCP.

Under the Proposed RHCP Alternative, the County would be authorized to utilize or issue participation certificates for up to 50 percent of all loss of potential Covered Species habitat. Under the Reduced Take Alternative, the County would be authorized to utilize or issue participation certificates for up to only 20 percent of all loss of potential golden-cheeked warbler habitat. Under each impact topic, the analysis focuses specifically on the impacts of issuing the requested Permit; that is, the impacts potentially caused by clearing a specified amount of Covered Species habitat. The impacts of non-participating projects are assumed to be adequately described under No Action and are not repeated under each action alternative. At the end of each impact topic, the impacts of the action alternative are compared to those of No Action (i.e., not issuing Comal County the Permit). Since No Action serves as a baseline from which to measure the degree of impact, the final determination of impacts (adverse or beneficial) is the *difference* between those of No Action and those of the given action alternative.

4.2 WATER RESOURCES (GROUNDWATER AND SURFACE WATER)

Impacts to water resources would be considered significant if they were to result in one or more of the following:

- Groundwater and/or surface water quality would be measurably altered as a result of an alternative.
- Groundwater and/or surface water quantity would be measurably altered as a result of an alternative.

The intensity of potential impacts to water resources is defined as follows:

Negligible: Impacts would not be detectable. Water quality parameters would be well below all water quality standards for the designated use. Water quality, recharge features, and surface water availability would be within the historical ambient and variability conditions.

Minor: Impacts would be detectable, but water quality parameters would be well below all water quality standards for the designated use. Water quality, recharge features, and surface water availability would be within the range of ambient conditions, but measurable changes from historical norms would occur.

Moderate: Changes to water quality, recharge features, and surface water availability would be readily apparent, but water quality parameters would be below all water quality standards for the designated use. Water quality, recharge features, and surface water availability would exceed the historic baseline.

Major: Changes to water quality, recharge features, and surface water availability would be readily apparent, and some water quality parameters periodically would be approached, equaled, or exceeded. Water quality, recharge features, and surface water availability would be outside of the range of ambient conditions, and could include a complete loss of water in some areas or flooding in other areas. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.2.1 Alternative A – No Action

(Impact Topic: Water Resources)

Under the No Action alternative, land development would proceed in Comal County, with the development of an estimated 80,427 acres of currently undeveloped land. While the location, magnitude, and nature of specific activities associated with future commercial, residential, and other types of development cannot be predicted at this time, it can be assumed that activities would include clearing vegetation, grading and contouring slopes, constructing buildings, and paving surfaces. An inevitable consequence of these activities is increased impervious cover. The expected increase in development and urbanization has the potential to adversely impact water resources through: 1) increased contamination of both surface water and groundwater (Ging 1999, Bush et al. 2000); 2) reduced aquifer recharge due to increased impervious cover (City of Olympia 1996, Chenoweth 2004); 3) increased water demand (South Central Texas

Regional Water Planning Group 2006); and 4) an overall decrease in water availability as current water resources become fully allocated (South Central Texas Regional Water Planning Group 2006). Over the next 30 years, land development of varying densities is expected to extend over much of western Comal County; however, some open space will be left in its natural condition. It is worth noting that of the approximately 80,427 acres that may be developed during the 30-year life of the Proposed Permit, much of that development will be low-density. Thus, although 80,427 acres may eventually be placed under a development plan, not all 80,427 acres will be paved over.

Between 2010 and 2040, annual water demand in the County is estimated to increase from 29,680 to 59,710 acre-feet (3,660 to 7,365 hectare meters) (South Central Texas Regional Water Planning Group 2006). In an effort to ensure that sufficient water is available for new development, the County requires subdivisions served by individual wells or a new water system not utilizing water regulated by the Edwards Aquifer Authority to submit a Certification of Availability pursuant to 30 TAC § 230.1–230.11 that is documented by a hydrogeologist. In areas where groundwater withdrawal is not regulated by the Edwards Aquifer Authority (i.e., from the Trinity Aquifer), the developer must submit a report by an engineer certifying water availability for 20 years. Despite these measures, the South Central Texas Regional Water Planning Group (2006) believes that current and projected water supplies are inadequate to meet future demand, and estimates that by 2040, Comal County will need to find an additional 30,700 acre-feet (3,786 hectare meters) annually.

Increased urbanization in the Recharge and Contributing Zones of the Edwards Aquifer could increase the potential for runoff containing toxic substances, oil spills, or leakage of hazardous materials to contaminate both groundwater and surface water, resulting in a moderate to major adverse effect. In studies comparing the quality of stormwater runoff in streams draining urbanized areas vs. undeveloped rangeland, pesticides, volatile organic compounds (VOCs), nitrates, trace elements, and sediment were generally at higher concentrations in the urban stream water (Ging 1999, Bush et al. 2000). Frequently detected pesticides in water from urban recharge zone wells in the Edwards Aquifer were the same as the most frequently detected pesticides in surface water at urban sites, indicating a correlation between the quality of recently recharged groundwater in an urban setting and the quality of urban surface water (Bush et al. 2000). A karst aquifer such as the Edwards Aquifer is susceptible to the same impacts as a surface stream because there is little or no filtration of recharging waters.

In addition to the increased use of chemicals associated with increased development, the expected increase in impervious cover would also likely have a minor adverse effect on water resources in Comal County. Studies have shown that an increase in impervious cover corresponds to a decrease in water quality (Horner et al. 1997, U.S. Geological Survey 1999, Kauffman and Brant 2000). Roadways and other impervious surfaces channel pollutants directly into streams, and increased runoff due to impervious cover has been directly linked with higher water velocities that cause erosion and higher sediment loads in watersheds (U.S. Environmental Protection Agency 1997a). More impervious cover would also inhibit infiltration and cover recharge features, thus reducing groundwater recharge (City of Olympia 1996, Chenoweth 2004). Increased sediment loads in surface watersheds due to more impervious cover may also reduce aquifer recharge by plugging recharge features. Increased impervious cover may increase

the volume of runoff to surface waterways, but direct infiltration of precipitation to groundwater would be reduced. Significantly, the studies referenced above were conducted prior to the implementation of the Edwards Aquifer Rules, which are discussed in greater detail below.

To minimize adverse impacts to water resources, development activities in Comal County would be expected to comply with existing local, state, and Federal water quality regulations, standards, and programs (including, but not limited to, the Edwards Aquifer Rules, TCEQ's Texas Pollutant Discharge Elimination System, and TCEQ's Best Management Practices; see Chapter 3, Section 3.3.3.1). With respect to water quality, and as noted in Chapter 3 of this EIS, the Edwards Aquifer Rules, for example, apply to construction (including mere clearing of land which results in soil disturbance) and post-construction activities in the Recharge and Contributing Zones. The goal of the Edwards Aquifer Rules, 30 T.A.C. 213, et seq., is that the "existing quality of groundwater not be degraded, consistent with the protection of public health and welfare, the propagation and protection of terrestrial and aquatic life, the protection of the environment, the operation of existing industries, and the maintenance and enhancement of the long-term economic health of the state" (30 T.A.C. 213.1). The intent of the Edwards Aquifer Rules, therefore, is that by implementing the rules set forth in 30 T.A.C. 213, regulated entities would avoid degradation of this resource. Because the Edwards Aquifer Rules are based on a non-degradation standard and are applicable to all construction and post-construction activities within the Recharge and Contributing Zones, we anticipate that impacts to groundwater quality due to new construction and post-construction activities will be minor.

In addition, significant preservation of land over the Recharge and Contributing Zones has occurred. For example, voters in the City of San Antonio passed two initiatives aimed at preserving the integrity of the Edwards Aquifer through purchase of conservation lands located over the Recharge Zone. Together, passage of Proposition 3 (2000) and Proposition 1 (2005) have resulted in the preservation of more than 54,000 acres of land in Bexar County and beyond to benefit Edwards Aquifer recharge. While most of these lands occur outside Comal County, the cumulative benefit for Edwards Aquifer recharge is positive and cannot be ignored. In addition to preservation of land over the Recharge Zone, other efforts have the potential to provide significant benefit to the Edwards Aquifer. Further protecting the water quality of the Edwards Aquifer are robust water quality ordinances (e.g., Ordinance No. 81491) passed by the City of San Antonio that apply to the City and those areas within its extra-territorial jurisdiction. These ordinances require, among other things, that plan proponents taking action on subject property prepare an Aquifer Protection Plan that must be approved by the Resource Protection Division of the San Antonio Water System. The ordinances also include impervious cover limitations and require floodplain setbacks, recharge feature protection and buffer zones, and use of best management practices.

Finally, in 1998, the State of Texas assumed authority to administer the Clean Water Act section 402 National Pollutant Discharge Elimination System. The Texas Commission on Environmental Quality administers the Texas Pollutant Discharge Elimination System (TPDES), which applies to discharge of pollutants into surface waters of Texas. The TPDES program requires, among other things, that regulated entities prepare a stormwater pollution prevention plan (SWPPP) and implement certain best management practices designed to treat reduce or eliminate the impact of stormwater runoff pollution from construction activities.

At least one initiative is currently underway that is anticipated to have a beneficial effect on water availability. The Edwards Aquifer Recovery Implementation Program (EA RIP) is a federally funded effort to develop a habitat conservation plan benefitting eight federally listed species dependent upon the water of the Edwards Aquifer. Participants in EA RIP development include the Edwards Aquifer Authority (which regulates pumping from the Aquifer), as well as state and local governmental entities and other interested groups. The Texas Legislature has required that any plan approved pursuant to the EA RIP process include recommendations regarding withdrawal or pumping adjustments during critical periods to ensure that the federally listed aquifer species will be protected. In addition, Comal County may soon become part of the Hays Trinity Groundwater Conservation District, the purpose of which is to manage groundwater supply in that region.

In sum, while anticipated land development in Comal County over the next 30 years might otherwise have the potential to result in moderate to major adverse impacts to the quality and availability of groundwater and surface water, the effectiveness of the above-referenced laws, regulations, efforts, and other measures will likely ensure that impacts to both quality and availability of groundwater and surface water will, in fact, be minor.

4.2.2 Alternative B – Proposed Comal County RHCP (Proposed Action)

(Impact Topic: Water Resources)

The Proposed RHCP assumes that up to 50 percent of future land development projects with the potential to impact Covered Species habitat in Comal County would seek and receive take authorization through participation in the RHCP (i.e., a 50 percent voluntary participation rate). The remaining 50 percent of land development with the potential to impact Covered Species habitat not covered by the RHCP would proceed under Alternative B as it would under No Action, and associated potential impacts would be the same or similar to those under No Action. In short, under the Proposed Action, the same approximately 80,427-acre build out would occur, but up to 50 percent of development with the potential to impact Covered Species habitat would be authorized for take of Covered Species through the County's Permit.

Potential adverse impacts to water resources under Alternative B would be the same or similar to potential adverse impacts described under the No Action Alternative in section 4.2.1 above. The major difference between the No Action Alternative and Proposed Alternative is that under the Proposed Alternative, the County, through its Permit and the participation process, would authorize incidental take of the Covered Species for actions covered by the Permit and would implement the coordinated minimization and mitigation measures specified in the RHCP for the benefit of the Covered Species. Under Alternative A, take authorization and mitigation measures would occur in a piecemeal fashion, and management of "preserve" lands in the County would not be under one management entity. Under Alternative B, implementation of the county-wide RHCP may result in increased ESA compliance due to a heightened awareness of the ESA. As a result, entities within Comal County who otherwise would not have complied with the ESA may take steps to avoid Covered Species habitat or seek incidental take authorization. Implementation of the Proposed Action may positively affect water resources through the preservation and perpetual management of habitat for the golden-cheeked warbler and the black-

capped vireo. Preserved acreage includes up to an estimated 6,548 acres of large, contiguous or near-contiguous woodland preserves (directly or through Service-approved conservation banks, the service area of which includes Comal County) as mitigation for impacts to the golden-cheeked warbler. Preserved acreage also includes an estimated 1,000 acres of shrubland for black-capped vireo (directly or through purchase of credits from Service-approved conservation banks, the service area of which includes Comal County).

Preserves established pursuant to the requirements of the Permit and RHCP would have a minor beneficial impact on water resources. Preserves include an estimated 6,548 acres of land, mostly in 500-acre (202-hectare) minimum patch sizes, set aside for the golden-cheeked warbler and 1,000 acres of preserved shrubland for the black-capped vireo. Protecting relatively large blocks of native vegetation from development in perpetuity would result in less impervious cover compared to developed land, thus greater infiltration of precipitation to groundwater. Preserving woodlands and shrublands may seem counterintuitive given the active shrub control programs underway to protect aquifers in central Texas; however, these programs are aimed at replacing trees and brush with grassland, not pavement. Woodlands, which allow aquifer recharge, are preferable to pavement and associated urban contaminants for protecting the quantity and quality of both groundwater and surface water.

Under Alternative B, mitigation for take of black-capped vireo authorized through the proposed permit could also include the purchase of conservation credits from a conservation bank either within or outside of the County. The permanent preservation of at least 1,000 acres of shrubland in either RHCP preserves or an outside conservation bank would have a small beneficial impact on water resources.

In addition to preserving blocks of natural vegetation in perpetuity, with the resulting positive benefits to water resources, RHCP participants would be made aware of and encouraged to adopt the TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer* (TCEQ 2007). If plan participants choose to implement these measures, water resources in the County may benefit.

4.2.2.1 Comparison with Alternative A (No Action)

As noted above, under both the No Action and Proposed RHCP Alternatives, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on water resources would likely be the same whether or not the requested Permit was issued. However, over the long term (including and beyond the 30-year life of the Proposed Permit), water resources in the County would benefit from the coordinated establishment and long-term management of an estimated 7,548 acres (3,055 hectares) of preserve land, particularly since such preserve land would be conserved in large (generally 500-acre+) blocks. In contrast, should ESA compliance occur under No Action, the result is likely to be smaller, more isolated patches of potential Covered Species habitat which may further serve to fragment Covered Species habitat. Larger blocks of preserved native vegetation protected and managed in perpetuity under one management entity are more likely to yield benefits to water resources than the piecemeal mitigation measures resulting from project-by-project ESA section 7 consultations or section 10(a) permits with the Service under the No Action Alternative. Specifically, lands

preserved through the Proposed Alternative would, under one management entity, be more likely to benefit water resources through the management entity exercising control over pesticide application, erosion control, and invasive species management.

In addition to providing for more coordinated preservation and management of native vegetation than would occur under the No Action Alternative, the scientific research and public awareness programs in the Proposed RHCP Alternative may provide benefit to water resources by focusing public attention on environmental protection. It is also expected that the existence of the Proposed RHCP would likely encourage compliance for non-RHCP participants through increased awareness of ESA requirements, enhanced understanding of the characteristics of potential Covered Species habitat, measures that a given landowner can taken to avoid the potential for take of one or more Covered Species, and the mechanisms for ESA compliance when take cannot be avoided. It is possible that increased knowledge of the public regarding the importance of preserving Covered Species and their habitats may result in the preservation of Covered Species habitat preserved through avoidance or through individual ESA section 10(a)(1)(B) permits or section 7(a)(2) incidental take statements. Preservation of potential Covered Species habitat would, in turn, likely benefit water resources. In sum, *compared to No Action*, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to water resources.

4.2.3 Alternative C – Reduced Take RHCP

(Impact Topic: Water Resources)

Like Alternative B, this alternative assumes that approximately 80,427 acres of land is developed over a three-year period. The difference between Alternative C and Alternative B is that, unlike Alternative B, the Reduced Take RHCP would authorize only up to 20 percent (rather than 50 percent) of the future land development projects in Comal County with the potential to impact Covered Species habitat. Potential adverse impacts of Alternative C would be the same or similar to those of the No Action Alternative and Alternative C, and potential beneficial impacts to water resources would be greater in magnitude than under the No Action Alternative, but reduced in magnitude compared to the Proposed RHCP. Compared to the Proposed RHCP, Alternative C would authorize the removal of 2,095 rather than 5,238 acres of golden-cheeked warbler habitat, and no removal of black-capped vireo habitat. As under Alternative B and No Action, plan participants would likely develop property once it has been cleared; therefore, the subsequent impacts to water resources would be the same or similar in nature to those described under Alternative B and No Action.

Establishing preserves under the Reduced Take RHCP would likely result in some beneficial impacts to water resources similar in nature to those described under Alternative B; however, compared to Alternative B, less land would be preserved for the golden-cheeked warbler: 2,619 acres compared to 6,548 acres, and Comal County would not be obligated to provide up to 1,000 acres of shrubland preserve for the black-capped vireo. Consequently, the magnitude of potential beneficial impacts would be reduced as compared to Alternative B, but increased as compared to the No Action Alternative.

Other elements of Alternative C that would provide long-term benefits to the water resources of the area of potential effect would remain unchanged from Alternative B. These elements include scientific research, public outreach, and making participants aware of TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer* (TCEQ 2007).

4.2.3.1 Comparison with Alternative A (No Action)

Under both No Action and the Reduced Take RHCP Alternative, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on water resources would be the same whether or not this alternative was implemented. However, over the long term, water resources in the County may benefit from the coordinated establishment and long-term management of an estimated 2,619 acres of preserves which would be conserved in blocks of at least 500 acres. In contrast, when ESA compliance does occur under No Action, the result is likely that mitigation lands would be preserved in smaller, more isolated, and fragmented patches of woodlands totaling relatively few acres throughout Comal County. Larger blocks of preserved native vegetation protected from development in perpetuity by County authority are more likely to yield benefits to water resources than the mitigation measures that would result from project-by-project consultations with the Service or issuance of individual incidental take permits under No Action. The differential is small, however.

In addition to providing for the preservation of more native vegetation, the scientific research and the public awareness program in the Reduced Take RHCP may benefit water resources by focusing public attention on environmental protection. It is also expected that the existence of the RHCP is likely to enhance compliance for non-RHCP participants through increased awareness of ESA requirements, resulting in more listed species habitat preserved through individual section 10(a)(1)(B) and section 7(a)(2) permits. This would, in turn, benefit water resources. In sum, *compared to No Action*, the Reduced Take RHCP is expected to result in a negligible reduction in adverse impacts to water resources.

4.3 VEGETATION

Impacts to vegetation would be considered significant if the existing levels of native vegetation would increase (beneficial impact) or decrease (adverse impact) to a substantial degree.

The intensity of potential impacts to vegetation is defined as follows:

Negligible: Individual native plants may occasionally be affected, but measurable or perceptible changes in plant community size, integrity, or continuity would not occur.

Minor: Effects to native plants would be measurable or perceptible, but would be localized within a small area. The viability of the plant community would not be affected and the community, if left alone, would recover.

Moderate: A change would occur over a relatively large area in the native plant community that would be readily measurable in terms of abundance, distribution, quantity, or quality. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major: Effects to native plant communities would be readily apparent, and would substantially change vegetation community types over a large area in and out of the County. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.3.1 Alternative A – No Action
(Impact Topic: Vegetation)

Under the No Action alternative, land development would continue throughout Comal County. It is estimated that the available vacant and developable land in Comal County includes 283,995 acres, 80,427 acres (28%) of which is expected to be developed over the next 30 years (see Table 3.2 in the Proposed RHCP). While the location, magnitude, and nature of specific activities associated with future commercial, residential, and other types of development cannot be predicted at this time, it can be assumed that these activities would include clearing and altering vegetation. The expected increase in development and urbanization would result in moderate, direct and indirect adverse impacts on native vegetation. As a result, under the No Action alternative, the natural vegetation of the County is expected to significantly decrease over the next 30 years. Affected biomes would include the dense woodlands favored by golden-cheeked warblers and shrublands possibly occupied by black-capped vireos.

Without a county-wide ESA 10(a)(1)(B) permit, when landowners comply with the ESA, the impacts of development to potential Covered Species habitat would be mitigated on a case-by case basis through individual section 10(a)(1)(B) permits and section 7(a)(2) consultations with the Service. As a result of certain mitigation requirements under the ESA, some parcels of native vegetation consisting of vegetation communities similar to the potential Covered Species habitat impacted by the proposed action would be preserved on a case-by-case basis either within Comal County or through purchase of credits from a Service-authorized conservation bank or other transaction outside the County. This preservation could result in a minor beneficial impact to these types of vegetation communities. In addition to conservation areas set aside to avoid or mitigate impacts to listed species, other areas, such as parks and floodplains, may be left in their natural condition.

4.3.2 Alternative B – Proposed Comal County RHCP (Proposed Action)
(Impact Topic: Vegetation)

The Proposed RHCP assumes that as much as 50 percent of future development occurring within potential Covered Species habitat in Comal County would be covered by the RHCP (i.e., a 50 percent voluntary participation rate). The 50 percent of land development not covered by the RHCP would proceed under Alternative B much as it would under No Action, and associated

potential impacts on vegetation would be similar to those under No Action, except there may be an increase in individual HCPs due to a heightened awareness of ESA compliance requirements.

The major differences under Alternative B would be 1) the RHCP-covered modification or removal of golden-cheeked warbler and black-capped vireo habitat; and 2) implementation of conservation measures specified in the Proposed RHCP. These covered actions and conservation measures would result in both adverse and beneficial, direct impacts to vegetation in the area of potential effect within the County.

A total of 6,238 acres of native vegetation (5,238 acres of woodland plus 1,000 acres of shrubland), could be cleared under the authority of the Proposed RHCP. This represents a minor adverse impact on native vegetation in the County. Direct, adverse impacts would include the potential modification or removal of 5,238 acres of relatively dense and mature woodland composed of a combination of Ashe juniper and hardwood tree species, especially deciduous oaks (typical golden-cheeked warbler habitat). Other hardwood tree species often found in golden-cheeked warbler breeding habitat include escarpment black cherry, Arizona black walnut, cedar elm, and Texas ash (Alldredge et al. 2002). The covered impacts on 5,238 acres of this vegetation community represent approximately eight percent of the total amount of such habitat (65,581 acres) in Comal County (see Chapter 3, Section 3.6.1.2).

Additional direct, adverse impacts to vegetation include the potential modification or removal of 1,000 acres of black-capped vireo habitat: early to mid-successional shrubland dominated by shin oak or evergreen sumac, with Texas red oak, plateau live oak, fragrant sumac, prairie sumac, poison ivy, Texas persimmon, agarita, redbud, and Ashe juniper (Maresh 2005). The covered impacts on the black-capped vireo (1,000 acres) represent approximately 28 percent of the estimated potential black-capped vireo habitat in Comal County; however, that loss would be mitigated as discussed below.

Potential beneficial impacts associated with implementation of the Proposed RHCP on vegetation include funding the purchase, preservation, and management of large blocks of intact native vegetation communities. Blocks of preserved native vegetation include an estimated 6,548 acres of golden-cheeked warbler habitat and 1,000 acres of black-capped vireo habitat. No development would be allowed in the preserve areas except where utilities have pre-existing easements, and strict management guidelines would be applied to maintain or improve, in perpetuity, the preserves' native vegetation communities, thus resulting in a minor beneficial impact.

Under Alternative B, mitigation for the RHCP-authorized take of the black-capped vireo would also include the purchase of conservation credits from a conservation bank either within or outside of the County. The permanent preservation of at least 1,000 acres of shrubland in either RHCP preserves or a conservation bank would have a small beneficial impact on native vegetation.

4.3.2.1 Comparison with Alternative A (No Action)

Under both No Action and the Proposed RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on native vegetation would be the same whether or not the requested Permit was issued. However, over the long term, vegetation communities in the County would benefit from the coordinated establishment and long-term management of an estimated 6,548 acres of preserved woodland habitat in blocks of at least 500 acres. In contrast, when ESA compliance does occur under No Action, the result is likely to be small, isolated patches of woodlands totaling relatively few acres of fragmented habitat. As a result, *compared to No Action*, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to native vegetation. In addition, the existence of the Proposed RHCP may enhance compliance for non-RHCP participants through increased awareness of ESA requirements, resulting in more native vegetation preserved through mitigation and other measures required under individual section 10(a)(1)(B) and section 7(a)(2) permits.

4.3.3 Alternative C – Reduced Take RHCP

(Impact Topic: Vegetation)

Potential adverse impacts of Alternative C would be similar in nature to those of the Proposed RHCP, but the acreage of vegetation impacted as a result of the incidental take permit would be reduced in magnitude. Compared to the Proposed RHCP, the amount of vegetation typical of golden-cheeked warbler breeding habitat modified or removed would be reduced from 5,238 acres to 2,095 acres. The covered impacts on 2,095 acres of this vegetation community represent approximately three percent of the total amount of such habitat (65,581 acres) in Comal County (see Chapter 3, Section 3.6.1.2). Impacts to potential black-capped vireo habitat would not be covered by the Reduced Take RHCP. Consequently, compared to the Proposed RHCP, the total potential loss of vegetation covered by the RHCP would be reduced by more than 4,000 acres.

Fewer acres of native vegetation would be preserved in perpetuity for the golden-cheeked warbler: 2,619 acres compared to 6,548 acres.

4.3.3.1 Comparison with Alternative A (No Action)

Under both No Action and the Reduced Take RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on native vegetation would be the same whether or not this alternative was implemented. However, compared to No Action, the coordinated establishment and perpetual management of an estimated 2,619 acres of woodland preserves under the Reduced Take RHCP are expected to result in a negligible reduction in adverse impacts to native vegetation. In addition, the existence of the RHCP is likely to enhance compliance for non-RHCP participants through increased awareness of ESA requirements, resulting in more native vegetation preserved through individual section 10(a)(1)(B) and section 7(a)(2) permits.

4.4 GENERAL WILDLIFE

Impacts to general wildlife would be considered significant if the existing levels of native wildlife would increase (beneficial impact) or decrease (adverse impact) to a substantial degree.

The intensity of potential impacts to wildlife is defined as follows:

Negligible: Wildlife would not be affected or the effects would be at or below the level of detection and would be so slight that they would not be of any measurable or perceptible consequence to wildlife populations.

Minor: Effects to wildlife would be measurable or perceptible, but would be localized within a small area. While the mortality of individual animals might occur, the viability of wildlife populations would not be affected and the community, if left alone, would recover.

Moderate: A change to wildlife would occur over a relatively large area. The change would be readily measurable in terms of abundance, distribution, quantity, or quality of populations. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major: Effects to wildlife would be readily apparent, and would substantially change wildlife populations over a large area in and out of the County. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.4.1 Alternative A – No Action
(Impact Topic: Wildlife)

Under the No Action alternative, conversion of native wildlife habitat to developed areas would proceed in Comal County in conjunction with trends in population growth. While the location, magnitude, and nature of specific activities associated with future development cannot be predicted at this time, it can be assumed that activities would include clearing and altering vegetation that provides habitat for wildlife. Thus, the expected increase in development and urbanization has the potential to cause moderate, direct and indirect adverse impacts on wildlife by habitat conversion, fragmentation, or removal. With the anticipated development over the next 30 years it is possible that as much as 28 percent of the existing natural vegetation would be removed (see Section 4.3.1). This vegetation removal would likely result in significant reductions to the wildlife populations dependent on these habitats (see Chapter 3, Table 3-1).

A partial list of the hundreds of species of wildlife present in the area of potential effect is provided in Chapter 3 (Table 3-1). The potential impacts to these species would be based upon the type of habitat impacted by clearing habitat with the potential to contain the Covered Species. For example, the forest bird community, which includes dozens of species, would be adversely impacted by development activities that remove woodland habitat. In general, wildlife populations would decline concomitant with the expansion of the human population, as habitat needed for shelter, breeding, foraging, and to support prey species is lost or altered. Conversely,

to the extent landowners clearing woodlands and shrublands preserve natural open space, either as part of their projects or apart from them, this decline would be ameliorated.

The situation is different for adaptable wildlife species that take advantage of suburban landscapes with large, well-maintained nutrient sources. The expected trend in the urbanization of Comal County may have a minor beneficial impact on these species. The most visible urban wildlife species typically include mice, squirrels, rabbits, skunks, raccoons, possums, foxes, and deer, some of which are non-native, or introduced, species. According to Chance and Walsh (2006), for avian species, urbanization tends to select for omnivorous (e.g., jays and crows), granivorous (e.g., house sparrows and domestic pigeons), and some cavity-nesting (especially starlings) species, and typically leads to an increase in avian biomass but a reduction in species diversity.

Texas Parks and Wildlife Code Title 5 establishes statewide laws for hunting and protecting wildlife, including the game or non-game status of wildlife, hunting seasons, hunting regulations, and protection for state-listed wildlife, and establishes special standards for certain animals such as bats and wolves. Most urbanized mammals such as raccoons and squirrels are not hunted seasonally or treated as game, while the hunting of other animals such as white-tailed deer is restricted to specific seasons and heavily regulated. Avian wildlife is protected by both the provisions of the Texas Parks and Wildlife Code and the Federal Migratory Bird Treaty Act, 16 USC § 703, et seq., which prohibits the taking, killing, or possession of all migratory birds, with the exception the following nuisance birds: European starlings, English sparrows, and feral rock doves (common pigeon). While these regulations protect wildlife to some degree, they provide no direct protection to the habitat required for wildlife survival.

Under the No Action alternative, development on land that provides habitat for endangered species and other wildlife species that utilize the same habitat would be mitigated on a case-by-case basis when landowners comply with the ESA. When ESA compliance does occur, the mitigation lands set aside for endangered species would likely be small isolated patches, totaling relatively few acres of fragmented habitat. The resulting benefit to other wildlife species occupying the preserved habitat would be minor, at best.

4.4.2 Alternative B – Proposed Comal County RHCP (Proposed Action)
(Impact Topic: Wildlife)

Potential adverse impacts on wildlife are primarily associated with the alteration and removal of habitat authorized under the Proposed RHCP and Permit. A total of over 5,238 acres of golden-cheeked warbler habitat and 1,000 acres of black-capped vireo habitat could potentially be impacted by RHCP participants, for a total of approximately 6,238 acres. This vegetation and its substrate may provide shelter, breeding, and foraging habitat for a host of woodland and shrubland species (see Chapter 3, Section 3.5). Consequently, through the adverse impacts on vegetation, issuance of the requested Permit would potentially result in indirect, adverse impacts (injury, mortality, or displacement) to the wildlife species occupying habitat provided by that vegetation.

Potential beneficial impacts associated with implementation of the Proposed RHCP on wildlife include perpetual preservation and management of 7,548 acres of land containing habitat suitable for the golden-cheeked warbler and black-capped vireo. Up to 6,548 acres of land will be set aside and managed for the benefit of the golden-cheeked warbler, and up to 1,000 acres may be set aside and managed for the black-capped vireo. New development will not be permitted within County-owned or controlled preserve lands, and strict management guidelines would be applied to maintain or improve the habitat for the Covered Species and other wildlife species with similar habitat requirements.[21] Some species of wildlife, such as white-tailed deer, may not benefit from the establishment and management of these protected areas if their habitat requirements conflict with those of the endangered species; however, overall, it is anticipated that these large blocks (equal to or greater than 500 acres in size) of unfragmented native habitat, managed in perpetuity, would have a minor beneficial impact on general wildlife.

4.4.2.1 Comparison with Alternative A (No Action)

Under both No Action and the Proposed RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on wildlife would be the same whether or not the requested Permit was issued. However, impacts to Covered Species habitat authorized through the Proposed RHCP would be mitigated by a large, contiguous system of preserves set aside and managed in a more consistent manner than under the No Action Alternative. This system of preserves would provide larger blocks of unfragmented wildlife habitat preserved and managed in perpetuity than would the No Action Alternative, as under the No Action Alternative, landowners would mitigate for impacts in a piecemeal fashion. In addition, the existence of the RHCP may enhance compliance for non-RHCP participants through increased awareness of ESA requirements and shortened ESA permitting timeframes under the Proposed RHCP, resulting in more wildlife habitat preserved through avoidance or through individual section 10(a)(1)(B) and section 7(a)(2) authorizations. In sum, *compared to No Action*, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to wildlife species and their habitat.

4.4.3 Alternative C – Reduced Take RHCP
(Impact Topic: Wildlife)

Potential indirect, adverse impacts of Alternative C on wildlife would be similar in nature to those of the Proposed RHCP, but the acres of wildlife habitat impacted (fragmented or removed) as a result of the incidental take permit would be reduced in magnitude. As described above in Section 4.3.3, the total potential loss of wildlife habitat to be covered under this alternative would be reduced by more than 4,000 acres (1,619 hectares). Compared to the Proposed RHCP, the amount of golden-cheeked warbler habitat modified or removed would be reduced from 5,238 acres to 2,095 acres, and the amount of black-capped vireo habitat modified or removed would be reduced from 1,000 acres to zero. As under Alternative B, issuance of the requested incidental take permit under this alternative would result in adverse impacts on vegetation, and

[21] It is noted, of course, that some preserve lands may come into the County's possession subject to pre-existing easements, rights-of-way, and similar rights. The County, of course, cannot prohibit the lawful use of such rights. The Service and the County will expect any parties exercising such rights to obtain their own ESA authorization.

this, in turn, would potentially result in indirect, adverse impacts (injury, mortality, or displacement) to the wildlife species occupying habitat provided by that vegetation; however, as stated above, the magnitude of that potential impact would be less.

Under Alternative C, wildlife would be benefited by the creation and management of preserves for the golden-cheeked warbler; however, fewer acres of wildlife habitat would be set aside in managed preserves than would occur under the Proposed RHCP: 2,619 acres compared to 7,548 acres. As with Alternative B, no development would be allowed in the preserve areas and strict management guidelines would be applied to maintain or improve the habitat of the endangered species. It is anticipated that this alternative would have a minor beneficial impact on wildlife.

4.4.3.1 Comparison with Alternative A (No Action)

Under both No Action and the Reduced Take RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on the County's wildlife would be the same whether or not this alternative was implemented. However, the coordinated establishment and long-term management of preserves under the Reduced Take RHCP would yield some beneficial impacts to wildlife habitat, but the difference would not rise to the level of significance. The existence of the RHCP may enhance compliance for non-RHCP participants through increased awareness of ESA requirements, resulting in more wildlife habitat preserved through avoidance or through individual section 10(a)(1)(B) and section 7(a)(2) authorizations. In sum, *compared to No Action*, the Proposed RHCP is expected to result in a negligible reduction in adverse impacts to wildlife species and their habitat.

4.5 COMAL COUNTY RHCP COVERED SPECIES

Impacts to the Covered Species would be considered significant if the existing populations of these species in Comal County would increase (beneficial impact) or decrease (adverse impact) to a substantial degree.

Two federally listed species, the golden-cheeked warbler and the black-capped vireo, would be covered by the incidental take permit requested under the Proposed Action. Indicators of impact significance vary by species and are provided in the appropriate subsection. Definitions of impact intensity, however, are similar for both Covered Species and are as follows:

Negligible: Listed species would not be affected or the change would be so small as to not be of any measurable or perceptible consequence to the population.

Minor: There would be a measurable effect on one or more listed species or their habitats, but the change would be small and relatively localized.

Moderate: A noticeable effect with moderate consequences to a population of a listed species. The effect would be of consequence to populations or habitats.

Major: Noticeable effect with severe consequences or exceptional benefit to populations or habitats of listed species.

4.5.1 Golden-cheeked Warbler

Impacts to the endangered golden-cheeked warbler would be considered significant if they were to result in one or more of the following:

- The existing primary threats to the woodland habitats utilized by the golden-cheeked warbler would decrease (beneficial impact) or increase (adverse impact) to a substantial degree.
- The golden-cheeked warbler Recovery Plan goals and objectives were met (beneficial impact) or precluded from being met (adverse impact).
- The local Comal County long-term golden-cheeked warbler population trends would decrease (adverse impact) or increase (beneficial impact) substantially.

4.5.1.1 Alternative A – No Action
(Impact Topic: Golden-cheeked Warbler)

Under the No Action alternative the current trends relating to threats to the golden-cheeked warbler, are expected to continue over the next 30 years, resulting in a moderate adverse impact. One of the primary threats to this species is loss of habitat due to clearing of habitat. Comal County is one of the fastest developing counties in Texas (See Chapter 3, Section 3.9.1). Prior to the listing of the golden-cheeked warbler in 1990, it was estimated that five to seven percent of the woodlands known to support golden-cheeked warblers range-wide was being removed annually (Clarke 1985, Pease and Gingerich 1989, Wahl et al. 1990). Under the No Action alternative, the adverse impact of habitat loss and loss of local populations of the golden-cheeked warbler is expected to continue at or above its present rate, and it is likely that the development required to support future population growth has the potential to impact approximately 16 percent (10,476 acres; see Table 3.2 in the RHCP) of the 65,581 acres of potential habitat in the County over the next 30 years. As explained in the discussion of vegetation impacts (see Section 4.3.1, above), some areas (e.g., preserves, parks, floodplains) would be left in their natural condition.

While the impacts and mitigation likely to occur under the No Action alternative are difficult to predict at this time due to the lack of information on the precise location of future development and the inability to predict the level of compliance with the ESA, it may be assumed that certain conservation efforts would take place. Since the golden-cheeked warbler was listed, efforts to protect the species' habitat throughout its range have resulted in the establishment of tens of thousands of acres of preserves (primarily in Bexar, Travis, and Burnet Counties) that would be managed in perpetuity for the benefit of the species.[22] Under the No Action alternative, as land development continues to occur, impacts to occupied golden-cheeked warbler habitat that rose to the level of take would require authorization from the Service under ESA sections 7 or 10 in order to proceed in compliance with the ESA. Authorization under ESA section 10 would

[22] Additional habitat protected from urban development exists on military reservations both to the north of Comal County (Fort Hood, Bell County) and to the south (Camp Bullis, Bexar County). Currently, neighboring Hays County is developing an RHCP that includes provisions for extensive golden-cheeked warbler preserves.

require that take of the golden-cheeked warbler would be mitigated to the maximum extent practicable. This mitigation may take the form of establishment of one or more preserves for the benefit of the golden-cheeked warbler, either within or outside of Comal County, resulting in a minor beneficial impact to the golden-cheeked warbler.

Despite these conservation efforts, it is likely that Comal County would experience a net loss of golden-cheeked warbler habitat and a concomitant decline in local golden-cheeked warbler populations.

4.5.1.2 Alternative B – Proposed Comal County RHCP (Proposed Action)
(Impact Topic: Golden-cheeked Warbler)

Over the next 30 years, up to approximately 11,000 acres (4,452 hectares) of potential golden-cheeked warbler habitat may be impacted or cleared. Under the Proposed RHCP, the Service would authorize impacts to up to 5,238 acres of potential and/or occupied golden-cheeked warbler habitat within the same period. The precise timing and location of this adverse impact is difficult to predict at this time for several reasons, including the lack of information on the precise location of future development and the future trends in golden-cheeked warbler distribution and population numbers. In addition to the incidental take that would be authorized by the requested Permit, development activities not covered by the Proposed RHCP may impact potential and/or occupied golden-cheeked warbler habitat.

The Proposed RHCP would mitigate for impacts to golden-cheeked warbler habitat by establishing approximately 6,548 acres of preserve managed for the primary benefit of the golden-cheeked warbler. A mitigation-to-take ratio of 1 acre of mitigation for every acre of impact (1:1) would apply to an estimated 80 percent of participant transactions. It is recognized, however, that in rare instances impacted habitat would be of a higher quality than golden-cheeked warbler habitat typically distributed throughout Comal County, and in these cases the mitigation ratio may increase to 2:1 (an estimated 15 percent) or in some cases up to 3:1 (an estimated 5 percent). For example, under the Proposed RHCP, the County would mitigate at a higher than 1:1 ratio where the potential habitat was adjacent to an existing golden-cheeked warbler preserve. While removing up to 5,238 acres of habitat may be an adverse impact on the golden-cheeked warbler within Comal County, preserving and managing an estimated 6,548 acres of golden-cheeked warbler habitat, with a typical minimum individual preserve size of 500 acres, may contribute to the future recovery of the golden-cheeked warbler in Recovery Region 6 (see USFWS 1992) by setting aside a large portion of the habitat necessary to house a viable population within that recovery region.

Under the Golden-cheeked Warbler Recovery Plan, the golden-cheeked warbler may be considered for delisting once each recovery region contains sufficient preserve land to house a viable population. (USFWS 1992). The recovery plan does not set forth a precise definition of "viable population," but does note that a viable population may include 500–1,000 pairs or more (USFWS 1992). As noted in the RHCP, a more recent population viability assessment workgroup tentatively concluded that a minimum viable population of warblers may be as high as 3,000 pairs (Alldredge et al. 2002). Although preservation of up to 6,548 acres may not, alone, provide sufficient habitat for a viable population, Comal County is just one of several

central Texas counties located within Recovery Region 6. Preservation of 6,548 acres managed for the primary benefit of the golden-cheeked warbler, together with conservation actions that are taking place within the other Recovery Region 6 counties (including, without limitation, development of the Southern Edwards Plateau Regional Habitat Conservation Plan in Bexar County), may indeed result in preservation of sufficient habitat to house a viable population within that recovery region. Thus, implementation of the conservation and mitigation measures prescribed by the Proposed RHCP may result in a moderate beneficial impact to that species.

Under the Proposed RHCP, additional potential beneficial impacts to the golden-cheeked warbler include:

- efforts to help landowners participating in the RHCP avoid and minimize impacts to occupied habitat by providing information on the location of potential habitat on the subject property and offering assistance on how impacts to that habitat might be avoided or reduced;
- temporal and spatial restrictions on clearing activities during the golden-cheeked warbler's nesting season that would be made conditions of voluntarily participation in the RHCP;
- scientific research and consistent RHCP management to monitor and regularly assess the status of the golden-cheeked warbler and the RHCP preserve system and the effectiveness of the monitoring and management actions;
- efforts to establish preserves where as many as possible Covered and Evaluation Species occur together, including the golden-cheeked warbler (i.e., species-rich locations); and
- the public outreach program of the RHCP, which would work to develop community awareness of the need to conserve listed and rare species and their habitat within the County.

The above measures may result in an additional minor beneficial impact to the golden-cheeked warbler.

4.5.1.2.1 Comparison with Alternative A (No Action)

Under both No Action and the Proposed RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on the golden-cheeked warbler and its habitat would be the same whether or not the requested Permit was issued. Under both alternatives, approximately 10,476 acres of golden-cheeked warbler habitat would be developed over the next 30 years (see Table 3.2 in the RHCP). This amount of habitat is an estimated 16 percent of the total amount of habitat estimated to exist within the County. Under both alternatives, any land disturbance that impacts potential and/or occupied golden-cheeked warbler habitat would require authorization under the ESA for it to be lawful. However, we anticipate that, under the Proposed RHCP, a greater proportion of impact to golden-cheeked warbler habitat would be authorized by the Service because up to half of projects would be covered by the Permit, and ESA compliance by others may increase as well due to increased awareness. As a result, more adverse impacts to golden-cheeked warbler habitat would likely be

mitigated than under the No Action alternative. The Proposed RHCP provides for the coordinated establishment and long-term management of an estimated 6,548 acres of preserved golden-cheeked warbler habitat in blocks of at least 500 acres. In contrast, when ESA compliance does occur under No Action, the result is likely to be small, isolated patches of woodlands, totaling relatively few acres of fragmented habitat. As a result, *compared to No Action*, the Proposed RHCP is expected to result in a minor reduction in adverse impacts to the golden-cheeked warbler and its habitat.

4.5.1.3 Alternative C – Reduced Take RHCP
(Impact Topic: Golden-cheeked Warbler)

Potential adverse impacts of Alternative C would be similar in nature to those of Alternative B, except the Reduced Take RHCP would authorize the removal of only 2,095 acres rather than up to 5,238 acres of golden-cheeked warbler habitat. While the adverse impacts of take authorized through the Reduced Take RHCP would be reduced compared to Alternative B, the beneficial impacts of Alternative C would be reduced as well. Mitigation in the Reduced Take RHCP for impacts to golden-cheeked warbler habitat would be limited to an estimated 2,619 acres of golden-cheeked warbler preserves, compared to 6,548 acres of preserves in the Proposed RHCP. Compared to impacts under the Proposed RHCP, both the adverse and beneficial impacts of the Reduced Take RHCP would be reduced to a minor level.

Other potential beneficial impacts to the golden-cheeked warbler would be the same as those listed under additional potential beneficial impacts in Alternative B (i.e., information on how impacts to golden-cheeked warbler habitat might be avoided or reduced; temporal and spatial restrictions on clearing activities in golden-cheeked warbler habitat; scientific research; species-rich preserves; and community awareness of the need to conserve endangered and rare species and their habitat within the County) and would result in a minor beneficial impact.

4.5.1.3.1 Comparison with Alternative A (No Action)

Under both No Action and the Reduced Take RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on the golden-cheeked warbler would be the same whether or not this alternative was implemented. Under both alternatives, approximately 10,476 acres of golden-cheeked warbler habitat would be developed over the next 30 years (see Table 3.2 in the RHCP). This amount of habitat is an estimated 16 percent of the total amount of habitat estimated to exist within the County. Under both alternatives, any take of the golden-cheeked warbler, including by modification of occupied habitat that results in death or injury to a member of the species, would require authorization under the ESA in order to be lawful. However, *compared to No Action*, the coordinated establishment and long-term management of an estimated 2,619 acres of woodland preserves under the Reduced Take RHCP may result in a minor or negligible reduction in adverse impacts to the golden-cheeked warbler. In addition, the existence of the RHCP may enhance compliance for non-RHCP participants through increased awareness of ESA requirements, resulting in more golden-cheeked warbler habitat preserved through measures implemented pursuant to individual section 10(a)(1)(B) permits and section 7(a)(2) incidental take statements.

4.5.2 Black-capped Vireo

Impacts to the endangered black-capped vireo would be considered significant if they were to result in one or more of the following:

- The existing primary threats to the shrubland habitats utilized by the black-capped vireo would decrease (beneficial impact) or increase (adverse impact) to a substantial degree.
- The black-capped vireo Recovery Plan goals and objectives were met (beneficial impact) or precluded from being met (adverse impact).

4.5.2.1 Alternative A – No Action
(Impact Topic: Black-capped Vireo)

Under No Action, the current trends relating to black-capped vireo abundance, threats to the species, and efforts to ameliorate those threats and conserve black-capped vireo habitat in Comal County are expected to continue over the next 30 years. Range-wide, conditions for this species appear to be improving. The recent 5-Year Review of black-capped vireo status (USFWS 2007b) indicates that, even with substantial increases in urban development over portions of the species' range in Texas, the black-capped vireo population has dramatically increased in numbers since the species was listed in 1987 (52 FR 37420). Based on these findings, the Service has recommended the downlisting of the black-capped vireo from endangered to threatened (USFWS 2007b).

No records exist for the black-capped vireo in Comal County, and little is known about its status in the County. However, the black-capped vireo is known to occur in all contiguous counties to the north, west, and south of Comal County, and potential habitat is present within Comal County. Therefore, it is reasonably certain that with time and adequate surveys, black-capped vireos will be recorded from the County.

The impacts likely to occur under the No Action alternative are difficult to predict due to the lack of data regarding black-capped vireo presence in the County, disagreement about the amount and location of black-capped vireo habitat, the lack of information on the precise location of future development, and the inability to predict the level of future compliance with the ESA. However, the anticipated increase in land development in Comal County is expected to adversely impact some portion of potential black-capped vireo habitat, which is estimated to total between 492 and 3,591 acres in the County (see Chapter 3, Section 3.6.2.2). In sum, the No Action alternative is unlikely to result in more than minor or negligible adverse impacts on the black-capped vireo that would not affect recovery of the species.

Based on the Service's recent findings regarding the black-capped vireo's status (USFWS 2007b), and the Service's recommendation that the black-capped vireo be downlisted, the trends in black-capped vireo numbers range-wide (increasing), available habitat range-wide (increasing), and cowbird parasitism (locally decreasing) are not expected to change on the Edwards Plateau or locally within Comal County over the next 30 years.

4.5.2.2 Alternative B – Proposed Comal County RHCP (Proposed Action)
(Impact Topic: Black-capped Vireo)

While the population size and distribution of black-capped vireos in Comal County is unknown, the presence of as much as 3,591 acres of potential black-capped vireo habitat scattered within the County (see Chapter 3, Section 3.6.2.2) indicates that within the next 30 years some need for authorized incidental take may occur. Under the Proposed RHCP, the requested Permit would authorize the incidental take of up to 1,000 acres of potential black-capped vireo habitat from developing areas within the County. It should be remembered that, while this impact analysis focuses on the take that would be authorized by the Proposed RHCP, development activities not covered by the Proposed RHCP would also impact potential and/or occupied black-capped vireo habitat in the County.

The requested incidental take (1,000 acres) represents as much as 28 percent of the potential black-capped vireo habitat estimated to exist in Comal County at this time (see Chapter 3, Section 3.6.2.2); however, while this must be considered an adverse impact locally, the loss of 1,000 acres of potential habitat in Comal County would not constitute a significant adverse impact to the species as a whole. This acreage represents less than 0.15 percent of potential black-capped vireo habitat in the recovery region that includes Comal County (678,641 acres; 274,636 hectares),[23] less than 0.07 percent of the potential black-capped vireo habitat in Texas (1,450,438 acres; 599,917 hectares), and barely over 0.03 percent of potential black-capped vireo habitat in the United States (4,000,000 acres; 1,618,742 hectares) (USFWS 2004).

To mitigate for impacts to the black-capped vireo, at least 1,000 acres of black-capped vireo habitat would be protected and managed in perpetuity in RHCP preserves or by the County's purchase of credits from one or more Service-approved black-capped vireo conservation banks, the service area of which includes Comal County. Additional features of the Proposed RHCP that would potentially benefit the black-capped vireo include:

- efforts to help landowners participating in the RHCP avoid and minimize impacts to occupied habitat by providing information on the location of potential habitat on the subject property and offering assistance on how impacts to that habitat might be avoided or reduced;
- temporal and spatial restrictions on clearing activities during the black-capped vireo's nesting season that would be made conditions of voluntarily participation in the RHCP;
- scientific research and RHCP management that would assess the status of all listed RHCP species (i.e., those included as Covered Species or Evaluation Species), including the black-capped vireo, and the RHCP preserve system;
- efforts to establish preserves where as many as possible Covered and Evaluation Species occur together, including the black-capped vireo (i.e., species-rich locations); and

[23] This acreage is presented in Wilkins et al. (2006) for the black-capped vireo recovery region containing Comal County as revised in 1996 (see Chapter 3, Section 3.6.2.5 above); however, the configuration of the revised recovery region is only slightly different from that of the official Recovery Region 3, so the percentage is comparable whichever boundary is used.

- the public outreach program of the RHCP, which would work to develop community awareness of the need to conserve listed and rare species and their habitats within the County.

In sum, the Proposed RHCP is expected to result in negligible adverse local impacts and beneficial impacts to the black-capped vireo within the Recovery Region or range-wide.

4.5.2.2.1 Comparison with Alternative A (No Action)

As with No Action, the existing trends in the identified levels of threats to the black-capped vireo (USFWS 1987, USFWS 2007b) should not change under the Proposed RHCP. Under both No Action and the Proposed RHCP, it is predicted that a total of 80,427 acres would be developed over the next 30 years, and the total impact of that development on the black-capped vireo and its habitat would be generally the same whether or not the requested Permit was issued; although, education and outreach under the Proposed RHCP might marginally reduce habitat loss. Under both alternatives, as many as 3,591 acres of potential black-capped vireo habitat in the County may ultimately be cleared (see, for example, section 3.6.2.2 of this EIS). While under the No Action Alternative, impacts to black-capped vireo habitat would need to be authorized pursuant to individual incidental take permits or ESA section 7 consultations, the Proposed RHCP Alternative would authorize up to 1,000 acres of black-capped vireo habitat to be impacted through the County's permit. Under both alternatives, any land disturbance that impacts occupied black-capped vireo habitat would require authorization under the ESA for that disturbance to be lawful. However, the level of past and existing compliance with the ESA in Comal County does not indicate significant levels of compliance under No Action. In comparison, the Proposed RHCP is likely to result in a greater proportion of the impact to black-capped vireo habitat being authorized by the Service and mitigated. This increase in ESA compliance would be attributable to the convenience for project proponents provided by the Proposed RHCP and a heightened public awareness of endangered species concerns. In sum, *compared to No Action*, the Proposed RHCP is expected to result in a negligible reduction in adverse impacts to the black-capped vireo.

4.5.2.3 Alternative C – Reduced Take RHCP
(Impact Topic: Black-capped Vireo)

The black-capped vireo is not included as a Covered Species in Alternative C. Therefore, potential impacts would be the same as under No Action.

4.6 COMAL COUNTY RHCP EVALUATION SPECIES

In addition to the Covered Species, which would be covered by the requested incidental take permit, the proposed Comal County RHCP addresses a second category of rare and/or endemic species termed "Evaluation Species," which would not be covered by the requested Permit but may benefit from conservation measures identified in the Proposed RHCP. These nine species include Cagle's map turtle and eight obligate cave-dwelling invertebrate species (See Chapter 3, Section 3.7).

Impacts to the Evaluation Species would be considered significant if they were to result in one or more of the following:

- The existing primary threats to the Evaluation Species would decrease (beneficial impact) or increase (adverse impact) to a substantial degree.
- The local Comal County long-term population trends of any of these species would decrease (adverse impact) or increase (beneficial impact) substantially.

Definitions of impact intensity are similar for all Evaluation Species and are as follows:

Negligible: Changes to the existing primary threats to the Evaluation Species, their habitats, or the natural processes sustaining them would be at the lowest levels of detection. Changes in distribution would be minimal and well within the range of natural variation.

Minor: Changes to the existing primary threats to the Evaluation Species, their habitats, or the natural processes sustaining them would be detectable, but short-term and/or spatially limited in scope. Changes in distribution would not be expected to greatly exceed the range of natural variability.

Moderate: Changes to the existing primary threats to the Evaluation Species, their habitats, or the natural processes sustaining them would be readily detectable over relatively wide areas of the County. Impacts could result in direct mortality and/or interference with activities necessary for survival, but would not be expected to threaten the continued existence or distribution of the species in the County.

Major: Changes to the existing primary threats to the Evaluation Species, their habitats, or the natural processes sustaining them would be readily detectable over most areas of the County, and outside the range of natural variability for long periods of time or be permanent. Direct impacts or habitat alterations could affect the distribution and abundance of the species in the County.

4.6.1 Cagle's Map Turtle

The Cagle's map turtle is an obligate aquatic species, known historically from the Guadalupe and San Antonio Rivers in south-central Texas. It was once thought to be threatened by loss and degradation of its riverine habitat and vulnerable to over-collecting for the pet and zoo trade. However, recent findings of the Service (71 FR 53767) indicate that these threats have been ameliorated, and the population of the Cagle's map turtle in the Guadalupe River is increasing. The long-term health of the species will be a function of the future condition of the water resources in the Guadalupe River watershed.

4.6.1.1 Alternative A – No Action
(Impact Topic: Cagle's Map Turtle)

The expected increase in development and urbanization and the concomitant increase in impervious cover in Comal County over the next 30 years is expected to impact an estimated

80,427 acres of presently undeveloped land (see Section 4.3.1). In the absence of applicable Federal, state, and local regulation, this loss of vegetative cover and increase in impervious cover has the potential to cause moderate direct and indirect adverse impacts on water resources through increased contamination, reduced aquifer recharge, and an overall decrease in water availability (see Section 4.2.1). However, existing Federal, state, and local water quality regulations, standards and programs are likely to minimize the potential impact of continuing growth on the Guadalupe River. In modeling future growth, for a variety of reasons, the County's consultants anticipated that the majority of growth would be, in fact, relatively low density. This is due to limitations on available water and other infrastructure, as well as topography.

Some development-related impacts would occur on listed species habitat, particularly the golden-cheeked warbler, and when ESA compliance is sought through individual permits, impacts may be mitigated by development set-asides and/or establishment of woodland preserves. Such future conservation measures may benefit the Guadalupe River and the aquatic species that depend on them, including Cagle's map turtle.

4.6.1.2 Alternative B – Proposed Comal County RHCP (Proposed Action)
(Impact Topic: Cagle's Map Turtle)

Like the No Action Alternative, up to 80,427 acres of land may be developed over the next 30 years. Similarly, it is expected that such activities may result in the loss of approximately 10,476 acres of potential golden-cheeked warbler habitat and between 492 and 3,591 acres of black-capped vireo habitat. If the Service approves the Proposed Comal County RHCP and issue the requested Permit, the Permit would authorize clearing and other impacts of up to 5,238 acres of golden-cheeked warbler habitat and up to 1,000 acres of black-capped vireo habitat. In the absence of applicable Federal, state, and local regulation, this loss of vegetative cover and increase in impervious cover has the potential to cause moderate direct and indirect adverse impacts on water resources through increased contamination, reduced aquifer recharge, and an overall decrease in water availability (see Section 4.2.1). However, existing Federal, state, and local water quality regulations, standards and programs are likely to minimize the potential impact of continuing growth on the Guadalupe River. In modeling future growth, for a variety of reasons, the County's consultants anticipated that the majority of growth would be, in fact, relatively low density. This is due to limitations on available water and other infrastructure, as well as topography.

In addition, relative to No Action, the establishment and perpetual management of up to an estimated 6,548 acres of golden-cheeked warbler preserves and up to 1,000 acres of black-capped vireo preserve under the Proposed RHCP may indirectly result in a minor improvement of water quality and availability in Cagle's map turtle habitat. This would depend, at least in part, on the location and other characteristics of those preserves. Preservation of at least 1,000 acres of habitat for the black-capped vireo either through establishment of in-County preserves or through the purchase of conservation credits from a Service-approved bank, the service area of which includes Comal County, may also indirectly benefit the Cagle's map turtle, although any such benefit is unlikely to be more than negligible.

The Cagle's map turtle may also benefit from the research, database, and public awareness programs provided for in the Proposed RHCP. A prioritized list of research topics would be prepared each year and may include studies related to the turtle. Information resulting from any RHCP-funded research would be assembled in a computerized database. The RHCP would also develop and implement a public education/outreach program designed to educate Comal County residents as to the value and appropriateness of conserving the RHCP Covered Species and Evaluation Species, including the Cagle's map turtle. The efforts of the Edwards Aquifer Recovery Implementation Program may also include conservation measures beneficial to the Cagle's map turtle.

Each year, the status of the Cagle's map turtle would be assessed. Depending on that assessment, the County would determine the level of expected impact and decide whether to seek coverage of the species under the RHCP. If so, the County may apply for an appropriate amendment to the RHCP.

4.6.1.2.1 Comparison with Alternative A (No Action)

The same amount of development is expected to occur in Comal County under the No Action and the Proposed RHCP Alternatives, and the impact of that development on the Cagle's map turtle would be the same whether or not the requested Permit was issued. However, because of the coordinated preservation of thousands of acres of woodlands and shrublands constituting potential Covered Species habitat and the programs designed to aid in the conservation of the Evaluation Species, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to the Cagle's map turtle compared to No Action.

4.6.1.3 Alternative C – Reduced Take RHCP
(Impact Topic: Cagle's Map Turtle)

Impacts to the Cagle's map turtle attributable to the Reduced Take RHCP would be similar to those under the No Action Alternative and the Proposed RHCP, except the potential for beneficial impacts would be less than under the Proposed RHCP. Potential for *adverse* impacts would be reduced because the RHCP and incidental permit would authorize the loss of fewer acres of native vegetation (i.e., golden-cheeked warbler habitat); as a result, potential adverse impacts to Cagle's map turtle habitat in the Guadalupe River may be reduced as well. Potential for *beneficial* impacts would be reduced relative to the Proposed RHCP because fewer acres of native vegetation (i.e., golden-cheeked warbler habitat) would be protected in preserves, which could indirectly benefit Cagle's map turtle habitat in the Guadalupe River. The potential beneficial impacts of the research, database, and public awareness programs would remain the same as under the Proposed RHCP. No black-capped vireo habitat would be affected under this alternative, so no impacts related to the black-capped vireo, adverse or beneficial, would accrue to the Cagle's map turtle.

4.6.1.3.1 Comparison with Alternative A (No Action)

The same amount of development is expected to occur in Comal County under the No Action and the Reduced Take RHCP alternatives, and the impact of that development on the Cagle's

map turtle would be the same for both alternatives. However, because of the programs designed to aid in the conservation of the Evaluation Species, the Reduced Take RHCP may result in a negligible reduction in adverse impacts to the Cagle's map turtle compared to No Action.

4.6.2 Obligate Cave-Dwelling Evaluation Species

The eight obligate cave-dwelling Evaluation Species fall into two groups: 1) aquatic invertebrate species including one decapod (*Palaemonetes holthuisi*), two amphipods (*Seborgia hershleri* and *Texiweckelia relicta*), and one snail (*Phreatoceras taylori*), and 2) terrestrial invertebrate species including one beetle (*Rhadine insolita*), one harvestman (*Texella brevidenta*), and two spiders (*Cicurina puentecilla* and *C. reclusa*).

4.6.2.1 Alternative A – No Action
(Impact Topic: Obligate Cave-Dwelling Evaluation Species)

4.6.2.1.1 Aquatic Troglobites (Stygobites)

Under the No Action alternative, existing threats to the decapod, amphipod, and snail Evaluation Species (*Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori*) would continue over the next 30 years as the population of Comal County grows and more land is developed. Reduced water flow in the caves, springs, and artesian wells occupied by these and similar species is considered the most serious threat to their continued existence (TPWD Undated-b). This groundwater flow is generally reduced by drought (see Section 4.2.1). Groundwater flow is also affected by pumping from wells. As described in Chapter 3, Section 3.3.1.1, increased water withdrawals—if not balanced by commensurate recharge—have the potential to lower groundwater levels, decrease artesian pressure in the aquifer, and reduce flow in springs and wells.

Based on what is known about similar stygobites (TPWD Undated-b), it is reasonable to assume that *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* require relatively constant water temperatures and flows. They may be affected by a reduction or loss of aquatic habitat if the groundwater level drops due to human activities. The degree of adverse impact related to subsidence of groundwater is difficult to judge because these species are subterranean, and the depth and extent of their suitable aquatic habitat in the aquifer is not known. Individual organisms may retreat deeper into the aquifer as the water level drops, and follow the water back up as it rises; however, it is probable that some number of individuals would be stranded in increasingly isolated, desiccating pools.

A decrease in the water level in the aquifer could also lead to decreased water quality at springs and wells. As described in Chapter 3, Section 3.3.1.1, lowered water levels resulting from groundwater pumping and/or decreased aquifer recharge may cause the bad water interface to shift westward, resulting in deterioration of water quality in the freshwater section of the aquifer. Even a small movement of brackish water may negatively impact freshwater aquatic invertebrate species (USFWS 1997). Reduced groundwater flow may also cause other changes in the chemical composition of the water in the aquifer and at the springs or wells, a decrease in current

velocity and corresponding increase in siltation, and an increase in temperature and temperature fluctuations in the aquatic habitat (McKinney and Watkins 1993).

The potential for adverse impact to these species due to pumping would be mitigated to a large extent by implementation of the Edwards Aquifer Authority regulations described in Chapter 3, Section 3.3.1.1. These regulations include provisions for capping the total amount of permitted withdrawals from the aquifer. The regulations also include provisions for reducing withdrawals if groundwater levels fall to stipulated trigger points measured at the index well in San Antonio or at Comal Springs. These provisions and the effect they have on aquatic species are currently under review through the EA RIP being developed by the Edwards Aquifer Authority and the Service. The EA RIP, when completed and implemented, has the potential to benefit not only listed species but all aquatic species that depend upon water from the aquifer for their survival.

Potential reductions in groundwater level resulting from increased impervious cover in the Recharge Zone would be reduced to some extent by the Edwards Aquifer Rules and TCEQ regulations, which generally require setbacks from sensitive features (see Chapter 3, Section 3.3.3.1).

Based on what is known about similar stygobites (TPWD Undated-b), *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* are expected to be vulnerable to human-caused contamination of the water environments they occupy. The expected increase in population and land development in Comal County over the next 30 years increases the probability of groundwater contamination associated with human sewage (particularly septic tanks), leaking underground storage tanks, and urban runoff (including pesticides, fertilizers, and detergents). All these contaminants could be injurious to aquatic invertebrates (USFWS 1997).

In sum, the adverse potential impacts of the No Action alternative on *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* are expected to be minor.

4.6.2.1.2 Terrestrial Troglobites (Karst Invertebrates)

Under the No Action alternative, the existing and anticipated threats to the terrestrial troglobitic invertebrate Evaluation Species (*Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa*) are expected to continue over the next 30 years. These organisms are vulnerable to impacts of land development, including loss or damage of karst habitat due to construction activities, chemical contamination introduced into caves from groundwater and/or surface drainages, destruction of surface habitat, and red imported fire ants that may feed on dead troglobites, cave crickets, and other species within caves (Elliott 1992, USFWS 1994).

The number of caves occupied by these species is unknown, and the number of occupied caves adversely affected by land development in the future cannot be determined. However, based on past experience in more developed counties in central Texas, and the urbanization expected in Comal County, it is not unreasonable to assume that some caves occupied by these species would be impacted under No Action. Potential impacts to these species, however, would be minimized by enforcement of the Edwards Aquifer Rules and TCEQ regulations, which, as noted above, generally require setbacks from sensitive features (see Chapter 3, Section 3.3.3.1). Additionally,

the TCEQ, with the cooperation and assistance of the Service, has established guidelines for the protection of karst invertebrate species habitat.

The No Action alternative, therefore, may result in minor adverse impacts to *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and/or *C. reclusa*.

4.6.2.2 Alternative B – Proposed Comal County RHCP (Proposed Action)
(Impact Topic: Obligate Cave-Dwelling Evaluation Species)

4.6.2.2.1 Aquatic Troglobites (Stygobites)

The impacts to *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* under the Proposed RHCP Alternative would be similar to those under No Action, except the adverse impacts of future development would be reduced by the preservation, in perpetuity, of up to an estimated 7,548 acres of native vegetation (i.e., potential golden-cheeked warbler and black-capped vireo habitat). No development could ever take place on the preserves, thus the adverse impacts to groundwater associated with development would not occur on those lands.[24] Additionally, the County's management activities on preserve lands could have beneficial long-term effects on the aquatic troglobites, including efforts by the County to minimize invasive species such as white-tailed deer and fire ants. Aquifer recharge would not be reduced by impervious cover, nor would runoff be diverted from recharge features. To the extent occupied caves, springs, or seeps occur on lands preserved by the County under the Proposed RHCP, such features would be permanently protected and monitored in accordance with the terms of the applicable preserve management and monitoring plan. The probability of contaminants entering the aquifer from human activities would be reduced.

In addition, *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* may benefit from the research, database, and public awareness programs provided for in the Proposed RHCP. A prioritized list of research topics would be prepared each year, and may include studies related to one or more of these species. Information resulting from any RHCP-funded research would be assembled in a computerized database. The Proposed RHCP would also develop and implement a public education/outreach program designed to educate Comal County residents as to the value and appropriateness of conserving the RHCP Covered Species and Evaluation Species, including *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori*.

Each year, the status of these aquatic invertebrates would be assessed. Depending on that assessment, the County would determine the level of expected impact and decide whether to seek coverage of any of these species under the RHCP. If so, the County may apply for an appropriate amendment to the RHCP. Finally, the Edwards Aquifer Recovery Implementation Program may provide substantial benefits to the aquatic invertebrates.

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[24] It is noted, of course, that some preserve lands may come into the County's possession subject to pre-existing easements, rights-of-way, and similar rights. The County, of course, cannot prohibit the lawful use of such rights. The Service and the County will expect any parties exercising such rights to obtain their own ESA authorization.

4.6.2.2.1.1 Comparison with Alternative A (No Action)

The same approximate amount of land clearing for development is expected to occur in Comal County under the No Action and the Proposed RHCP Alternatives, and the impact of that development on the *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* would be essentially the same whether or not the requested Permit was issued. However, because of the establishment and management of a coordinated and largely contiguous system of preserves, and the programs designed to aid in the conservation of the Evaluation Species, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to the *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* compared to No Action.

4.6.2.2.2 Terrestrial Troglobites (Karst Invertebrates)

The impacts to the karst invertebrates *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* under the Proposed RHCP Alternative would be similar to those under No Action, except the adverse impacts of future development, which would occur with or without Service approval of the Proposed RHCP and issuance of the Permit, would be mitigated by the preservation, in perpetuity, of up to an estimated 7,548 acres of native vegetation (i.e., potential golden-cheeked warbler and black-capped vireo habitat). To the extent occupied karst features occur on preserve lands, the adverse impacts to any karst habitat associated with development would not occur on those lands. Additionally, should occupied karst habitat occur on the RHCP preserves, such habitat would likely benefit from preserve management activities such as controlling and reducing the number of certain invasive species occurring within the preserves.

In addition, *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* may benefit from the research, database, and public awareness programs provided for in the Proposed RHCP. A prioritized list of research topics would be prepared each year, and may include studies related to one or more of these species. Information resulting from any RHCP-funded research would be assembled in a computerized database. The RHCP would also develop and implement a public education/outreach program designed to educate Comal County residents as to the value and appropriateness of conserving the RHCP Covered Species and Evaluation Species, including *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa*.

Each year, the status of these karst invertebrates would be assessed. Depending on that assessment, the County would determine the level of expected impact and decide whether to seek coverage of any of the species under the RHCP. If so, the County may apply for an amendment to the RHCP.

4.6.2.2.2.1 Comparison with Alternative A (No Action)

The same amount of development is expected to occur in Comal County under the No Action and the Proposed RHCP Alternatives, and the impact of that development on the *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* would be the same whether or not the requested Permit was issued. However, because of the programs designed to aid in the

conservation of the Evaluation Species, including particularly the establishment and related management and monitoring of RHCP preserves, the Proposed RHCP is expected to result in a minor or negligible reduction in adverse impacts to the *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* compared to No Action.

4.6.2.3 Alternative C – Reduced Take RHCP
(Impact Topic: Obligate Cave-Dwelling Evaluation Species)

4.6.2.3.1 Aquatic Troglobites (Stygobites)

Impacts to *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* under the Reduced Take RHCP would be similar to those under the Proposed RHCP. Potential for *beneficial* impacts to groundwater resources, and hence to these species, would be reduced relative to the Proposed RHCP because fewer acres of native vegetation (i.e., golden-cheeked warbler habitat) would be protected in preserves. The potential beneficial impacts of the research, database, and public awareness programs would remain the same as under the Proposed RHCP.

4.6.2.3.1.1 Comparison with Alternative A (No Action)

The same amount of development is expected to occur in Comal County under the No Action and the Reduced Take RHCP alternatives, and the impact of that development on the *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* would be the same whether or not the Service issued the County an incidental take permit. However, because of the programs designed to aid in the conservation of the Evaluation Species, including specifically the establishment of approximately 2,619 acres of golden-cheeked warbler preserve, the Reduced Take RHCP alternative may result in a negligible reduction in adverse impacts to the *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* compared to No Action.

4.6.2.3.2 Terrestrial Troglobites (Karst Invertebrates)

Impacts to *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* under the Reduced Take RHCP would be similar to those under the Proposed RHCP. Potential for *beneficial* impacts to these species would be reduced relative to the Proposed RHCP because fewer acres of golden-cheeked warbler habitat would be protected in preserves. The potential beneficial impacts of the research, database, and public awareness programs would remain the same as under the Proposed RHCP.

4.6.2.3.2.1 Comparison with Alternative A (No Action)

The same amount of development is expected to occur in Comal County under the No Action and the Reduced Take RHCP alternatives, and the impact of that development on the *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* would be the same for both alternatives. However, because of the programs designed to aid in the conservation of the Evaluation Species, and because approximately 2,619 acres of native vegetation would be

preserved under the Reduced Take RHCP, this alternative is expected to result in a negligible reduction in adverse impacts to the *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* compared to No Action.

4.7 OTHER PROTECTED SPECIES

Impacts to the Other Protected Species would be considered significant if they were to result in one or more of the following:

- The existing primary threats to the Other Protected Species would decrease (beneficial impact) or increase (adverse impact) to a substantial degree.
- The local Comal County long-term population trends of any of these species would decrease (adverse impact) or increase (beneficial impact) substantially.

The intensity of potential impacts to Other Protected Species is defined as follows:

Negligible: The existing primary threats to Other Protected Species would not be affected or the change would be so small as to not be of any measurable or perceptible consequence to the population.

Minor: There would be a measurable effect on the existing primary threats to Other Protected Species, but the change would be small and relatively localized and would not affect the long-term population trends in the County.

Moderate: A noticeable effect to the existing primary threats to Other Protected Species. The effect would be of consequence to the long-term population trends in the County.

Major: Noticeable effect on the existing primary threats to Other Protected Species with severe consequences or exceptional benefit on the long-term population trends in the County.

4.7.1 Alternative A – No Action

(Impact Topic: Other Protected Species)

Under the No Action alternative, existing threats are likely to increase over the next 30 years for the Federal- and state-protected wildlife species listed in Chapter 3, Table 3-4 that occur in Comal County. As the human population of the County grows, and encroachment into woodland, subterranean, and aquatic habitats increases, the threats to these species may increase as well. The potential impacts associated with No Action for each of the Other Protected Species are discussed below.

4.7.1.1 Avian and Terrestrial Protected Species

Black bears, jaguarundis, and red wolves are unlikely to occur in Comal County (see Chapter 3, Section 3.8); therefore, none of these species are expected to be affected under No Action.

American peregrine falcon, arctic peregrine falcon, bald eagle, and whooping crane are migrants through Comal County and mostly associated with riverine and other aquatic habitats when they pass through. While some aspects of surface water quality and/or quantity may suffer decline under No Action (see Section 4.2.1), any decline is unlikely to be sufficient to affect the migratory patterns of these species or result in harm to individuals of these species. Any adverse impacts would be indirect and negligible.

Zone-tailed hawks may occasionally occur in Comal County as summer residents, and use densely wooded, steep terrain as both nesting and foraging habitat. Loss of such habitat due to the anticipated development in Comal County has the potential to adversely affect the zone-tailed hawk. This impact is expected to be negligible to minor, however, because Comal County is on the extreme eastern edge of the species' distribution in Texas, and few individuals could be affected.

The Texas horned lizard may be present in Comal County, although it is rare there and more likely to occur in more arid regions of the state (Linam 2008). Nonetheless, some suitable habitat for the lizard is present in the County, and future development may destroy or fragment this habitat, resulting in a minor adverse impact to local populations of the species. Because this lizard ranges widely throughout much of Texas, and is more prevalent in other parts of the state, the anticipated development in Comal County is not expected to have more than a negligible adverse impact on the species as a whole.

4.7.1.2 Aquatic Protected Species

No impacts are expected to the San Marcos salamander, Texas blind salamander, San Marcos gambusia, and Texas wild-rice because none of these species are likely to occur in Comal County. Because of the programs described in Section 4.2 of this EIS that were established and are implemented to benefit water quality (e.g., Edwards Aquifer Rules, the City of San Antonio's water quality ordinances, TCEQ's implementation of the TPDES program, and preservation of water quality protection lands throughout the Edwards Aquifer Recharge Zone) and water quantity (e.g., the EA RIP and groundwater conservation districts), the potential adverse impacts of the No Action Alternative on the Cascade Caverns salamander, Comal blind salamander, Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter are expected to be minor.

Five of these species are known from springs issuing from the Edwards Aquifer in Comal County (Cascade Caverns salamander, Comal blind salamander, Peck's cave amphipod, Comal Springs dryopid beetle, and Comal Springs riffle beetle). Because these species all occupy similar aquatic habitat, they are all subject to similar threats. For a discussion of these threats and an analysis of potential impacts of No Action to aquatic species that inhabit similar habitats, see Section 4.6.2.1.1, above. As with the aquatic invertebrates addressed in that section, adverse

potential impacts of the No Action alternative on the Cascade Caverns salamander, Comal blind salamander, Peck's cave amphipod, Comal Springs dryopid beetle, and Comal Springs riffle beetle are expected to be minor due to the water quality and water quantity conservation programs described in detail in Section 4.2 of this EIS. Without these programs, future land development in Comal County could adversely affect both the quantity and quality of the groundwater needed to support these species; however, enforcement of existing regulations, laws, and programs, as well as implementation of currently developing programs, such as the EA RIP should minimize those effects. Indeed, the EA RIP, when completed and implemented, has the potential to benefit all five of these aquatic species, and may lead to the recovery of the federally listed aquatic species.

The potential impacts to the fountain darter under the No Action alternative would be largely similar to those described for the aquatic species addressed above. Fountain darters in Comal County only occur in the Comal River, which is the outflow of Comal Springs; therefore, they may be adversely impacted by a reduction in spring flow from the Edwards Aquifer. Increased water withdrawals from the aquifer associated with increased population growth and land development may reduce instream flow and adversely affect water quality in the Comal River. The fountain darter is likely to be more vulnerable to these affects than the other protected aquatic species because, unlike those species, it is dependent on surface flow and cannot retreat to subterranean habitat as the groundwater level subsides. Future land development in Comal County could affect both the quantity and quality of the water needed to support this species; however, enforcement of existing laws, rules, regulations, and other programs described in detail in Section 4.2 of this EIS should significantly minimize those effects.

4.7.2 Alternative B – Proposed Comal County RHCP (Proposed Action)

(Impact Topic: Other Protected Species)

4.7.2.1 Avian and Terrestrial Protected Species

Under the Proposed RHCP, impacts to the black bear, jaguarundi, red wolf, American peregrine falcon, arctic peregrine falcon, bald eagle, and whooping crane would be the same as under the No Action alternative. The Proposed RHCP is not anticipated to result in the incidental take of the whooping crane, a federally listed species.

While impacts to vegetation would be approximately the same under both the No Action and Proposed RHCP Alternatives, Comal County's establishment of up to an estimated 7,548 acres (depending on the method by which the County preserves potential black-capped vireo habitat) of preserve lands may result in beneficial impacts to the zone-tailed hawk and Texas horned lizard, particularly since those preserve lands will be set aside in large, relatively contiguous blocks.

4.7.2.1.1 Comparison with Alternative A (No Action)

Compared to No Action, the establishment and perpetual management of up to an estimated 7,548 acres of preserves under the Proposed RHCP is expected to result in negligible reduction in adverse impacts to the zone-tailed hawk and the Texas horned lizard.

4.7.2.2 Aquatic Protected Species

The impacts of the Proposed RHCP on the Cascade Caverns salamander, Comal blind salamander, Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter are the same or similar to the impacts that would occur under the No Action Alternative.[25] Similar to the No Action Alternative, the impacts to these species under the Proposed RHCP Alternative are expected to be negligible because impacts to water quality and quantity would be minimized by the implementation and enforcement of existing laws, rules, regulations, and programs set forth in detail in Section 4.2 of this EIS, as well as future implementation of programs such as the EA RIP. The primary activity proposed to be authorized under the Proposed RHCP is the clearing of golden-cheeked warbler or black-capped vireo habitat, and the mere clearing of woodlands is not likely to result in the take of Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter, all federally listed species.

Moreover, under the Proposed RHCP Alternative, up to 7,548 acres of land would be preserved for the primary benefit of the Covered Species. Although the preserve land would be managed in perpetuity for the benefit of golden-cheeked warbler and black-capped vireo, protected aquatic species may also benefit from the preservation and management of these preserves. For example, management of the preserves under the Proposed RHCP Alternative would likely include such measures as limiting application of pesticides and controlling nonnative and/or invasive species. These measures may incidentally provide benefit to the protected aquatic species.

Under the Proposed RHCP, plan participants would be made aware of and encouraged to adopt the TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer* (TCEQ 2007). The Service has indicated that these measures are sufficient to avoid harm to several key aquatic species, including the fountain darter (TCEQ 2007). If RHCP participants choose to implement the Optional Enhanced Measures, the protected aquatic species may benefit.

4.7.2.2.1 Comparison with Alternative A (No Action)

As noted above, adverse impacts to protected aquatic species would be the same under both the No Action and the Proposed RHCP Alternatives; however, under the Proposed RHCP Alternative, protected aquatic species may receive greater conservation benefits than under the No Action Alternative. This would occur through the preservation, in perpetuity, of up to an estimated 7,548 acres of native vegetation in preserves, as well as the management of the same, including, but not limited to, the control of invasive and/or nonnative species and limiting the use of pesticides. Encouraging participants to utilize TCEQ's Optional Measures will provide added benefit to those species, particularly where participants would otherwise not have known of the availability of the Optional Measures. Finally, the Proposed RHCP's educational measures may

[25] It is important to note that the Proposed RHCP does not authorize development. Rather, the Proposed RHCP would authorize take of Covered Species that may occur when the habitat of those species was cleared.

further community awareness of the need to protect water quality and quantity in Comal County for the benefit of the protected aquatic species. In sum, beneficial impacts to the water quantity and quality needed by these aquatic species would be slightly increased compared to No Action.

4.7.3 Alternative C – Reduced Take RHCP
(Impact Topic: Other Protected Species)

4.7.3.1 Avian and Terrestrial Protected Species

Under Alternative C, impacts to black bears, jaguarundis, red wolves, American peregrine falcon, arctic peregrine falcon, bald eagle and whooping crane would be the same as under the No Action alternative and the Proposed RHCP. Impacts to the zone-tailed hawk and the Texas horned lizard would be similar to those under the Proposed RHCP. Potential for *beneficial* impacts to these species would be better relative to the No Action Alternative because more than 2,000 acres (809 hectares) of native vegetation and substrate (i.e., golden-cheeked warbler habitat) would potentially be protected in preserves.

4.7.3.2 Aquatic Protected Species

Adverse impacts to the protected aquatic species would be the same under Alternative C as they would under the No Action and Proposed RHCP Alternative; however, potential for *beneficial* impacts to water resources, and hence to these species, would be slightly increased relative to the No Action Alternative because more than 2,000 acres of native vegetation (i.e., golden-cheeked warbler habitat) would potentially be protected in preserves. In addition, Comal County would be encouraged to adopt TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer* (TCEQ 2007),[26] and landowners may become more aware of the need to protect the protected aquatic species through Comal County's educational programs.

4.7.3.2.1 *Comparison with Alternative A (No Action)*

Compared to No Action, Alternative C would result in a negligible reduction in adverse impacts to the Cascade Caverns salamander, Comal blind salamander, Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter.

4.8 SOCIOECONOMIC RESOURCES

Impacts to socioeconomics would be considered significant if they were to result in one or more of the following:

- Population and economic growth rate, including employment and per capita income, would increase (beneficial impact) or decrease (adverse impact) substantially.

[26] The Service has indicated that implementation the TCEQ's *Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer* (TCEQ 2007) are sufficient to avoid take of several federally listed aquatic species, including the fountain darter.

- County finances measured as accrual of annual tax base would increase (beneficial impact) or decrease (adverse impact) substantially.
- A decrease in taxes would result in a beneficial impact on individuals' finances but an adverse impact on County finances. Conversely, an increase in taxes would result in an adverse impact on individuals' finances but a beneficial impact on County finances.
- Time and money expended on individual development projects by landowners for ESA compliance would decrease (beneficial impact) or increase (adverse impact) substantially.
- The amount of time expended by the Service in ESA compliance for the County would decrease (beneficial impact) or increase (adverse impact) substantially.

The intensity of potential impacts to socioeconomic resources is defined as follows:

Negligible: No change in economic or government agency activities would occur or the magnitude of change would not be measurable.

Minor: Changes in economic or government agency activities would be measurable but would not alter the structure, composition, or function of socioeconomic resources in the County and would be limited in context.

Moderate: Changes in economic or government agency activities would be measurable and may somewhat influence the structure, composition, or function of socioeconomic resources in the County but would be limited in context.

Major: Changes in economic or government agency activities would be measurable, would alter the structure, composition or function of socioeconomic resources in the County and may be extensive in context.

4.8.1 Alternative A – No Action

(Impact Topic: Socioeconomic Resources)

4.8.1.1 Population and Economic Trends

The economy and population of the San Antonio MSA (including Comal County) is likely to continue to grow over the long term; however, the area has begun to feel the effects of recession. It is unknown how extensive the economic reverses will be or how long they will last. The rapid economic growth seen in the San Antonio MSA and Comal County through most of the 2000s has largely stalled and is unlikely to resume at the same pace in the near future. Some sources, however, maintain that the San Antonio MSA economy is sufficiently buffered by a large and growing military sector and the relatively stable health industry to allow the area to weather the recession better than the state as a whole, and certainly better than the nation as a whole (Zumbrun 2008, Guerra 2009). For example, it has been estimated that the Department of Defense's Base Realignment and Closure program will eventually add $2.1 billion in military construction and over 4,886 net new jobs in the San Antonio area, for a total estimated economic impact of $5.7 billion (Birdwell and Nivin 2006). Infusions from the Federal economic stimulus

package will also help to counteract the current downward trend; for example, three highway projects in Comal County totaling nearly $10 million have been approved using Federal stimulus funds (Herald-Zeitung 2009). This said, the severity of the global and national recession is such that the any optimistic regional economic forecast at this point must be viewed with caution.

Comal County Population. It is unknown if the national recession and the local downturn in the economy will affect migration into County, and if so, to what extent. However, economic conditions in the San Antonio MSA, including Comal County, are better than in most of the rest of the nation, and people are still likely to be attracted to the area in search of jobs. From 2009 to 2039, population in the County is expected to grow from an estimated 113,658 to 202,500, an increase of over 78 percent (Table 4-1). This prediction assumes a somewhat slower average growth rate in the future than seen in the last decade (Texas Perspectives, Inc., unpublished data).

Table 4-1. Population forecast in 10-year increments, 2009–2039, for Comal County, Texas.

Year	County Population Forecast
2009	113,658
2019	141,853
2029	170,787
2039	202,500

Source: Texas Perspectives, Inc., unpublished data.

Comal County Employment and Per Capita Income. Given the current state of the economy and uncertainties about how the recession will play out, it is not possible to predict future employment and per capita income in the San Antonio MSA and Comal County with any degree of confidence. Over the long term, however, employment is expected to increase as a reflection of population growth, although not at a steady rate. Assuming employment in the County parallels the estimated population growth, and extrapolating from Texas Workforce (2009c) data, employment may rise from an estimated 38,204 workers in 2009 to 66,826 in 2039. Over the same 30-year period, per capita income in the County would reach $94,832 if that income were to rise by a steady three percent a year, a somewhat slower annual rate than seen in the last decade. In reality, changes in per capita income will vary, reflecting economic upturns and downturns, and, while income in the County is likely to increase over the long term, given the present economic situation, predictions are highly conjectural.

4.8.1.2 Comal County Real Estate Sector

In recent months, Comal County has seen a decline in the construction industry, housing prices have begun to drop, and the rate of foreclosures has risen. Still, development, including large master-planned communities and commercial developments, is expected to proceed in the future, initially at a slower rate than seen in the early 2000s. Rapid growth is expected to resume once the economy recovers; however, when this will occur is unknown.

4.8.1.3 Comal County Finances and Services

County finances are primarily influenced by the assessed value of taxable property (tax base). During the five-year period from 2003 to 2007, Comal County's tax base increased by 85 percent to almost $9.5 billion (see Chapter 3, Table 3.5). Under the No Action alternative, if the tax base growth were to continue in a similar pattern (85 percent increase every five years), the tax base for Comal County would exceed $380 billion in 30 years. Over the same period, if property tax revenues were to increase at the rate seen from 2003 to 2007 (46.5 percent over the five-year period), in 30 years the annual revenue from property taxes would exceed $161 billion. Such a sustained growth is unlikely, particularly in light of the current economic downturn. Given the uncertainties associated with the depth and extent of the recession, predicting future revenues and how they might affect County services is speculative.

4.8.1.4 Endangered Species Act Compliance and Implementation

While no section 10(a)(1)(B) permits have been issued for any land development project in the County to date and section 7(a)(2) consultations have been rare, it is possible that ESA compliance will increase in the future as the County's and state's focus on protecting listed species increases. Under No Action, landowners who comply with the ESA will do so through avoidance, individual section 10(a)(1)(B) permits, and/or or section 7 consultations. Delays of up to two years or more could occur for projects seeking incidental take authorization under section 10(a)(1)(B). The costs in time and money to project proponents cannot be calculated due to a lack of information on the specifics of each future project in terms of location, species affected, amount of habitat on each property, future interest rates, debt service needs, and lack of information on the specifics of each business affected; however, the cumulative costs may be substantial. For each habitat conservation plan, the Service would expend an estimated one-quarter to one-half of an FTE per year (B. Seawell, U.S. Fish and Wildlife Service, pers. comm. to SWCA, 2007).

4.8.2 Alternative B – Proposed Comal County RHCP (Proposed Action)

(Impact Topic: Socioeconomic Resources)

4.8.2.1 Population and Economic Trends

Under the Proposed RHCP, population and economic growth, including employment and per capita income, are expected to continue in Comal County in a pattern similar to that of the No Action alternative. For those businesses requiring incidental take permits for construction and/or operation of new facilities, the availability of a regional habitat conservation plan that would streamline ESA compliance in Comal County may be a positive factor in site selection. However, this potential beneficial affect cannot be quantified at this time and may be small compared to other economic and social factors.

4.8.2.2 Comal County Real Estate Sector

Under the Proposed RHCP, development in the County would not deviate from that expected with the No Action alternative, with the exception that up to 50 percent (estimated RHCP participation rate) of development projects with ESA compliance issues may be completed up to two years sooner than under the No Action alternative. Eliminating the time delay would result in a moderate beneficial impact in time and cost. The average value of single-family dwelling units across the County is not expected to be affected by the Proposed RHCP; however, homes near RHCP preserves may increase in value because of the proximity of permanent open space (see the discussion of the proximate principle below in Section 4.8.2.3.3)

4.8.2.3 Comal County Finances and Services

Implementation of the Proposed RHCP would require the County to commit to the long-term funding of the RHCP. The ESA requires that an applicant (in this case Comal County) for a section 10(a)(1)(B) permit ensure adequate funding will be available to implement the associated HCP. In addition, Texas state law requires that when applicants for RHCPs are governmental entities they must demonstrate that adequate sources of funding will exist to acquire all land for habitat preserves within required state law timeframes. To meet these requirements, Comal County has approved an RHCP financial plan (see RHCP, Chapter 7). Included in the financial plan is the commitment that every year during the 30-year life of the RHCP the County will reevaluate the financial plan to ensure adequate funding and appropriate disposition of excess revenues to meet plan goals. While the County may opt out of the RHCP at some point in the future, any mitigation requirements for take that has already occurred would be completed as stipulated in the RHCP.

The financial plan described in the Proposed RHCP would provide for the mitigation measures, monitoring and research programs, and any other permit conditions to be implemented under the plan. All expenditures in excess of income would be borne by the County, and all income in excess of expenses would be the sole property of the County. Other than the County contributions, the only County funds specifically segregated for the RHCP would be those of the endowment (see RHCP, Sections 7.2.6 and 7.3.3), and so long as the County is otherwise meeting its financial obligations under the RHCP, the disposition of its financial resources remains within the sole and exclusive purview of the Commissioners Court, and the County is not required to establish separate accounts for the RHCP.

4.8.2.3.1 Estimated Costs and Income for the Proposed RHCP

Costs to implement the Proposed RHCP include acquisition and management of Covered Species preserves, research and monitoring, a public awareness program, establishment of an endowment to fund the County's Permit obligations in perpetuity, and administration expenses. Funding for the Proposed RHCP would be generated from three primary sources: 1) participation fees, including sale of conservation credits to participants; 2) return on endowment investments; and 3) County contributions.

As shown in Table 4-2, the RHCP cumulative costs ($133,913,468) are projected to be lower over the 30-year period than the projected income ($135,087,982). Initial estimates indicate a surplus of approximately $1,174,500, all of which is realized in the first five years of the financial plan. This surplus represents a minor beneficial impact for the County.

Table 4-2. Proposed RHCP total costs and income over the 30-year life of the plan.

Costs	Income	30-Year Cumulative Balance
$133,913,468	$135,087,982[1]	$1,174,514

[1] The larger income than costs reflects surpluses in only two years, Years 2 and 4, when no preserve land is acquired but golden cheeked warbler mitigation credits generated by earlier acquisitions are sold. In all other years the annual balance is zero.

4.8.2.3.2 County Contributions to the Proposed RHCP

The Proposed RHCP financial plan provides for annual direct contributions from the County in 28 of the 30 years of the RHCP. These annual contributions would range from $0 to $2,883,869, with an annual average of approximately $1,440,000. In Years 1, 3, and 5, the County would contribute $1,344,000, $1,369,026, and $2,883,869, respectively. No contributions would be made in Years 2 and 4. Contributions would be required each year in Years 6–30, generally decreasing over time. Table 4-3 shows the average annual contribution for each five-year period.

Table 4-3. Average annual contribution by the County to fund preserve acquisition in five-year increments.

Years 1–5*	Years 6–10	Years 11–15	Years 16–20	Years 21–25	Years 26–30
$1,119,379	$2,069,146	$1,971,445	$1,582,139	$1,266,357	$648,040

* The average contribution in Years 1–5 includes two years, Years 2 and 4, in which the contribution equals zero.

The preserves acquired as a result of County contributions (as well as the other sources of income) would provide an estimated 6,548 acres of green open space for the citizens of Comal County. These properties would become capital assets and represent a moderate beneficial impact to the County. Although more open space would be preserved under the Proposed RHCP than under No Action, public use of the RHCP preserves may be limited compared to other types of open space that might be acquired using County funds (e.g., parks). The primary functions of preserves are to provide natural habitat for Covered Species and protect them from the potential adverse consequences of human activities; consequently, activities likely to cause adverse impacts would have to be constrained. Although access to one or more preserves may be allowed by the County, it is not anticipated that any access allowed by the County would increase funding required for the RHCP. Should any such access be shown to increase funding requirements for preserve management or monitoring needs, those costs may be passed on to the individuals accessing the preserves.

The average annual County contribution to the Proposed RHCP ($1,440,000) represents 2.97 percent of the revenues from all sources ($48,470,754) collected in 2007, and 4.69 percent of just the property and sales taxes collected in that year ($30,700,612). County contributions to the Proposed RHCP may require the County to 1) divert funds from other uses, and thus reduce services, or 2) raise property and/or sales tax rates to fund the contributions. Either course of action would represent a minor adverse impact on the County. Funding for the RHCP contributions could also come, at least in part, from increased property tax revenues that would be generated by an expanding tax base rather than by increased tax rates. To place $1,440,000 (the average annual County contribution to the Proposed RHCP) in context, between 2006 and 2007, the assessed property value in Comal County increased by $520,033,000 (see Chapter 3, Table 3-5). The increase in revenues resulting from the increase in tax base value in just that one year exceeded a million dollars.

4.8.2.3.3 Potential Impacts of the Proposed RHCP on the County Tax Base

It is expected the Proposed RHCP would contribute to an expanded tax base in Comal County. The time savings for permitting take under the Proposed RHCP would likely result in participants' properties entering the tax base at residential and commercial land tax rates one to two years sooner than without the RHCP; thus accelerating growth of the County's tax base (a beneficial impact). For example, assume a participant had a project that resulted in the building and sale of 1,000 homes, and that participant realized a one-year acceleration of the construction and sale of those homes due to the RHCP permitting process. One thousand homes at an average price of $140,000 per home would result in a $140,000,000 addition to the tax base. In 2008, the County property tax was computed at approximately 0.308 per $100; that is, $431 per $140,000 house, or $431,000 in tax revenues for all 1,000 houses. At a 50 percent participation rate this would result in $215,500 in new tax revenues for the County for the first year the property was enrolled (a year sooner than if there were no RHCP) and accumulate every year thereafter. The exact amount of beneficial impact the RHCP would have on tax revenues is impossible to calculate at this time due to the long-term uncertainties in the economy of Comal County; however, the anticipated effect on these revenues is expected to be positive, resulting in a minor beneficial impact.

Another small but beneficial impact of the Proposed RHCP on the property tax base would occur for those homes built in proximity to RHCP preserves. It has been demonstrated in other locations that proximity to greenbelts, parks, and preserves commonly has a positive effect on values of residential property (called the "proximate principle"). In one study it was found that properties adjacent to a greenbelt were appraised at over 30 percent higher than properties 3,200 feet or more away from the greenbelt (Correll et al. 1978). In Dallas, homes facing parkland were found to be worth 22 percent more than homes that were more than one-half mile from such an amenity (Miller 2001), and in Austin, property adjoining the Barton Creek Greenbelt was 8–12 percent higher in value than comparable property not adjacent to the greenbelt (Nicholls 2002). Since the Proposed RHCP would facilitate the establishment and perpetual maintenance of at least an estimated 7,548 acres of preserves in the County, a boost in surrounding property values is likely. Any increase in property values due to the proximate principle is likely to be greater under this alternative than under No Action because a larger amount of preserve lands would be established.

4.8.2.4 Landowner/Service Endangered Species Act Compliance

Compared to the No Action alternative, a beneficial effect of the Proposed RHCP on landowner/Service ESA compliance burden would be to reduce the amount of time (by up to two years) and associated costs both the landowners and Service have to spend processing individual permits for the golden-cheeked warbler and the black-capped vireo. The cost savings in time and money to participants cannot be calculated due to a lack of information on the specifics of each future project in terms of location, species affected, amount of habitat on each property, future interest rates, debt service needs, and lack of information on the specifics of each project affected.

Under this alternative, substantial cost and time savings may accrue to landowners and the Service if the conservation and mitigation measures included in the Proposed RHCP contribute to the long-term conservation of one or more of the Evaluation Species, thus precluding the need to list them under the ESA. Similarly, the compliance burden would be lifted for both landowners and the Service if the conservation and mitigation measures included in the Proposed RHCP contribute to the eventual delisting of either of the Covered Species.

4.8.2.5 Comparison with Alternative A (No Action)

In summary, general trends in population and economic growth, job availability, and per capita income would be the same under this alternative as under the No Action alternative. Compared to No Action, the primary effects of the Proposed RHCP would be the reduced time (up to two years) and money expended on individual development projects by project proponents (including the County) and the Service for ESA compliance for projects involving the two RHCP Covered Species. The result would be accelerated and less costly economic development in the County with more preserved open space. Additional differences in potential impacts between the two alternatives (e.g., altered tax structure and increased tax base under the Proposed RHCP) are more fully described in the preceding sections.

In considering the potential impacts of the Proposed RHCP, it is important to place the plan in context of the many larger forces driving regional economic growth and development, as well as the RHCP's limited scope. While access to the RHCP, as opposed to individual permitting under the ESA, may save developers time and consultation-related costs, experience since the listing of the Comal County endangered species demonstrates that the strictures of the ESA, even without an RHCP in place, have not been a significant impediment to robust growth within the County. Therefore, it is reasonable to assume that the RHCP would not be a significant inducement to new development, but may allow for more efficient permitting of the development that would occur over the next 30 years with or without the RHCP. Any potential for growth-inducing effects of the RHCP is further minimized by the limited scope of the RHCP; projected participation levels in the RHCP represent no more than 50 percent of anticipated development.

4.8.3 Alternative C – Reduced Take RHCP
(Impact Topic: Socioeconomic Resources)

4.8.3.1 Population and Economic Trends

The effects of the Reduced Take RHCP on Comal County regional population and economic growth trends, employment, and per-capita income would be the same as for the No Action and Proposed RHCP Alternatives. Like the Proposed RHCP, the Reduced Take RHCP may be seen as a potential benefit for those businesses seeking to relocate to Comal County or those existing businesses requiring incidental take permits for construction and/or operation of new facilities. However, this potential beneficial effect cannot be quantified at this time and is likely to be small compared to other economic and social factors.

4.8.3.2 Comal County Real Estate Sector

Under the Reduced Take RHCP, the increase in the number of large master-planned communities and commercial developments expected over the next 30 years in response to the increasing human population growth would not deviate from that expected with the No Action alternative, with the exception that 20 percent (participation rate) of development projects could be completed up to two years sooner than under the No Action alternative. The average value of single-family dwelling units is not expected to be affected by the Reduced Take RHCP, except homes near RHCP preserves may increase in value because of the proximity of permanent open space (see the discussion of the proximate principle above in Section 4.8.2.3.3). Compared to the Proposed RHCP, the potential beneficial impact on property values would be less because fewer acres would be set aside as preserves: a total of 2,619 acres of land compared to up to 7,548 acres in the Proposed RHCP.

4.8.3.3 Comal County Finances and Services

As with the Proposed RHCP, implementation of the Reduced Take RHCP would require the County to commit to the long-term funding of the plan. The financial plan for the Reduced Take RHCP (see Chapter 2, Section 2.4) would provide for the mitigation measures, monitoring and research programs, and any other permit conditions to be implemented under the plan. All expenditures in excess of income would be borne by the County, and all income in excess of expenses would be the sole property of the County.

4.8.3.3.1 Estimated Costs and Income for the Reduced Take RHCP

The major differences for County finances and services between this alternative and the Proposed RHCP are the reduced costs and 30-year surplus associated with implementation of this alternative. Under the Reduced Take RHCP, the 30-year estimated cost is $55,124,166 and income is $55,529,414, yielding a surplus of $405,248. Compared to the Proposed RHCP, the Reduced Take RHCP provides approximately $769,265 less in surplus funds. See Table 4-4 for a comparison of line-item costs and Table 4-5 for a comparison of line-item income and net surplus.

Table 4-4. Summary of costs from financial plans for Alternative B (Proposed RHCP) and Alternative C (Reduced Take RHCP).

Line Item	Change from Alternative B to Alternative C	Alternative B Cumulative Costs	Alternative C Cumulative Costs
Administration 2.5 Annual Increase	From: $62,500 in Year 1 To: $ $50,500 in Year 1	$2,973,463	$2,402,558
Preserve Acquisition	From: 6,548 acres To: 2,619 acres	$107,083,312	$42,826,255
Preserve Operation		$6,474,852	$2,589,879
Research 2.5 Annual Increase	From: $10,000 starting in Year 3 To: $8,000 starting in Year 3	$429,309	$343,447
Public Awareness 2.5 Annual Increase	From: $5,000 starting in Year 3 To: $4,000 in Year 3	$214,655	$171,724
Endowment	From: $1,000,000 starting in Year 22 To: $400,000 starting in Year 22	$16,500,000	$6,600,000
Contingency Fund 2.5 Annual Increase	From: $5,000 in Year 1 To: $4,000 in Year 1	$237,877	$190,302
Cumulative 30-Year Costs		**$133,913,468**	**$55,124,166**

Table 4-5. Summary of income from financial plans for Alternative B (Proposed RHCP) and Alternative C (Reduced Take RHCP).

Line Item	Change from Alternative B to Alternative C	Alternative B Cumulative Income	Alternative C Cumulative Income
Sale of Mitigation Credits for Impacts to Golden-cheeked Warbler	From: 6,548 credits at $7,500/credit To: 2,619 credits at $7,500/credit	$88,230,447	$35,288,644
Endowment Investment Return 7% Annual Return	From: $55,000 starting in Year 22 To: $22,000 starting in Year 22	$3,575,000	$1,430,000
Contribution 2.5% Annual Increase	From: varying amounts; $1,344,000 in Year 1 To: smaller varying amounts; $565,100 in Year 1	$43,282,535	$18,810,770
Cumulative 30-Year Income		**$135,087,982**	**$55,529,414**
Less Cumulative 30-Year Costs		$133,913,468	$55,124,166
Net Surplus		**$1,174,514**	**$405,248**

4.8.3.3.2 County Contributions in the Reduced Take RHCP

The Reduced Take RHCP financial plan provides for annual direct contributions from the County in 28 of the 30 years of the RHCP. These annual contributions would range from $0 to $1,190,864, with an annual average of approximately $627,026. In Years 1, 3, and 5, the County

would contribute $565,100, $582,785, and $1,190,864, respectively. No contributions would be made in Years 2 and 4. Contributions would be required each year in Years 6–30, generally decreasing over time. Table 4-7 shows the average annual contribution for each five-year period.

Table 4-6. Average annual contribution by the County to fund preserve acquisition in five-year increments.

Years 1–5*	Years 6–10	Years 11–15	Years 16–20	Years 21–25	Years 26–30
$467,750	$868,471	$835,891	$687,705	$570,128	$332,209

* The average contribution in Years 1–5 includes two years, Years 2 and 4, in which the contribution equals zero.

The preserves acquired as a result of County contributions (as well as the other sources of income) would provide an estimated 2,619 acres of green open space for the citizens of Comal County and add to the County's capital assets. This would represent a moderate beneficial impact to the County. As with the Proposed RHCP, the issue of public access to RHCP preserves has not been addressed and may vary on a case-by-case basis.

The average annual County contribution to the Reduced Take RHCP ($627,026) represents 1.29 percent of the revenues from all sources ($48,470,754) collected in 2007, and 2.04 percent of just the property and sales taxes collected in that year ($30,700,612). Similar to the Proposed RHCP, County contributions to the Reduced Take RHCP may require the County to divert funds from other uses, and thus reduce services, or raise property and/or sales tax rates to fund the contributions. Either course of action would represent a minor adverse impact on the County. Funding for the RHCP contributions could also come, at least in part, from increased property tax revenues that would be generated by an expanding tax base (see below).

4.8.3.3.3 Potential Impacts of the Reduced Take RHCP on the County Tax Base

Potential impacts of the Reduced Take RHCP to the County tax base would be similar to those of the Proposed RHCP, but the beneficial impact would be reduced due to the smaller participation rate (20% vs. 50%). As with the Proposed RHCP, the time savings for permitting take under the this alternative would likely result in participants' properties entering the tax base at residential and commercial land tax rates one to two years sooner than without the RHCP; thus accelerating growth of the County's tax base. For example, assume a participant had a project that resulted in the building and sale of 1,000 homes, and that participant realized a one-year acceleration of the construction and sale of those homes due to the RHCP permitting process. One thousand homes at an average price of $140,000 per home would result in a total of $140,000,000 addition to the tax base. In Comal County today, property tax is computed at approximately 0.308 per $100; that is, $431 per $140,000 house, or $431,000 in tax revenues for all 1,000 houses. At a 20 percent participation rate this would result in $86,200 in new tax revenues for the County for the first year the property was enrolled (a year sooner than if there were no RHCP) and accumulate every year thereafter. This compares to $215,500 under the Proposed alternative. The exact amount of beneficial impact the Reduced Take RHCP would have on tax revenues is impossible to calculate at this time due to the long-term uncertainties in the economy of Comal County;

however, the anticipated effect on these revenues is expected to be positive, resulting in a minor beneficial impact.

Under the Reduced Take RHCP, any increase in the tax base attributable to the "proximate principle" would be less compared to the Proposed RHCP because this alternative provides for less open space: a total of 2,619 acres of land preserved for the golden-cheeked warbler in the County, compared to 6,548 acres in the Proposed RHCP. As a result, fewer properties would be adjacent to the preserves provided for under this alternative, and fewer properties would increase in value because of that proximity.

4.8.3.4 Landowner/Service Endangered Species Act Compliance Burden

As under the Proposed Action, this alternative would reduce the amount of time (by up to two years) both the landowners and Service would have to spend processing individual incidental take permits. However, due to the lower level of take authorization, fewer landowners would benefit, and the savings in time and costs to the Service would be reduced.

4.8.3.5 Comparison with Alternative A (No Action)

In summary, general trends in population and economic growth, job availability, and per capita income would be the same under this alternative as under the No Action alternative. Compared to No Action, the Reduced Take RHCP would reduce the time expended on individual development projects by landowners and the Service for ESA compliance by up to two years. The result would be accelerated and less costly economic development in the County, although the magnitude of this beneficial impact would be limited because a relatively small portion (20%) of development projects is expected to participate in the plan. Also compared to No Action, the County's tax base is expected to increase somewhat due to accelerated development for plan participants and a slight increase in value for properties proximate to preserves.

Compared to the No Action alternative, the Reduced Take RHCP would not be significantly induce additional development. The geographic area and pace of residential and commercial development that has occurred since the listing of the Covered Species demonstrate that the strictures of the ESA, even without an RHCP in place, have not been a significant impediment to robust growth within the County.

4.9 CUMULATIVE IMPACTS

4.9.1 Introduction

According to NEPA regulations, a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR § 1508.7). "Reasonably foreseeable future actions" are defined as actions that are not speculative—they have been approved, are included in short- to medium-term planning and budget documents prepared by government agencies or other entities, or are

likely given trends. Cumulative impacts can result from individually minor but collectively noteworthy actions taking place over a period of time (40 CFR § 1508.7).

The Proposed Action is issuance of an incidental take permit under section 10(a) of the ESA that will authorize potential species take associated with the clearing of up to 5,238 acres of golden-cheeked warbler habitat and up to 1,000 acres of black-capped vireo habitat at various locations within Comal County over a period of 30 years. Given the amount of potential habitat for these species in Texas (1,363,807 acres of golden-cheeked warbler habitat and 1,450,000 acres of black-capped vireo habitat), the proposed action is relatively modest in scale. Indeed, the Service has approved non-regional HCPs (such as for the Barton Creek Community in Travis County) more similar to this scale of expected impacts than some regional HCPs. By contrast, for example, the Service anticipated that the Balcones Canyonlands Conservation Plan would authorize the clearing of over 26,000 acres (10,521 hectares) of golden-cheeked warbler habitat over the 30-year life of the permit. On September 22, 2009, the Service issued its biological opinion authorizing impacts to 5,000 acres of golden-cheeked warbler habitat associated with activities conducted on the Department of the Army's Camp Bullis installation in Bexar County, Texas. That biological opinion found that the loss of 5,000 acres of golden-cheeked warbler habitat would not jeopardize the continued existence of the golden-cheeked warbler, particularly given that mitigation for any impacts would occur prior to clearing the habitat. Bexar County, like Comal County, is located in current golden-cheeked warbler Recovery Region 6.

The limited scale of the Proposed RHCP and even more limited scale of the Reduced Take RHCP must be kept in mind when considering the cumulative impacts of these alternatives when combined with those of other actions. The other actions in the following analyses are largely framed as increased land development and urbanization in the regions that incorporate Comal County. Growth in development and urbanization, as indicated by projected population increases, are trends that have the potential to adversely affect the human environment, specifically the natural resources addressed in this EIS. Neither the Proposed RHCP nor the Reduced Take RHCP would contribute significantly to those cumulative impacts.

The following ongoing and/or planned actions are expected to lessen the potential impacts on water resources and aquatic species:

- Edwards Aquifer Rules
- Texas Pollutant Discharge Elimination System regulations for essentially all forms of point source pollution to waters of the state, including from storm water
- Environmental Protection Agency and Army Corps of Engineers wetlands programs
- Texas Commission on Environmental Quality total maximum daily load program
- Groundwater pumping regulations of the Edwards Aquifer Authority
- Texas House Bill 1763, passed in 2005, which requires groups of Groundwater Districts to plan for the desired future condition of the groundwater resources in their Groundwater Management Area

- Texas Senate Bill 3, passed in 2007, which provides for a process that will eventually lead to the establishment of minimum environmental flow standards for each river basin in the state
- Water quality regulations of the City of San Antonio
- State legislatively prescribed Edwards Aquifer Recovery Implementation Program
- Creation of a groundwater district with jurisdiction over the portions of the Trinity Aquifer occurring over Comal County

The following ongoing and/or planned actions occurring outside the action area are contributing to the conservation of Covered Species and their habitat:

- Pending development of the Southern Edwards Plateau RHCP and associated open space initiatives
- Camp Bullis' announced initiatives to provide for the conservation of several thousand acres within the region utilizing base buffering monies
- Hays County's pending RHCP
- A variety of non-profit organization efforts at conserving undeveloped land within the Balcones Canyonlands ecoregion

In the following cumulative impact analyses, the geographic area of analysis varies by impact topic as appropriate. The time frame for future impacts remains 30 years. The impact topics are the same as those analyzed in the preceding sections for direct and indirect impacts.

4.9.2 Water Resources

The area of cumulative impact analysis for water resources encompasses the hydrologically relevant regions of the Edwards and Trinity Aquifers and the South Central Texas Regional Water Planning Group (Region L), the water planning area to which Comal County belongs. These three areas overlap to a considerable extent, and the water shortage totals provided below are not additive; however, they provide three different and meaningful regional contexts in which to assess cumulative impacts on water resources.

Approximately a third of Comal County falls within the Recharge (outcrop) and Confined Zones of the Southern Segment of the Edwards Aquifer (see Figure 3.2 and Chapter 3, Section 3.3.1.1). Six Texas counties overlie the Southern Segment: Bexar, Comal, Hays, Kinney, Medina, and Uvalde Counties. In recent years, Bexar, Comal, and Hays Counties have seen rapid population and economic growth, with rural landscapes increasingly urbanized. The San Antonio Metropolitan Statistical Area (MSA) is expanding from Bexar County into neighboring Medina County, but Kinney and Ulvalde Counties remain largely rural with very little growth. Since 2000, the combined population of these six counties has grown from 1,636,150 to an estimated 1,877,891, an increase of approximately 15 percent (Texas State Data Center and Office of the State Demographer 2007; 0.5 scenario). By the year 2040, total population of the six-state area is expected to reach an estimated 2,442,915, an increase of 30 percent. This recent and projected growth has caused concern about the effects of increased demands for water from the Edwards

Aquifer. Concern over the impacts of development and increased pumping on water availability and water quality in the aquifer led to the establishment of the Edwards Aquifer Authority and the Edwards Aquifer Rules (see Chapter 3, Sections 3.3.1.1 and 3.3.3.1), as well as the Edwards Aquifer Recovery Implementation Program.

The northwestern half of Comal County overlies a hydrologically bounded portion of the Middle Trinity Aquifer (Mace et al. 2000). This part of the aquifer is influenced by activities in all or parts of 11 counties in the Texas Hill Country: Bandera, Bexar, Blanco, Comal, Gillespie, Hays, Kendall, Kerr, Medina, Travis, and Uvalde Counties. Included within this area are portions of two metropolitan areas, San Antonio and Austin, and several other rapidly growing cities, as well as large tracts of rural land. Since 2000, the combined population of these 11 counties has grown from 2,559,324 to an estimated 2,970,259, an increase of approximately 16 percent (Texas State Data Center and Office of the State Demographer 2007; 0.5 scenario).

By 2040, the total population of these counties is projected to grow to 4,009,462, an overall increase of 35 percent (Texas State Data Center and Office of the State Demographer 2007; 0.5 scenario). Several of these counties, particularly Bexar County, which includes most of the San Antonio MSA, rely heavily on the Edwards Aquifer as a source of water. However, all 11 counties are at least partially dependent on water pumped from the Trinity Aquifer and on surface waters fed by that aquifer (such as the Guadalupe River and Canyon Lake in Comal County). All 11 counties are expected to increase their demand for water over the next 30 years. According to the South Central Texas Regional Water Planning Group (2006), which represents five of these counties, the Trinity Aquifer is already being stressed due to rapid growth in the number of wells being drilled to supply new homes and commercial establishments. Mace et al. (2000) report that some areas relying on the Middle Trinity Aquifer could see a decrease in groundwater levels of 100 feet or more within their study period (2010–2040), and the most vulnerable parts of the aquifer may be depleted by 2030. While the modeling performed by Mace et al. (2000) provides for periods of drought, the model also indicates that large water-level declines may occur even without droughts. But droughts will occur; in fact, until recently, central Texas was in its second year of what may be the worst drought since the drought-of-record in the 1950s.

The South Central Texas Regional Water Planning Group (Region L) comprises 19 counties in South Central Texas. From 2010 to 2024, the population within those counties is estimated to grow from 2,460,599 to 3,644,661, an increase of 48 percent. Based on historical statistics, the South Central Texas Regional Water Planning Group (2006) reported that from 2010 to 2040 Region L's existing water supply is expected to decline from 1,280,559 to 1,264,173 acre-feet (157,955 to 155,933 hectare meters), while water demands are projected to increase from 985,235 acre-feet to 1,154,493 acre-feet (121,527 to 142,405 hectare meters). It is expected that increased water conservation, reuse, reallocation, and desalination will balance water supply with increased demand. However, it is possible that Region L will have to find water supplies from outside the region to meet its future needs (Texas Water Development Board 2006).

Measures to maintain groundwater and surface water supplies, including those listed in Section 4.9.1, may ensure a sustainable level of water in regional aquifers, springs, and streams. Shifting water from agricultural uses to municipal and industrial uses, desalination of brackish

groundwater, transport of water over long distances from sources outside the region, new reservoirs, and water conservation practices may provide sufficient water to support the projected population growth over the next 30 years. Alternatively, insufficient water availability may limit growth, and the current population projections may not be met. Under Texas law, developers are required to certify to the County that there is sufficient water available to serve any proposed new development.

Cumulative Impact Determination. Over the next 30 years and beyond, the projected population growth and concomitant commercial and residential development in the areas of analysis may result in shortfalls in available water in both the Trinity and Edwards Aquifers and in Region L. Adverse cumulative impacts to water *quality* are not likely to reach significant levels because of local, state, and Federal laws and regulations currently in place (see Chapter 3, Section 3.3.3.1).

The same amount of population growth and land development, and the same cumulative impacts, are expected to occur in the areas of analysis whether or not a county-wide incidental take permit is issued for Comal County. Therefore, the act of issuing a county-wide incidental take permit in and of itself would not contribute to the potential adverse cumulative impacts described above. In fact, implementation of the conservation measures in either the Proposed RHCP or the Reduced Take RHCP could reduce the cumulative adverse impacts on water resources, but any reduction would be relatively minor.

4.9.3 Vegetation and Wildlife

The area of analysis for vegetation and wildlife are the 14 counties, or parts of counties, that make up the Balcones Canyonlands ecoregion, the dominant ecoregion of Comal County (see Figure 3-1). The 14 counties are Bandera, Bexar, Blanco, Burnet, Comal, Edwards, Hays, Kendall, Kerr, Medina, Travis, Uvalde, and Williamson Counties. The vegetation communities and wildlife typical of this area, popularly referred to as Texas Hill Country, are described in Chapter 3, Sections 3.4 and 3.5.

Most of the adverse impacts to these resources in the last decade have resulted from population growth and urban development. The extent to which any one county has been affected by this growth depends on the county's location, primarily its proximity to large urban centers. The fastest growing counties since 2000 have been those bordering Travis County (Austin) and Bexar County (San Antonio). In the last decade, the populations of Williamson, Burnet, Hays, Comal, Kendall, Bandera, and Medina Counties all grew by 24–40 percent as the Austin and San Antonio metropolitan areas spread across county borders. Travis and Bexar Counties have the largest populations, but they saw their fastest growth rates in the years before 2000. The counties farthest from large urban centers and the transportation corridors connecting them have seen less development. In fact, some counties have barely grown (Kerr, Real) or have actually lost population (Edwards). These counties have retained their rural landscapes, and livestock grazing and associated land clearing is more likely to impact native habitats and the wildlife species that inhabit them than urbanization.

Over the next 30 years, the same development patterns are expected to continue. Overall, total population in the 14 counties is projected to grow from an estimated 3,340,943 to 4,063,860, an

increase of approximately 22 percent (Texas State Data Center and Office of the State Demographer 2007; 0.5 scenario). The counties that will likely suffer the greatest loss of natural plant and animal communities are Williamson, Hays, Burnet, Hays, Comal, and Kendall. Their populations are projected to grow by an average of 87 percent.

Cumulative Impact Determination. Over the next 30 years and beyond, the projected population growth and associated commercial and residential development in the area of analysis may result cumulative adverse impacts to the vegetation and wildlife communities of the Balcones Canyonlands ecoregion. The same amount of population growth and land development, and the same cumulative impacts, are expected to occur in the area of analysis whether or not a county-wide incidental take permit is issued for Comal County. Therefore, the act of issuing a county-wide incidental take permit in and of itself would not contribute to the potential adverse cumulative impacts described above. In fact, implementation of the conservation measures in either the Proposed RHCP or the Reduced Take RHCP could reduce the cumulative adverse impacts on vegetation and wildlife, but any reduction would be relatively minor.

4.9.4 Golden-cheeked Warbler

The areas of analysis for the golden-cheeked warbler are the species' breeding range (i.e., Texas) and Recovery Region 6 as defined in the Golden-cheeked Warbler Recovery Plan (USFWS 1992). The cumulative impact on golden-cheeked warblers of the Proposed RHCP combined with previously authorized incidental take is summarized in Table 4-7.

Table 4-7. Cumulative impact on golden-cheeked warblers of the Proposed RHCP combined with previously authorized incidental take.

Golden-cheeked Warbler Habitat in Texas						
Acres of Breeding Habitat in Texas (hectares)[1]	**Acres of Take Requested in Proposed RHCP (hectares)**	**% of Total Habitat in Texas**	**Acres of Previously Authorized Take in Texas (hectares)[2]**	**% of Total Habitat in Texas**	**Acres of RHCP & Previously Authorized Take in Texas (hectares)**	**% of Total Habitat in Texas**
1,363,807 (551,913)	5,238 (2,120)	0.4	38,804 (15,703)	2.8	44,042 (17,823)	3.2
Golden-cheeked Warbler Habitat in Recovery Region 6 (RR6)						
Acres of Breeding Habitat in RR6 (hectares)[1]	**Acres of Take Requested in Proposed RHCP (hectares)**	**% of Total Habitat in RR6**	**Acres of Previously Authorized Take in RR6 (hectares**	**% of Total Habitat in RR6**	**Acres of RHCP & Previously Authorized Take in RR6 (hectares)**	**% of Total Habitat in RR6**
244,106 (98,786)	5,238 (2,120)	2.1	954 (386)	0.4	6,192 (2,506)	2.5

[1] Source: SWCA 2007

[2] Data for previously authorized take were derived from the Service's Southwest Region on-line electronic library (USFWS 2007d). This estimate does not include take requested in the draft Hays County RHCP.

Impact is expressed in acres of golden-cheeked warbler breeding habitat modified or lost due to the covered actions. Unauthorized clearing of golden-cheeked warbler habitat has likely occurred in the past in Comal County, as it has throughout central Texas; however, the location and extent of such clearing is unknown and is not included in the following analysis.

To calculate the total number of estimated acres of the golden-cheeked warbler that have been previously authorized by the Service for take, the Service's Southwest Region on-line electronic library was queried for all HCPs and biological opinions posted for this species (USFWS 2007d). As a result of this search, it was determined that in 152 separate Federal actions, a total of 38,804 (15,703 hectares), have been permitted for incidental take in Texas. Most of the authorized take (26,753 acres; 10,826 hectares) is in Travis County; however, the established preserves encompassing almost 30,000 acres (12,140 hectares) of prime habitat in Travis County are assumed to fully mitigate for authorized take in that county.

The approved take represents approximately 2.8 percent of the estimated available habitat for the golden-cheeked warbler (38,804/1,363,807 x 100). If the 0.4 percent of the habitat identified for take through the Proposed RHCP is added to the estimate of take previously authorized, approximately 3.2 percent of the available species' known breeding habitat will have been authorized for removal. Within Recovery Region 6, the cumulative take totals 6,192 acres (2,506 hectares), or 2.5 percent of all the golden-cheeked warbler breeding habitat in the region (954+5,238/244,106 x 100).

If one were to use the habitat estimates derived from Model C in Diamond (2007), the impacts of the Proposed RHCP would appear to be much lower (see Table 4-8). Compared to the impacts shown in Table 4-7, the amount of cumulative take in Texas would be reduced from 3.2 percent of all golden-cheeked warbler breeding habitat to 1.0 percent. The cumulative take in Recovery Region 6 (6,192 acres) would be reduced from 2.5 percent of all golden-cheeked warbler breeding habitat in the region to 0.8 percent.

For the Reduced Take RHCP alternative, the combined take would equal 2,095 acres plus 38,804 acres, for a total of 40,899 acres (16,551 hectares) of golden-cheeked warbler habitat. This represents 3.0 percent of the species' breeding habitat in Texas (40,899/1,363,807 x 100). The cumulative take in Recovery Region 6 totals 3,038 acres (1,229 hectares), which represents 1.2 percent of all the golden-cheeked warbler breeding habitat in the region (2,095+954/244,106 x 100).

Future actions that are likely to affect golden-cheeked warbler breeding habitat are impossible to predict with any precision. However, within the 35 counties identified as containing golden-cheeked warbler breeding habitat (USFWS 1992), human population growth is expected to increase by approximately 40 percent over the life of the RHCP (Texas State Data Center and Office of the State Demographer 2007). While it is not possible to project how much of this growth will occur in golden-cheeked warbler habitat, a 40 percent increase in population and associated development is likely to result in a cumulative loss of golden-cheeked warbler habitat. Hays County, immediately north of Comal County, is developing an RHCP that will impact golden-cheeked warbler habitat. The expected take of golden-cheeked warbler habitat in Hays County is 9,000 acres (3,642 hectares) or 0.7 percent of the estimated available habitat

(9,000/1,363,807 x 100). Combined with the proposed Comal County RHCP, these two plans will impact 1.1 percent of the remaining available habitat throughout the species range. Bexar County, immediately south of Comal County, is also initiating an RHCP planning process (the Southern Edwards Plateau RHCP); however, no take estimates are available at this time.

Table 4-8. Cumulative impact on golden-cheeked warblers of the Proposed RHCP combined with previously authorized incidental take based on habitat estimates derived by Model C in Diamond 2007.

Golden-cheeked Warbler Habitat in Texas						
Acres of Breeding Habitat in Texas (hectares)[1]	**Acres of Take Requested in Proposed RHCP (hectares)**	**% of Total Habitat in Texas**	**Acres of Previously Authorized Take in Texas (hectares)[2]**	**% of Total Habitat in Texas**	**Acres of RHCP & Previously Authorized Take in Texas (hectares)**	**% of Total Habitat in Texas**
4,378,418 (1,771,883)	5,238 (2,120)	0.1	38,804 (15,703)	0.9	44,042 (17,823)	1.0
Golden-cheeked Warbler Habitat in Recovery Region 6 (RR6)						
Acres of Breeding Habitat in RR6 (hectares)[1]	**Acres of Take Requested in Proposed RHCP (hectares)**	**% of Total Habitat in RR6**	**Acres of Previously Authorized Take in RR6 (hectares**	**% of Total Habitat in RR6**	**Acres of RHCP & Previously Authorized Take in RR6 (hectares)**	**% of Total Habitat in RR6**
769,581 (311,438)	5,238 (2,120)	0.7	954 (386)	0.1	6,192 (2,506)	0.8

[1] Source: Model C in Diamond 2007

[2] Data for previously authorized take were derived from the Service's Southwest Region on-line electronic library (USFWS 2007d). This estimate does not include take requested in the draft Hays County RHCP.

Cumulative Impact Determination. Over the next 30 years and beyond, the projected population growth and concomitant commercial and residential development in the area of analysis could result in some adverse impacts to golden-cheeked warblers. The degree of adverse impacts will depend significantly upon the degree of compliance with the ESA throughout the species' range in Texas. The several large-scale HCPs either recently completed or in the planning stages (Williamson County RHCP, Balcones Canyonlands Conservation Plan, Hays County RHCP, Comal County RHCP, and Southern Edwards Plateau RHCP) together cover the nine most rapidly developing counties within the golden-cheeked warbler's breeding range. These conservation plans provide mechanisms for a higher level of ESA compliance than has been seen in most parts of this area in the past, and lay the foundation for the establishment of several large golden-cheeked warbler preserves all along the southeastern portion of the specie's breeding range. The high visibility of these conservation plans is also expected to encourage additional regional and individual compliance actions for the golden-cheeked warbler. With increased ESA compliance and heightened enforcement by the Service of non-compliance, the cumulative adverse impacts of development on the golden-cheeked warbler should be substantially reduced. In fact, implementation of the conservation measures in either the Proposed RHCP or the Reduced Take RHCP could reduce the cumulative adverse impacts on golden-cheeked warbler habitat, but any reduction would be negligible.

4.9.5 Black-capped Vireo

The area of analysis for the black-capped vireo comprises the 53 counties in Texas identified as containing black-capped vireo breeding habitat (USFWS 2007b). Cumulative impacts to the black-capped vireo are summarized in Table 4-9.

Table 4-9. Cumulative impact on black-capped vireos of the RHCP combined with previously authorized incidental take.

Black-capped Vireo Habitat in Texas						
Acres of Breeding Habitat in Texas (hectares)[1]	**Acres of Take Requested in Proposed RHCP (hectares)**	**% of Total Habitat in Texas**	**Acres of Previously Authorized Take in Texas (hectares)[2]**	**% of Total Habitat in Texas**	**Acres of RHCP & Previously Authorized Take in Texas (hectares)**	**% of Total Habitat in Texas**
1,450,000 (586,794)	1,000 (405)	0.1	7,567 (3,062)	0.5	8,567 (3,467)	0.6
Black-capped Vireo Habitat in Recovery Region (RR)						
Acres of Breeding Habitat in RR (hectares)[1]	**Acres of Take Requested in Proposed RHCP (hectares)**	**% of Total Habitat in RR**	**Acres of Previously Authorized Take in RR (hectares**	**% of Total Habitat in RR**	**Acres of RHCP & Previously Authorized Take in RR (hectares)**	**% of Total Habitat in RR**
678,641 (274,636)	1,000 (405)	0.1	10	0.001	1,010 (409)	0.1

[1] Source: Wilkins et al. 2006. Figures for the recovery region are for the recommended Recovery Region 2 (USFWS 1996b), which is only slightly different from Recovery Region 3 as defined in the Black-capped Vireo Recovery Plan.

[2] Data for previously authorized take were derived from the Service's Southwest Region on-line electronic library (USFWS 2007d). This estimate does not include take requested in the draft Hays County RHCP.

The breeding range of the black-capped vireo in the United States (four percent of the known breeding population resides in Mexico) comprises almost 34 million acres (13,759,611 hectares) of rangeland, including approximately 1,450,000 acres of potential breeding habitat in 53 counties across the species range in Texas (USFWS 2007b). For the black-capped vireo the Service has consulted on 13 separate projects (including the Williamson County RHCP), and through section 7(a)(2), approved the removal of approximately 7,567 acres (3,062 hectares) of occupied or potentially occupied habitat (USFWS 2007d). The impact of past unauthorized take is unknown.

The existing approved impacts to 7,567 acres of potential black-capped vireo habitat plus the impacts to an estimated 1,000 acres of potential habitat for which this RHCP seeks approval totals 8,567 acres (3,467 hectares), or 0.6 percent of black-capped vireo habitat in Texas (Table 4-9). Existing authorized take in Recovery Region 2 totals only 10 acres. Combined with the requested take in the RHCP, the cumulative take (1,010 acres; 409 hectares) represents only 0.1 percent of all the potential black-capped vireo habitat in the region.

Future actions that are likely to affect black-capped vireo breeding habitat are impossible to predict with any precision. However, Hays County, immediately north of Comal County, is developing an RHCP that will impact vireo habitat. The expected impacts to black-capped vireo habitat in Hays County is 1,300 acres (526 hectares) or 0.09 percent of the estimated available habitat (1,300/1,450,000 x 100). Combined with the Comal County RHCP, these two plans will impact 0.16 percent of the remaining available habitat throughout the species range. Bexar County, immediately south of Comal County, is also initiating an RHCP planning process that is likely to include the black-capped vireo (the Southern Edwards Plateau RHCP); however, no take estimates are available at this time.

Cumulative Impact Determination. The cumulative impacts determination is similar to that for the golden-cheeked warbler, however, black-capped vireo habitat is distributed over a wider area that includes slower-growing counties in West Texas and beyond. It is also important to note that the recent status review of the black-capped vireo (USFWS 2007b) found that the population size and distribution of the species is significantly greater today than was thought at the time of the listing. As a result, the Service has recommended that the black-capped vireo be downlisted from endangered to threatened. Even with continued growth in the human population within the range of the black-capped vireo over the life of the Proposed RHCP, the focus on management of the black-capped vireo brought by the original listing, and the long-term habitat preservation that will occur as a requirement of existing HCPs, this RHCP, and future HCPs may assure the long-term viability of this species. In fact, implementation of the conservation measures in the Proposed RHCP could reduce the cumulative adverse impacts on black-capped vireo habitat, but any reduction would be negligible.

4.9.6 Evaluation Species and Other Protected Species

The areas of analysis of the cumulative impact analysis for the Evaluation Species are the upper Guadalupe River for the Cagle's map turtle and Comal County and the adjacent Texas Hill Country for the obligate cave-dwelling species.

Cagle's Map Turtle. Future land development in the upper Guadalupe River watershed and the associated impacts to water resources may lead to a decrease in the quality of Cagle's map turtle habitat and adversely affect the species. Increased demand for water taken directly from the Guadalupe River and from the aquifers that discharge to the river could reduce instream flow. Spring flows (primarily from Comal and San Marco Springs) contribute from 30 to 80 percent of the Guadalupe River's base flow (Guadalupe-Blanco River Authority Undated). Without spring flow, the Guadalupe River would be 30 percent drier during normal times, and up to 80 percent drier during periods of drought. The increased demand for water described in Section 4.9.2, above, may reduce the availability of water for natural ecosystems, including those of the Guadalupe River. Some water protection measures are in place, however. For example, Edwards Aquifer Authority groundwater pumping regulations include measures designed to limit depletion of the Edwards Aquifer and maintain Comal and San Marcos Spring flows. Nothing comparable exists for the Trinity Aquifer, which discharges to the Guadalupe River upstream of Comal and San Marco Springs and contributes groundwater to the Edwards Aquifer, but the groundwater conservation districts in the Hill Country Priority Groundwater Management Area are required to work together to develop and attain desired future conditions for the groundwater

in that management area. Further measures that may help ensure adequate flows in the Guadalupe River to protect the Cagle's map turtle include the eventual establishment of minimum environmental flow standards for the Guadalupe River basin (per Texas Senate Bill 3). Water quality in the river is protected by local, state, and Federal laws and regulations currently in place (see Chapter 3, Section 3.3.3.1). Recent findings of the Service (71 FR 53767) indicate that threats to Cagle's map turtle have been reduced, and the population of the species in the Guadalupe River is increasing.

Obligate Cave-Dwelling Evaluation Species. All eight obligate cave-dwelling evaluation species may be adversely impacted by future land development and subsequent impacts to water resources in Comal County and the adjacent Hill Country (see Section 4.9.2, above). In Comal County alone, water consumption is expected to increase from 29,680 acre-feet in 2010 to 59,710 acre-feet in 2040 (South Central Texas Regional Water Planning Group 2006). By 2040, the water supply in Comal County is projected to fall short of demand by 30,700 acre-feet annually. Increased human demand for water may reduce the availability of water for natural ecosystems, including those of caves and springs. Reduced water flow in the caves, springs, and artesian wells occupied by *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, and *Phreatoceras taylori* is considered the most serious threat to the continued existence of these and similar stygobitic species (TPWD Undated-b). Troglobitic species such as *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa* are particularly vulnerable to the impacts of development, including construction activities, chemical contamination introduced into caves from groundwater and/or surface drainages, destruction of surface habitat, and red imported fire ants that may feed on dead troglobites, cave crickets, and other species within caves (Elliott 1992, USFWS 1994). All these cave-dwelling species will receive some protection from the implementation of the regulations described in Chapter 3, Section 3.3.1.1.

Cumulative Impact Determination. Over the next 30 years and beyond, the projected population growth, land development, and associated impacts to water resources in the areas of analysis may result in adverse impacts to one or more of the Evaluation Species. However, the potential for adverse impacts is reduced by the local, state, and Federal laws and regulations currently in place (see Chapter 3, Section 3.3.3.1).

The same amount of population growth and land development, and the same cumulative impacts, are expected to occur in the areas of analysis whether or not a county-wide incidental take permit is issued for Comal County. Therefore, the act of issuing a county-wide incidental take permit in and of itself would not contribute to the adverse cumulative impacts described above. In fact, implementation of the conservation measures in either the Proposed RHCP or the Reduced Take RHCP could reduce the cumulative adverse impacts on the Evaluation Species, but any reduction would be relatively minor.

4.9.7 Other Protected Species

The area of analysis of the cumulative impact analysis for the Evaluation Species is Comal County and the adjacent Texas Hill Country.

Avian and Terrestrial Protected Species. As described in Section 4.7.1.1, above, no or negligible direct and indirect impacts are expected under any of the alternatives to black bears, jaguarundis, red wolves, American peregrine falcons, arctic peregrine falcons, bald eagles, whooping cranes, zone-tailed hawks, and Texas horned lizards. These species are not likely to occur in Comal County, or they visit only occasionally as migrants, or they are at the edge of their range and unlikely to be encountered. Consequently, these species are dismissed from cumulative impact analysis.

Aquatic Protected Species. The aquatic protected species are the Cascade Caverns salamander, Comal blind salamander, San Marcos salamander, Texas blind salamander, Fountain darter, San Marcos gambusia, Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and Texas wild-rice. Except for the Cascade Caverns and Comal blind salamanders, these species are all known only or primarily from Comal Springs and/or San Marcos Springs. While future land development and subsequent impacts to water resources in Comal County and the adjacent Texas Hill Country would, alone, have the potential to adversely affect these species, numerous water quality and quantity-related laws, rules, regulations, and conservation efforts are in effect or underway that reduce the potential for development activities to adversely affect these species. These laws, rules, regulations, and conservation efforts are described in detail in Section 4.2 of this EIS, and include the EA RIP, the Edwards Aquifer Rules, the City of San Antonio's water quality protection lands program, the City of San Antonio's water quality ordinances, and regulation of Edwards Aquifer pumping by various groundwater conservation districts throughout central Texas and the Hill Country. Specifically, the Edwards Aquifer Authority regulates pumping of groundwater from the Edwards Aquifer specifically to maintain flow in Comal and San Marcos Springs (see Chapter 3, Section 3.3.1.1). These regulations have the potential to protect all the aquatic protected species from the adverse effects of groundwater pumping to meet the projected increase in water demand (see Section 4.9.2, above).

Cumulative Impact Determination. Over the next 30 years and beyond, the projected population growth, land development, and associated impacts to water resources in the area of analysis may result in adverse impacts to one or more of the Other Protected Species. However, the potential for adverse impacts is reduced by the local, state, and Federal laws and regulations currently in place (see Chapter 3, Section 3.3.3.1), and particularly the efforts of the Edwards Aquifer Recovery Implementation Program.

The same amount of population growth and land development, and the same cumulative impacts, are expected to occur in the area of analysis whether or not a county-wide incidental take permit is issued for Comal County. Therefore, the act of issuing a county-wide incidental take permit in and of itself would not contribute to the potential for adverse cumulative impacts described above. In fact, implementation of the conservation measures in either the Proposed RHCP or the Reduced Take RHCP could reduce the cumulative adverse impacts on Other Protected Species, but any reduction would be relatively minor.

4.9.8 Socioeconomic Resources

The scope of the cumulative impact analysis for socioeconomic conditions is the San Antonio MSA, an eight-county area that includes Comal County.

Socioeconomic conditions in the San Antonio MSA are primarily a function of the ability of the area to attract new businesses and residents while sustaining old ones. Factors such as tax rates, availability of trained labor, quality of schools, cultural amenities, social climate, accessibility to transportation corridors and hubs, the physical environment, and a whole host of other circumstances affect and define the socioeconomic dynamics of any community. Local conditions are also strongly influenced by wider regional, state, and national economic factors, as shown by the recent recession that began in the nation's financial sector far from Comal County. Compared to these larger forces, the Proposed RHCP would contribute relatively little to long-term demographic and economic trends in the County. The RHCP participants would enjoy cost and time savings as a result of the RHCP, but these savings are not likely to rise to a level of significance for local and regional economies over the long term. The time savings for permitting take under the Proposed RHCP would likely result in 50 percent of the properties developed over the next 30 years entering the tax base one to two years sooner than without the RHCP, thus accelerating growth of the County's tax base. In addition, creation of preserves under the Proposed RHCP would likely increase the value of adjacent property, further increasing the County's tax base (see Section 4.8.2.3.5); however, these increases are not quantifiable at this time and are likely to be relatively small. Perhaps the longest lasting benefit of the Proposed RHCP would be the preservation of over 6,000 acres (2,428 hectares) of natural woodland habitat, a significant contribution in face of the widespread urbanization of the San Antonio MSA.

Cumulative Impact Determination. When combined with the planned Southern Edwards Plateau (SEP) RHCP, the Proposed RHCP is likely to result in significant beneficial cumulative impacts to socioeconomic conditions in the San Antonio MSA. Of the two plans, the SEP RHCP is expected to have a greater impact on socioeconomic conditions in the San Antonio MSA than the Comal County RHCP, resulting in greater total cost savings and more protected habitat. This is because the SEP RHCP will focus on Bexar County and the City of San Antonio, a far more populous area than Comal County with a much larger economy, and it will cover more listed species than the Comal County RHCP.

4.9.9 Climate Change and Cumulative Impacts

NEPA requires that documents disclose the reasonably foreseeable environmental effects of proposed Federal actions. As early as 1997, the Council on Environmental Quality issued a draft guidance paper indicating climate change was reasonably foreseeable and should be addressed in NEPA documents, especially for long-term Federal actions. And in 2007, in *Massachusetts v. EPA (2007)* 127 S.Ct. 1438, the Supreme Court in a 5 to 4 decision, decided that a state has standing to bring and environmental lawsuit based on climate change effects of a Federal action. This ruling has broad NEPA implications because the Supreme Court recognized that climate change is not speculative, but rather that "the harms associated with climate change are serious and well-recognized" (127 S.Ct. at 1455). For these reasons, climate change is included in this cumulative effects discussion.

The Environmental Protection Agency (1997b) predicts that over the next century, climate in Texas is likely to become warmer, with wider extremes in both temperature and precipitation.

Weather in Texas is already highly variable; it is likely to become more so. Based on projections made by the Intergovernmental Panel on Climate Change and results from the Hadley Centre's climate model (HadCM2), by the year 2100, temperatures in Texas could increase by approximately 3°F in spring and 4°F in other seasons, with variant ranges of 1–9°F (Environmental Protection Agency 1997b). According to the HadCM2 model, precipitation is estimated to decrease by 5–30 percent in winter and increase by about 10 percent in other seasons. Increases in summer could be slightly larger (up to 30%) than in spring and fall. Results from the Canadian Climate Centre model (CGCM1) concur in regard to a projected temperature increase, but predict an increase rather than a decrease in precipitation (Environmental Protection Agency 1997b).

4.9.4.1 Impact of Climate Change on Water, Biological, and Socioeconomic Resources

The following analyses pertain equally to all three alternatives in this EIS.

4.9.4.1.1 Water Resources

The modeling done to date predicts increased temperatures over the long term in central Texas, with more extreme variability likely. For water resources, higher temperatures suggest increased demand for water. More extreme variability may portend more extreme periods of drought, even if the model that predicts an overall increase in precipitation proves to be correct. Even without a change in climate, for much of central Texas, including Comal County, water planners predict that existing water supplies will be insufficient to meet demand over the next 30 years (see Section 4.9.1.1, above). The stresses on water resources already projected would be exacerbated if the average temperature increases, precipitation decreases, and droughts become more extreme. If precipitation increases over the long term, the stresses on water resources may be reduced, although periods of severe droughts are still likely.

4.9.4.1.2 Biological Resources

In general, when regions slowly warm, as is currently happening in many parts of the world, plant and animal communities shift northward (in the Northern Hemisphere) or to a higher elevation, following the temperature gradient. Of course, suitable habitat for any given species consists of many variables, not all of them governed by temperature (e.g., soil type, topography, availability of water, etc.). A species distribution will shift and its abundance will vary in response to the availability of all its habitat requirements. If all habitat requirements are no longer available due to climate change, a species may become extinct.

Over the long term, if temperatures increase and precipitation decreases, some biotic communities in the Balcones Canyonlands ecoregion, including Comal County, may gradually come to resemble those of the more arid ecoregions to the west: the Edwards Plateau Woodlands or even the Semiarid Edwards Plateau. The landscape may become more open, with less dense canopy cover. Live oak woodland may eventually be restricted to north- and east-facing slopes and floodplains, with drier slopes covered with open shrublands of juniper, sumac, acacia, and honey mesquite. If precipitation increases, however, vegetation communities may become more luxuriant.

The distribution and abundance of wildlife species will respond to whatever conditions prevail. Reduced precipitation and increasingly severe periods of drought, combined with increased human demands on water supplies, increase the likelihood of decreased groundwater levels, reduced springflow, and reduced instream flow in streams and rivers. If this were to happen, species that depend on wet caves, springs and rivers and streams would be adversely affected. These species include all of the Evaluation Species in the Proposed RHCP: Cagle's map turtle, *Palaemonetes holthuisi*, *Seborgia hershleri*, *Texiweckelia relicta*, *Phreatoceras taylori*, *Rhadine insolita*, *Texella brevidenta*, *Cicurina puentecilla*, and *C. reclusa*. More arid conditions would also likely have adverse impacts on state-listed aquatic species (Cascade Caverns salamander and Comal blind salamander) and federally listed aquatic species (Peck's cave amphipod, Comal Springs dryopid beetle, Comal Springs riffle beetle, and fountain darter). If precipitation increases, however, adverse cumulative impacts on aquatic species may be reduced.

Many birds are considered to be particularly vulnerable to global warming and associated climate change, because habitat composition shifts due to the global climatic changes (Both and Visser 2001). Price and Glick (2002) predict that birds which rely on very specific habitat for at least part of their life cycle, such as the endangered golden-cheeked warbler, have the potential of becoming extinct if their habitat disappears. A study of North American warbler species (including the golden-cheeked warbler) has found that the range of occurrence has shifted significantly farther north in the past 24 years, by an average of more than 65 miles; although none were found to be shifted farther south (Price and Root 2001). This trend has serious implications for the already endangered golden-cheeked warbler. The Environmental Protection Agency (EPA; 2009) recently developed a tool for evaluating species vulnerability to climate change and used the golden-cheeked warbler as one of several species for a test application of the tool. In general, the EPA found that the southern end of the golden-cheeked warbler's range is likely to become drier and less suitable and, thus, conservation in the central and more northerly portions of the range may be particularly important. In general, Comal County benefits from a relative abundance of surface water and groundwater, and it is believed that some of the higher quality habitats located within the County will be more resilient to the effects of climate change than similar habitats currently existing south and southwest of Comal County within the species range. If global warming and associated climate change contributes to hotter, drier conditions in the region, as some models project, the species could disappear (Van Riper et al. 1997). The Environmental Protection Agency (1997b) predicts that, combined with human encroachment, the trend of warmer and possibly drier conditions could reduce critical habitat in the Balcones Canyonlands National Wildlife Refuge and further stress endangered golden-cheeked warbler population, as well as the black-capped vireo inhabiting the Texas Hill Country.

While future climate change in Texas may adversely affect the resources analyzed in this EIS, the RHCP action alternatives are not expected to contribute cumulatively to such effects should they occur. Because the action alternatives, in their own right, would not result in adverse impacts any greater than those expected under No Action, they would not contribute to adverse cumulative impacts to a greater degree than would No Action.

4.9.4.1.3 Socioeconomic Resources

The potential effects of climate change on socioeconomic condition in Comal County and the San Antonio MSA are most likely connected to impacts on water availability. If the region becomes more arid and water availability is significantly reduced, both population and economic growth are likely to be adversely affected.

4.10 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are effects that cannot be avoided due to constraints in alternatives. These effects do not have to be avoided by the planning agency, but they must be disclosed, discussed, and mitigated, if possible (40 CFR § 1500.2(e)). It is not always possible to avoid adverse impacts from implementation of an alternative.

Since development in Comal County would continue as trends predict, all three alternatives discussed in this EIS would result in unavoidable adverse impacts that would include loss of vegetation, wildlife, and endangered species habitat in Comal County, as well as adverse impacts to water resources. Under the RHCP action alternatives, conservation measures for the Covered Species should minimize lost habitat for those species and associated vegetation communities and wildlife. Unavoidable adverse impacts would be offset by the preservation of larger blocks of unfragmented habitat (at least 500 acres in each preserve) than would occur under the No Action alternative. As a result, both action alternatives would result in some offset of unavoidable impacts.

4.11 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA regulations at 40 CFR § 1502.16 require that the discussion of environmental consequences include ". . . any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented." An irreversible commitment of resources may be defined as the loss of future options. It applies primarily to non-renewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity.

Irretrievable commitments represent the loss of production, harvest, or use of renewable resources. These opportunities are foregone for the period of the Proposed Action or its alternatives, during which other resource utilization cannot be realized. These decisions are reversible, but the utilization opportunities foregone are irretrievable.

Under all alternatives, the loss of potential Covered Species habitat in Comal County would result in irreversible potential habitat loss for both the golden-cheeked warbler and the black capped vireo. However, under the RHCP action alternatives, the mitigation lands would help preserve large, unfragmented blocks of habitat for these species. Under both RHCP action alternatives, the commitment and funding by the County for acquisition and permanent

management of mitigation properties would be irreversible. The commitment and funding of mitigation and monitoring activities for the duration of the Permit would be irretrievable.

4.12 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

NEPA requires consideration of the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity (40 CFR § 1502.16). Short-term uses are generally those that determine the present quality of life for the public. The quality of life for future generations depends on long-term productivity; the capability of the environment to provide on a sustainable basis.

All three alternatives would result in a long-term decrease in habitat for the Covered Species in Comal County because of human development; however, both RHCP action alternatives, especially the Proposed RHCP, are expected to conserve suitable habitat for these species in the long term, particularly through the acquisition and management of suitable species habitat in the County in perpetuity.

CHAPTER 5 — PREPARERS AND PUBLIC PARTICIPATION

5.1 PREPARERS AND CONTRIBUTORS

U.S. Fish and Wildlife Service

Name	Role	Education	Years Experience
Bill Seawell	Project Manager	B.S., Wildlife Management M.S., Fisheries Management	42

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Name	Role	Education	Years Experience
Alan Glen	Review and comment regarding legal sufficiency	A.B., Economics J.D.	25
Rebecca Barho	Review and comment regarding legal sufficiency	B.A., Journalism J.D.	3
J.B. Ruhl	Review and comment regarding legal sufficiency	B.A., Economics Ph.D., Geography J.D. L.L.M., Environmental Law	27

SWCA Environmental Consultants

Name	Role or Area of Expertise	Education	Years Experience
Gary Galbraith	Project Manager	B.S., Wildlife and Fisheries Sciences	25
Steven Carothers	Ecology, ESA Consultation	B.S., Biology M.S., Biology Ph.D., Zoology	40
Dorothy House	NEPA, Technical Writing	B.A., Social Sciences M.A., Librarianship	15
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Christine Westerman	Hydrology, Biology	B.S., Biology M.S., Range Science	21
Palani Whiting	Biology	B.A., Animal Conservation M.S., Environmental Science	8
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Clint King	Biology	B.S., Ecology Evolution and Behavior	4
Glenn Dunno	GIS, Graphics	B.S., Applied Geography M.S., Applied Geography	17
Lindsey Doubleday	Document Production	High School Diploma	5

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Name	Role	Education	Years Experience
Paula Gruber	Financial Plan	B.A., Liberal Arts	22
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Texas Perspectives, Inc.

Name	Role	Education	Years Experience
Travis James	Socioeconomics	B.A., Economics B.S., Computer Science MBA, Business	14
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Charles Heimsath	Socioeconomics	B.S., Economics M.S., Community and Regional Planning	27

5.2 PUBLIC PARTICIPATION

5.2.1 Public Scoping

"Scoping," both public and internal, is the process conducted by the agency preparing the EIS to determine the scope of the EIS; that is, identify the range of actions, alternatives, and impacts to be considered in the EIS (40 CFR § 1508.25). Scoping for the Comal County RHCP EIS began on October 16, 2008, with publication of a Notice of Intent (NOI) to prepare this EIS in the *Federal Register* (73 FR 61433). The NOI described the proposed Federal action and the purpose and need for action, and announced a public scoping meeting that was held December 4, 2008, in New Braunfels, Texas. In addition to the *Federal Register* notice, Comal County issued a press release to media outlets announcing initiation of the RHCP EIS process, informing the public of the public meeting date and venue, soliciting written comments by letter, and providing contact information for Service and County personnel. That information was also posted on the Comal County Web site.

Seven people attended the public scoping meeting, which consisted of an open house and brief presentations by representatives from the County and the Service. Everyone attending the meeting was encouraged to ask questions or provide comments. Blank comment cards were provided, and all proceedings, including oral comments, were recorded by a court reporter. A transcript of the proceedings is included in the Service's administrative record for this EIS process.

The official scoping period extended from October 16 to December 15, 2008. During that time, one unique comment document was received (from the League of Women Voters of Comal

Area). Additionally, oral comments were received at the public scoping meeting from two individuals.

5.2.2 DRAFT ENVIRONMENTAL IMPACT STATEMENT RECIPIENTS

Copies of the DEIS have been distributed to the following Federal, state, and local agencies, public libraries, and Comal County Regional Habitat Conservation Plan Citizens Advisory Committee and Biological Advisory Team members for public review.

Federal Government Agencies

Department of the Interior
Natural Resources Library
Office of Environmental Policy and Compliance

Southwest Regional Office
U.S. Fish and Wildlife Service

Field Supervisor
Austin Ecological Field Services
U.S. Fish and Wildlife Service

Division of Policy and Directives Management
U.S. Fish and Wildlife Service

Office of Federal Activities
U.S. Environmental Protection Agency, DC

Region 6 Office
U.S. Environmental Protection Agency, TX

State Government Agencies

Texas Parks and Wildlife Department
Terry Turney

Local Government Agencies

Comal County Commissioners Court
Danny Scheel, County Judge
Donna Eccleston, Pct. 1
Jay Millikin, Pct. 2
Gregory Parker, Pct. 3
Jan Kennady, Pct. 4

Local Libraries

Bulverde/Spring Branch Public Library
New Braunfels Public Library
Tye Preston Memorial Library

Comal County RHCP Committee Members

Citizens Advisory Committee

Ben Appleby
Curtis Bremer
Linda Laack
Carroll Lindeman
Roy Linnartz
Jensie Madden
Judy Myers
Mike Norris
Jack Ohlrich
Alan Stahlman
Cathy Talcott
Terry Turney
David Welsch
Travis Wuest, Chairman

Biological Advisory Team

John Baccus
Michael Barrett
Clay Green
Hal Herbelin
Randy Simpson
Terry Turney, Chairman
Sandra West

5.2.3 Public Review of the Draft RHCP and DEIS

On June 3, 2010, the Service announced the availability of the Draft Comal County RHCP and Draft Environmental Impact Statement (DEIS). Written public comments on both documents were accepted by the Service up to the end of the business day on September 1, 2010. Written and oral comments were also welcomed at a public hearing held on July 27, 2010, at the Comal County Commissioners Court in New Braunfels, Texas. A total of five comment documents were received from five individuals and two organizations, as well as two letters from the Environmental Protection Agency (which reviews all EISs for compliance with Federal regulations). A summary table listing the substantive comments received, and the responses to those comments, is provided in Appendix A. Copies of the letters and e-mails received are provided in Appendix B, and a transcript of the public hearing is provided in Appendix C.

GLOSSARY OF TERMS AND ABBREVIATIONS

Aquifer: Rocks or sediments, such as cavernous limestone and unconsolidated sand, that store, conduct, and yield water in significant quantities for human use.

Area of Potential Effect: For the EIS impact analyses, the area within which potential impacts are measured and evaluated.

Balcones Canyonlands National Wildlife Refuge: Located in Travis and Burnet Counties north of Lake Travis. The primary purpose of the refuge is to conserve the nesting habitat of the endangered golden-cheeked warbler and black-capped vireo. The Balcones Canyonlands National Wildlife Refuge is planned to include 46,000 acres (18,615 hectares) within an 80,000-acre (32,375-hectare) "acquisition boundary." Current holdings total approximately 21,400 acres (8,660 hectares).

Balcones Canyonlands Conservation Plan: The regional habitat conservation plan covering western Travis County. The Balcones Canyonlands Conservation Plan calls for the creation of a preserve system to protect eight endangered species as well as 27 other species believed to be at risk. The Balcones Canyonlands Conservation Plan was approved by the Service in 1996 and has a 30-year term. It allows for incidental take outside of proposed preserve lands, and provides mitigation for new public schools, roads and infrastructure projects of the participating agencies (Travis County, the City of Austin, and the Lower Colorado River Authority). Landowners and developers may elect to participate in the Balcones Canyonlands Conservation Plan to obtain ESA take authorization rather than by seeking authorization directly from the Service.

Biological Advisory Team: Three or more professional biologists retained to provide guidance for the RHCP, especially with respect to the calculation of harm to the endangered species and the size and configuration of the habitat preserves. The Texas Parks and Wildlife Code § 83.015(c) requires a Biological Advisory Team for RHCPs and specifies that at least one member shall be appointed by the Texas Parks and Wildlife Commission and one by landowner members of the Citizens Advisory Committee. The members of the Biological Advisory Team for this RHCP are experts on the species covered by the RHCP.

Biological opinion: The Service document issued at the conclusion of formal consultation pursuant to section 7(a)(2) of the ESA that generally includes: 1) the opinion of the Fish and Wildlife Service as to whether or not a Federal action is likely to jeopardize the continued existence of listed species, or result in the destruction or adverse modification of designated critical habitat; 2) a summary of the information on which the opinion is based; and 3) a detailed discussion of the effects of the action on listed species or designated critical habitat (50 CFR §§ 402.02, 402.14(h)).

Candidate species: Under U.S. Fish and Wildlife's ESA regulations, "...those species for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposal rules have not yet been issued because this action is precluded..." (see 61 FR 7598).

Citizens Advisory Committee: Texas Parks and Wildlife Code § 83.016 requires that plan participants appoint a Citizens Advisory Committee to assist in preparing the RHCP and application for the Federal permit. The state law requires that at least 4 members, or 33 percent, of the Citizens Advisory Committee, whichever is greater, must own undeveloped land or land in agricultural use in the RHCP area. The law also specifies that a landowner member may not be an employee or elected official of a plan participant or any other governmental entity and that the Texas Parks and Wildlife Commission shall appoint one voting representative to the Citizens Advisory Committee.

CEQ: *See Council on Environmental Quality*

CFR: *See Code of Federal Regulations*

Code of Federal Regulations (CFR): A compilation of the general and permanent rules of the executive departments and agencies of the Federal Government as published in the *Federal Register*. The code is divided into 50 titles that represent broad areas subject to Federal regulation.

Conservation plan: *See habitat conservation plan*

Consultation: A process that: 1) determines whether a proposed Federal action is likely to jeopardize the continued existence of a listed species or destroy or adversely modify designated critical habitat; 2) begins with a Federal agency's written request and submittal of a complete initiation packet; and 3) concludes with the issuance of a biological opinion and incidental take statement by the Service. If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required (except when the Service concurs, in writing, that a proposed action "is not likely to adversely affect" listed species or designated critical habitat). In the context of an HCP, the consultation is an "intra-service" consultation within the pertinent Service departments (50 CFR §§ 402.02, 402.14).

Council on Environmental Quality (CEQ): A three-member council created by Title II of NEPA in the Executive Office of the President, responsible for advisory, reporting, and policy analysis functions.

DEIS: Draft Environmental Impact Statement; *see Environmental Impact Statement*

Delist: To remove a species from the Federal list of endangered and threatened species (50 CFR §§ 17.11, 17.12) because the species no longer meets any of the five listing factors provided under section 4(a)(1) of the Endangered Species Act and under which the species was originally listed (i.e., because the species has become extinct or is recovered).

Downlist: To reclassify an endangered species to a threatened species based on alleviation of any of the five listing factors provided under section 4(a)(1) of the Endangered Species Act (16 USC § 1533(a)(1)).

EIS: *See Environmental Impact Statement*

Endangered species: "Any species [including subspecies or qualifying distinct population segment] which is in danger of extinction throughout all or a significant portion of its range" (section 3(6) of the Endangered Species Act, 16 USC § 1532(6)).

Endangered Species Act of 1973, as amended (ESA): 16 USC §§ 1513–1543; Federal legislation that provides means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, and provides a program for the conservation of such endangered and threatened species.

Endemic: Being native and restricted to a particular geographic region.

Environmental Impact Statement (EIS): A detailed written statement required by section 102(2)(C) of the National Environmental Policy Act containing, among other things, an analyses of environmental impacts of a proposed action and alternatives considered, adverse effects of the project that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance and enhancement of long-term productivity, and any irreversible and irretrievable commitment of resources (40 CFR §§ 1508.11, 1502).

EPA: Environmental Protection Agency

ESA: *See Endangered Species Act of 1973, as amended*

Fault: Fracture in bedrock along which one side has moved with respect to the other.

Federally listed: Included in the list of endangered or threatened species maintained by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service under section 4 of the Endangered Species Act, and therefore protected by the Act.

HCP: *See Habitat conservation plan*

Habitat: The location where a particular taxon of plant or animal lives and its surroundings, both living and non-living; the term includes the presence of a group of particular environmental conditions surrounding an organism including air, water, soil, mineral elements, moisture, temperature, and topography.

Habitat conservation plan (HCP): Under section 10(a)(2)(A) of the Endangered Species Act, a planning document that is a mandatory component of an incidental take permit application, also known as a "section 10(a)" or "HCP."

Harm: Defined in regulations promulgated by the Department of the Interior to implement the Endangered Species Act as an act "which actually kills or injures" listed wildlife. Harm may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 CFR § 17.3 (2005)).

Harass: An intentional or negligent act or omission which creates the likelihood of injury to wildlife 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).

Impervious cover: Land cover that prevents rain from infiltrating into soil, including roofs and pavement.

Incidental take: Take of any federally listed wildlife species that is incidental to, but not the purpose of, otherwise lawful activities (see definition for "take") (Endangered Species Act section 10(a)(1)(B)).

Incidental take permit: A permit that exempts a permittee from the take prohibition of section 9 of the Endangered Species Act issued by the Service pursuant to section 10(a)(1)(B) of the Endangered Species Act. Also sometimes referred to as a "section 10(a)(1)(B) permit."

Karst: A terrain characterized by landforms and subsurface features, such as sinkholes and caves, that are produced by solution of bedrock. Karst areas commonly have few surface streams; most water moves through cavities underground.

Karst feature: Generally, a geologic feature formed directly or indirectly by solution, including caves; often used to describe features that are not large enough to be considered caves, but have some probable relation to subsurface drainage or groundwater movement. These features typically include but are not limited to sinkholes, enlarged fractures, noncavernous springs and seeps, soil pipes, and solution cavities in the epikarst (the highly solutioned zone in karst areas between the land surface and the predominantly unweathered bedrock).

Listed species: Species listed as either endangered or threatened under section 4 of the Endangered Species Act (16 USC § 1533).

Mitigation: Under National Environmental Quality Act regulations, to moderate, reduce or alleviate the impacts of a proposed activity, including: 1) avoiding the impact by not taking a certain action or parts of an action; 2) minimizing impacts by limiting the degree or magnitude of the action; 3) rectifying the impact by repairing, rehabilitating or restoring the affected environment; 4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or 5) compensating for the impact by replacing or providing substitute resources or environments (40 CFR § 1508.20). Under the Endangered Species Act, the applicant must demonstrate that the applicant would, to the maximum extent practicable, undertake to minimize and mitigate the impacts of take of species. According to the HCP Handbook, typical mitigation actions under HCP and incidental take permits include the following: 1) avoiding the impact (to the extent practicable); 2) minimizing the impact; 3) rectifying the impact; 4) reducing or eliminating the impact over time; or 5) compensating for the impact.

MSA: Metropolitan Statistical Area

National Environmental Policy Act (NEPA): Federal legislation establishing national policy that environmental impacts would be evaluated as an integral part of any major Federal action. Requires the preparation of an Environmental Impact Statement for all major Federal actions significantly affecting the quality of the human environment (42 USC §§ 4321–4327).

NEPA: *See National Environmental Policy Act*

NMFS: National Marine Fisheries Service

NOI: *See Notice of Intent*

Notice of Intent: Formal notice in the *Federal Register* to initiate the NEPA process (required for Environmental Impact Statements).

NPDES: National Pollution Discharge Elimination System (for discharge of pollutants or contaminated water to waters of the U.S.). NPDES or federally authorized state (see TPDES) permits are required for facilities and activities that discharge waste into surface waters from a confined pipe or channel.

RHCP participant: Any non-Federal party desiring to undertake activities covered by the RHCP, who agrees to comply with the terms and conditions of the RHCP.

Proposed Action: Under National Environmental Policy Act regulations, a plan that has a goal which contains sufficient details about the intended actions to be taken or that would result, to allow alternatives to be developed and its environmental impacts to be analyzed (40 CFR §1508.23).

Recharge: Natural or artificially-induced flow of surface water to an aquifer.

Recovery plan: Section 4(f) of the Endangered Species Act, 16 USC § 1533(f), requires that the Service develop and implement recovery plans for the conservation and survival of listed species, unless the Service finds that such a plan would not promote the conservation of the species. Recovery plans are required to include (1) a description of site-specific management actions necessary to achieve the plan's goal for conservation and survival of the species, (2) objective, measurable criteria which, when met, would result in the species' removal from the list, and (3) estimates of the time and cost required to achieve the recovery goals. The Service has developed recovery plans for the karst species, golden-cheeked warbler, and black-capped vireo (USFWS 1994, USFWS 1992, and USFWS 1991, respectively).

Regional habitat conservation plan (RHCP): An RHCP typically covers a large geographic area, numerous landowners, and multiple species. Local or regional authorities or entities are often the applicant and permittee, and may be relied upon to implement the mitigation plan under an RHCP (see HCP).

RHCP: *See regional habitat conservation plan*

Runoff: Water from precipitation or irrigation that flows over the ground surface and returns to streams or other water bodies. It can collect pollutants from the air or land and carry them to the receiving waters.

Section 7: The section of the Endangered Species Act that describes the responsibilities of Federal agencies in conserving threatened and endangered species. Section 7(a)(1) requires all Federal agencies "in consultation with and with the assistance of the Secretary [to] utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species." Section 7(a)(2) requires Federal agencies to "ensure that any action authorized, funded, or carried out by such agency...is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of..." designated critical habitat.

Section 9: The section of the Endangered Species Act dealing with prohibited acts, including the take of any listed species without specific authorization of the Service.

Section 10: The section of the Endangered Species Act dealing with exceptions to the prohibitions of section 9 of the Endangered Species Act.

Section 10(a)(1)(B): That portion of section 10 of the Endangered Species Act that authorizes the Service to issue permits for the incidental take of threatened or endangered species.

Sensitive Feature: Permeable geologic or human-made feature located on the Edwards Aquifer Recharge Zone or Transition Zone where a potential for hydraulic interconnectedness between the surface and the Edwards Aquifer exists, and rapid infiltration to the subsurface may occur.

Service: United States Fish and Wildlife Service

Stygobite: An obligate aquatic species of subterranean waters with troglomorphic adaptations, an aquatic equivalent of a (terrestrial) troglobite.

Surface water: Any water, temporary or permanent, which is above the ground surface, observable with the unaided eye.

SWCA: SWCA Environmental Consultants

Take: Under section 3(18) of the Endangered Species Act, "...to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" with respect to federally listed endangered species of wildlife. Federal regulations provide the same taking prohibitions for threatened wildlife species (50 CFR § 17.31(a)).

TCEQ: Texas Commission on Environmental Quality

TDS: total dissolved solids

Threatened species: "Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (Endangered Species Act § 3 (20), 16 USC § 1532(20)].

TPDES: Texas Pollution Discharge Elimination System. Texas' state water quality program authorized by the EPA in September 1998; it has Federal regulatory authority over discharges of pollutants to Texas surface waters.

Troglobite: A obligate cave-dwelling organism (i.e., is unable to live outside the cave environment). Usually defined as an obligate species with troglomorphic adaptations. The term is usually restricted to terrestrial species

Troglomorphic adaptations: Adaptations to the cave environment, particularly for species living in the dark zone; e.g., lengthening of appendages; loss of pigment; modification of eyes; modified olfactory sensory organs (for "sniffing" out prey and mates, etc.); extra sensory structures (e.g., elongated legs used as feelers); and reduced metabolic rate.

Trogloxenes: Species that have adapted to the cave environment sufficiently that they complete part of their life cycle in cave, but must return to the surface to feed and thus retain adaptations for surface life.

USC: United States Code

USFWS: United States Fish and Wildlife Service

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APPENDIX A

Summary Table of Public Comments and Responses
Draft Comal County Regional Habitat Conservation Plan and
Draft Environmental Impact Statement

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Appendix A

Public Comments Received and Responses
Draft Comal County Regional Habitat Conservation Plan and
Draft Environmental Impact Statement

Table 1. Public comments received during the 90-day public comment period, June 3 through September 1, 2010.

Date	Commenter	Summary of Comment	Response to Comment
July 7, 2010	United States Environmental Protection Agency, Region 6	Based on the information provided for the project, we have determined that the project, as proposed, should not have an adverse effect on the quality of the ground water underlying the project site.	Thank you for your comment
July 27, 2010	United States Environmental Protection Agency, Region 6	EPA classified your DEIS and proposed action as "LO," i.e., EPA has "Lack of Objections". ...EPA encourages holistic efforts such as the RHCP/EIS, which is a more positive approach compared to "piecemealing" individual take permits in Environmental Assessments. Piecemealing could potentially have long-term, negative cumulative impacts to the species and the environment.	Thank you for your comment
July 27, 2010	Deanna Frisk, President, League of Women Voters of Comal Area	The League of Women Voters of Comal Area supports the proposed Comal County Regional Habitat Conservation Plan, known as "Alternative B" in the Environmental Impact Statement. We believe that the proposed plan meets the criteria agreed upon by our members.	Thank you for your comment

Date	Commenter	Summary of Comment	Response to Comment
July 27, 2010	Rittler Strachan	I wonder who is going to make [the cumulative adverse impacts] evaluations? I hope it's not going to be TxDOT. This is a kind of thinly-veiled position they're trying to take to hurry up all the endangered species studies and trying to sell this toll road [Outer Loop 281]. When they take that outer loop off the master transportation plan, then this might be a great idea. It really might. I mean, I would really support it.	The RHCP is being developed to benefit Comal County as a whole and aid in the preservation of the golden-cheeked warbler and black-capped vireo by establishing preserves and encouraging compliance with the Endangered Species Act (ESA) within the County. It is not being developed specifically for the proposed Outer Loop. Potential impacts will be verified on a case-by-case basis with on-site habitat assessments conducted according to Texas Parks and Wildlife Department (TPWD) standards. Species presence/absence surveys will comply with U.S. Fish and Wildlife Service (Service) protocols. All assessments and surveys will be performed by Service-permitted biologists. The mitigation (that is, mitigation ratio) for take will be determined by RHCP staff and approved by the Service based on the biologists' findings.
July 27, 2010	Name withheld at the request of the commenter	1 500 acre areas are insufficient preserve size areas for viable GC Warbler/BC Vireo bird habitat. The effect of edges on even immensely larger (thousands) of acres present significant destruction and harm.	1. Edge effects (increased predation and nest parasitism) may occur in any patch of habitat no matter the size of that patch. Large patches with a relatively low ratio of perimeter-to-area are likely to support more birds than smaller patches with a higher perimeter-to-area ratio, all other variables being equal. Golden-cheeked warblers are known to nest and fledge young in patches as small as 11 acres (see RHCP Section 2.2.1.1). 500 acres of good warbler habitat are expected to constitute a suitable preserve size for the species.
		2. Buffers will be insufficient. Buffers in each road and subdivision must be required by the plan.	2. If the RHCP called for habitat to be set aside at each project site, buffers between that habitat and the development would likely be appropriate. However, site-by-site mitigation would result in small, isolated patches of habitat scattered throughout the County. The RHCP is designed to avoid that by providing mitigation in the form of large preserves.
		3. By Year 6, plan more acquisition.	3. The RHCP provides for acquisition of land at a rate that is expected to be financially feasible for the County. There is nothing preventing the County from acquiring land at a faster rate, should it have the funds to do so.
		4. Do not mitigate by only allowing conservation bank credit purchases for other counties.	4. As stated in Section 4.1.1.2 of the RHCP, the primary method of creating mitigation credits under the RHCP is creation of in-county preserves for the benefit of the golden-cheeked warbler and black-capped vireo. The conservation credits generated by those in-county preserves will be available for purchase as mitigation by RHCP participants.

Date	Commenter	Summary of Comment	Response to Comment

	Name withheld at the request of the commenter, continued	5. The mitigation land would be too small.	5. The mitigation amounts set forth in the RHCP were determined pursuant to several years of coordination between the County, the Service, a citizens' advisory committee, and a biological advisory team. A representative of the Texas Parks and Wildlife Department sat on both the citizens advisory committee and the biological advisory team. As set forth in the RHCP, the County may not authorize impacts under the RHCP that exceed the amount stipulated in the permit, nor may the County authorize take that is not adequately mitigated by credits created by establishment of in-county preserves that have been approved by the Service.
		6. Public Education component needs development.	6. The public education component will be developed after the RHCP is approved.
		7. Put funds into cowbird traps, hire a good biologist dedicated to this area conservation district to coordinate with FWS and County.	7. At this time, the RHCP does not specify setting up cowbird traps on preserve lands, but that may be considered in the future if it is deemed appropriate by the County and the Service. The County will employ a Service-permitted biologist to conduct habitat assessments and surveys.
September 1, 2010	Tim and Sharlene Fey	1. If the RHCP was in place, would the quarry companies [IN PRECINCT 202 AND ADJACENT PRECINCT] just keep expanding, and at an even quicker pace, by paying the participation fees?	1. Development of all types, including quarrying, is likely to proceed whether or not the RHCP is implemented. One of the purposes of the RHCP is to provide an avenue for compliance with the ESA while setting aside Hill Country habitat that probably would not otherwise be preserved. The alternative is likely to be development as it was done in the past, which has not resulted in the preservation of open space and endangered species habitat in the County.
		2. Would any consideration be given to the already vast damage in this area in hopes of preserving some habitat in this immediate vicinity, or would the credits be used to purchase land elsewhere? We would hope that the precincts and local areas would have a voice in identifying possible land purchases that would help the immediate vicinity.	2. Preserve lands will be selected based on habitat conditions, size of tract, and land availability. A potential preserve property would typically contain a minimum 500 acres of high-quality golden-cheeked warbler habitat; however, acquisition of preserve land may be in smaller parcels if the subject acquisition is contiguous to an existing conservation area that has been established for the benefit of the golden-cheeked warbler, or if the Service approves establishment of smaller preserves on a case-by-case basis. Recommendations from citizens about potential preserve properties will be welcome.

Date	Commenter	Summary of Comment	Response to Comment
	Tim and Sharlene Fey, continued	3. Would the Administrator for the RHCP be elected or appointed? Would the Administrator be held accountable to the citizens on a precinct by precinct basis? Would the Administrator be held accountable to the U.S. Fish and Wildlife Service? Would the program be administered on a fair and equitable basis throughout the county? Would the Precincts have any say in the program?	3. The Administrator for the RHCP will be appointed by the Comal County Commissioners Court and be accountable to the citizens of the County via their elected representatives on the Court. The Service will provide oversight to the County and will be involved in the determination of mitigation ratios for specific projects and will monitor the RHCP by means of an annual report prepared and submitted by the RHCP Administrator.
		4. Some of the numbers presented at the July 27, 2010 meeting were not very convincing, i.e., the beneficial impacts were in the "minor" category. How can this program be cost justified?	4. The RHCP is expected to result in preservation of at least 6,548 acres of golden-cheeked and black-capped vireo habitat in the County, primarily in large tracts. Acquisition and management of that amount of open space in perpetuity necessarily entails cost. County officials believe the benefits to the endangered species and to the citizens of Comal County justify the cost.
		5. There seems to be discord among Comal County citizens on many, many issues. The RHCP would be added to this list and present opportunities for even more conflicts. Why add on to the list of issues? If only three other counties in Texas have this type of plan, perhaps it would be prudent to evaluate a bit longer. Please do not rush into the RHCP. Perhaps special meetings in each Precinct would be helpful.	5. ESA compliance and the continuing loss of wooded open space in the county are already issues facing citizens of the County. The RHCP is a systematic way of addressing those issues. The proposed plan has been carefully considered for several years, and was developed in large part with federal grant monies. The County and the Service received input from a Citizens Advisory Committee, which was appointed by Commissioners Court, as well as a Biological Advisory Team, which included at least one member selected by landowner representatives from the Citizens Advisory Committee. Every meeting of the Citizens Advisory Committee and Biological Advisory Team were open to the public. In addition, the public was invited to provide input during a 60-day scoping period in 2008 and again in a 90-day comment period ending 1 September 2010. Public meetings were held during both comment periods. The level of public response during the comment periods does not suggest that the RHCP is a controversial issue with the residents of Comal County and that additional meetings are not warranted.
		6. one of the benefits stated was that it would relieve the burden and time-consuming permitting process for developers. If developers (and quarries) are devastating the habitat, why offer them relief? Wouldn't it be better to incur the necessary time to make sure things are done for the right purpose (saving the habitat) rather than facilitating quicker development.	6. Rather than offering relief to project opponents, the RHCP offers an efficient mechanism for complying with the ESA that is designed to encourage a higher rate of compliance than might be the case if the only alternatives were a costly, time-consuming process or no compliance at all.

Table 2. Public comments received after the close of the 90-day public comment period.

Date	Commenter	Summary of Comment	Response to Comment
September 2, 2010	Annalisa Peace, Executive Director, Tom Hayes, Science Director, Greater Edwards Aquifer Alliance	1. The lack of accurate baseline measures of habitat for the focal species [golden-cheeked warbler, GCWA], and the resultant inability to reasonably estimate impacts (take) and mitigation, fatally flaw the HCP and EIS process. SWCA found only 5,501 ha (13,594 ac) of prime GCWA habitat (80–100% canopy) in Comal County, while GEAA, using Model C (Diamond, 2007; as updated for loss 2001–08) found 31,049 ha (76,722 ac) of prime GCWA habitat (80–100 % canopy) in the county, or 564.4% more than reported by SWCA in the HCP. Much of the SWCA analysis may be subjective and relatively low-tech, especially during their initial screening of woodland density, Ashe juniper and deciduous tree density, tree size, habitat patch size, and land use at local and landscape scale. The actual methods of these and other aspects of the SWCA analysis, however, are not presented in either the draft HCP or EIS documents.	1. First, use of the Diamond Model C is not a requirement for developing HCPs in golden-cheeked warbler habitat, nor has this model been demonstrated to result in more "accurate" estimates of habitat. To date, very few on-site habitat evaluations, and even fewer bird surveys, have been conducted in Comal County – or even rangewide; consequently, all estimates of warbler habitat must be based on theoretical modeling. The RHCP and EIS disclose the fact that other models, including the Diamond model, exist for estimating the amount of golden-cheeked warbler habitat. All such models rely on remote sensing images, knowledge of warbler habitat preferences, and assumptions about how to interpret as habitat what is seen in the images. These assumptions vary widely and none have been statistically validated by rigorous ground-truthing studies. Compared to the Diamond Model C, the modeling used by SWCA takes a conservative approach and results in estimates far closer to those upon which the listing of the golden-cheeked warbler was based. If the Diamond model is indeed accurate, as this commenter maintains, much more suitable warbler habitat (and hence a much higher population of warblers) exists in Texas than thought at the time of listing. Assuming an abundance of suitable warbler habitat reduces the urgency for preserving that habitat. This could be detrimental to the species if the model overestimates the amount of actual habitat. Thus, the model used in the RHCP errs (if it errs at all) on the side of conserving the species. We note that the most recent study (A&M 2010) estimates based on habitat modeling and extensive ground truthing a population of male singing golden-cheeked warblers in excess of 200,000. Second, the choice of models is of no real consequence. The requested permit allows a set amount of incidental take (5,238 acres). For every project covered by the permit, both take and mitigation will be assessed by a Service-permitted biologist based on an on-site habitat evaluation, and, at least for the first several years of the plan, that assessment will be reviewed by the Service. No modeling or maps based on modeling will be used for this purpose. If it turns out that there is more demand for participation in the RHCP than predicted, and 5,238 acres of take was an underestimate, then the County is free to apply for an amendment to the permit to increase the amount of take and mitigation for the RHCP. Should this happen, additional NEPA evaluation would be considered at that time. As for disclosing the amount of potential adverse impact to warbler habitat, the EIS is accurate. The amount of impact cannot exceed the amount of permitted take; i.e., 5,238 acres. If, as the commenter contends, the total amount of prime warbler habitat in the County is 564.4% more than that estimated in the RHCP, then the percentage of habitat represented by the permitted take would be far less. Again, the approach used in the EIS is conservative and errs, if it errs at all, on the side of the species by potentially overestimating rather than underestimating adverse impacts.

Date	Commenter	Summary of Comment	Response to Comment
	Annalisa Peace, Executive Director, Tom Hayes, Science Director, Greater Edwards Aquifer Alliance, continued	2. A detailed analysis of listed karst invertebrates is well warranted, but not included. This oversight is problematic, given the documented occurrence of nine federally endangered species of karst invertebrates in Bexar County immediately south of Comal County. We suggest that the exclusion of these species might be addressed by including Comal County in the HCP for listed Karst Invertebrates that will be submitted for the Southern Edwards Plateau region.	2. Peck's cave amphipod, Comal Springs riffle beetle, and Comal Springs dryopid beetle, all listed aquatic invertebrates, were not included in the RHCP for reasons explained at length in Section 1.1.1.2 of the draft RHCP. No other listed karst invertebrate species are known from Comal County, thus it would not be possible to estimate their location or abundance within the County, and consequently, it would not be possible to reasonably estimate potential take, which is a basic requirement for inclusion in an HCP. Likewise, it would be impossible to judge at what point impacts to these species, if, in fact, they occur at all in Comal County, would rise to the prohibited level of jeopardizing their continued existence. Indeed, the biological advisory team for the Southern Edwards Plateau Habitat Conservation Plan mentioned by the commenter has suggested that several of the known listed karst species within Bexar County cannot be covered because of their limited known distribution. Based on this rationale, it would appear impossible to cover a species not even known to occur within Comal County. The complete absence of biological information is a fatal flaw. Even were these species to occur in Comal County, the RHCP does not authorize any take. It should be remembered that regardless of whether or not a federally listed species occurring in Comal County is covered by the RHCP, that species is still protected under the Endangered Species Act . No one, including an RHCP participant, may cause direct or indirect harm to such a species without being in violation of section 9 of the Act. With respect to the possibility of including Comal County in the Southern Edwards Plateau Habitat Conservation Plan, it should be noted that Comal County is, in fact, within the proposed plan area for that plan, and that a representative of Comal County sits on the citizens advisory committee of the proposed Southern Edwards Plateau Habitat Conservation Plan.
		3. The Comal County HCP/EIS documents' failure to consider all listed (karst inverts) and other rare species potentially existing within Comal County is of great concern in regard to the adequacy of the analysis of potential impacts underlying the proposed issuance of an incidental take permit to Comal County for implementation of the HCP.	3. Potential impacts to all listed karst invertebrates known from Comal County, other rare species, and wildlife in general are analyzed in Sections 4.4 through 4.7 of the DEIS. There is no requirement that the developer of an HCP include all listed or rare species occurring within the plan area. There are no known listed terrestrial karst invertebrates within Comal County, and the documents do analyze potential impacts to listed aquatic invertebrates occurring within Comal County. We note that the EPA commented that implementation of the Comal County RHCP should not have an adverse effect on the quality of groundwater underlying the project site.

Date	Commenter	Summary of Comment	Response to Comment
	Annalisa Peace, Executive Director, Tom Hayes, Science Director, Greater Edwards Aquifer Alliance, continued	4. Without accurate baseline information [for the GCWA, see Comment 1 above], the HCP legal requirement simply cannot be met for *ensuring the survival of and contributing to the recovery of covered species*.	4. See the response to this commenter's Comment 1, above. In addition, we note that the A&M 2010 study estimates a population of male singing golden-cheeked warblers in excess of 200,000. This indicates a total population of warblers well in excess of an order of magnitude greater than previous recovery standards. By the commenters' own application of the Diamond model, Comal County contains 76,722 acres of prime warbler habitat. The Comal County RHCP seeks to authorize impacts to a mere 5,238 acres of habitat of varying quality. A suggestion that this plan could jeopardize the survival and recovery of the warbler is simply not credible.
		5. The HCP and EIS final drafts fail to adhere to regulatory requirements. The HCP and EIS do not provide adequate documentation to assure that the taking of covered species will be minimized and mitigated to the maximum extent practicable.	5. Service guidance with respect to the "maximum extent practicable" standard provides as follows: "To the extent that the minimization and mitigation program can be demonstrated to provide substantial benefits to the species, less emphasis can be placed on the second factor [maximum practicable]." In this case, the RHCP utilizes minimization and mitigation measures adopted by the Service across a wide range of HCPs covering the warbler. It is not necessary that every dollar available be expended towards minimization and mitigation where the plan otherwise adequately offsets impacts to the species. Among the minimization measures contained in the RHCP are the following: • Clearing activities in, or within 300 feet of, Covered Species habitat would be conducted only during the time of year when the species are not present, unless a breeding season survey indicates that no Covered Species are present within 300 feet of the desired activity. Construction activities within, or within 300 feet of, Covered Species habitat may be conducted during the time of year when either species are present, as long as such construction follows permitted clearing conducted outside the relevant Covered Species' breeding season in a reasonably prompt and expeditious manner indicating a continuous activity. Among the mitigation measures contained in the RHCP are the following: • For the golden-cheeked warbler, establish an estimated 6,548 acres of preserve(s)/conservation bank(s) in the County. • For the black-capped vireo, acquire credits from a Service-approved conservation bank; acquire, preserve, and manage in perpetuity black-capped vireo habitat; and acknowledge black-capped vireo conservation bank credits owned by an applicant. • Fund and manage research $10,000/yr for a cumulative cost of $429,309. • Fund and manage public awareness programs $5,000/yr for a cumulative cost of $214,655. • Establish a total endowment of $16,500,000 by end of Year 30. Together, these two sets of measures are consistent with what the Service has accepted in HCPs covering the warbler over the last several years.

Date	Commenter	Summary of Comment	Response to Comment
	Annalisa Peace, Executive Director, Tom Hayes, Science Director, Greater Edwards Aquifer Alliance, continued	6. How the HCP will ensure survival of and contribute to recovery of covered species is not sufficiently specified, including trend analyses and statistically vigorous extrapolations.	6. The commenter appears to assume that the HCP must ensure survival and contribute to recovery of the covered species. This is not the case. There is no legal requirement for a showing that an HCP will, in fact, contribute to recovery of the listed species. While the applicant believes strongly that this RHCP will, in fact, contribute to the recovery of the covered species, it is not required to demonstrate that to be the case through trend analyses or otherwise. The RHCP documentation does demonstrate that implementation of the RHCP resulting in the loss of 5,238 acres of warbler habitat of varying quality in exchange for the conservation of large preserves of greater size will not jeopardize the continued existence of the warbler, a species whose breeding habitat exceeds a million acres and whose population may be as high as 440,000 individuals.
		7. The HCP implementation funding is neither specified nor guaranteed, as required. Furthermore, no upfront funding source to initiate preserve acquisition is identified.	7. The funding chapter of the RHCP includes a reference to a reserve of several million dollars available to the County for early acquisition of habitat for preserves. More importantly, however, funding is, in a sense, assured in that no take would be authorized for any covered species unless and until adequate mitigation has previously been secured with review and approval of the Service to offset that taking in accordance with the terms of the plan. This structure means that funding is, by definition, assured, or no take will be authorized.
		8. The EIS does not sufficiently assess all significant environmental effects. The HCP Handbook emphasizes that the impact analysis in an EIS must evaluate all significant effects on the environment, such as air quality, water quality, cultural resources, and land use patterns, in addition to impacts to species.	8. As explained in Sections 3.2.1 and 3.2.2 of the DEIS, all identifiable impacts with any potential for rising to the level of significance were analyzed in the DEIS. Neither NEPA nor the HCP Handbook require detailed analysis of insignificant impacts or detailed treatment of resources for which no causal relationship can be reasonably established between such resources and the proposed action or alternative actions addressed in the EIS. It is worth noting that the EPA, which is charged with reviewing the adequacy of information and public disclosure in all EISs, did not find the RHCP DEIS inadequate in either regard (letter dated July 27, 2010, from Cathy Gilmore, Chief, Office of Planning and Coordination, EPA, to Adam Zerrenner, Field Supervisor, USFWS) . Ultimately, this plan is modest in scope, allowing for the loss of a few thousand acres of potential warbler habitat. The Service has granted similar levels of impact to the warbler with preparation of only an environmental assessment or less (e.g., Barton Creek community, Travis County, Texas). Similarly, in a single biological opinion in Bexar County, the Service authorized the loss of 5,000 acres of warbler habitat within Camp Bullis over a five-year period. This amounts to the loss of half of the habitat within that military installation. It is inconceivable that the loss of 5,000 contiguous acres of habitat within Camp Bullis does not jeopardize the continued existence of the warbler, but that the loss of a similar amount of habitat across all of Comal County over a period of 30 years could conceivably do so.