

Draft
Environmental Impact
Statement for the Town of
Marana
Habitat Conservation Plan
March 2009

Prepared for

U.S. Fish and Wildlife Service
Department of the Interior



and

Town of Marana



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Draft
Environmental Impact Statement
for the
Town of Marana Habitat Conservation Plan
March 2009

Prepared for

Prepared by



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ABSTRACT

The U.S. Fish and Wildlife Service (Service) is considering issuance of an Incidental Take Permit (ITP) pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA) to the Town of Marana (Town). The ITP would authorize the incidental take of species protected by the ESA associated with the Town's capital improvement projects (CIP) and discretionary activities, and implementation of a Habitat Conservation Plan (HCP). The species addressed in the Section 10(a)(1)(B) ITP application include western burrowing owl, cactus ferruginous pygmy-owl, southwestern willow flycatcher, western yellow-billed cuckoo, lesser long-nosed bat, Merriam's mesquite mouse, pale Townsend's big-eared bat, ground snake, Mexican garter snake, Sonoran desert tortoise, Tucson shovel-nosed snake, lowland leopard frog, and talus snail. If the permit is approved, the Town will implement an HCP in fulfillment of requirements of the ESA. The HCP provides measures to avoid, minimize, and mitigate, to the maximum extent practicable, the impacts of the Town's activities on covered species and their habitat and ensure that any take of covered species will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

The Service is issuing this Draft Environmental Impact Statement (DEIS) to evaluate the potential impacts associated with implementation of the HCP and issuance of a Section 10(a)(1)(B) ITP, and to evaluate alternatives. Three alternatives are considered in this DEIS, including a No Action Alternative (Alternative A). The Service-preferred alternative is the issuance of an ITP associated with the Town's CIP and discretionary action activities (Alternative C) and the HCP involving measures to minimize and mitigate the incidental take of covered species. A third alternative, Alternative B, includes the Town's CIP activities and those opting for voluntary inclusion in the HCP and is included for comparison to the other alternatives. The consequences of these actions on various resources are discussed in this DEIS.

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Chapter 1.0 Introduction

1.1 Background

The Town of Marana (Town) in Pima County, Arizona contains unique natural resource values within much of its undeveloped lands. Some of the most notable are the ironwood-dominated Arizona Upland and xeroriparian plant communities along the bajadas (fans) and slopes of the Tortolita Mountains and along portions of the Santa Cruz River Corridor (Figure 1.1 in Appendix A). The Town recognizes that the quality of life of its citizens is dependent upon an integrated environment that balances the needs of listed species and their habitats with human needs.

The Town has been one of the fastest growing communities in Arizona and recognizes the need to provide a solid economic base and desirable quality of life for its citizens. Given the Town's rapid growth rate and desire to develop its economic interests, the Town leaders have acknowledged the need to balance economic, environmental, and human interests by implementing a community-wide conservation planning effort. The overall goals of this conservation planning effort are to:

- identify appropriate regulatory mechanisms to best conserve these Federal, State Trust, county, and private lands over the long term; provide for regional economic objectives including the orderly and efficient development of certain private and State Trust Lands and associated public and private infrastructure;
- contribute to regional conservation planning efforts in Pima County; and
- facilitate compliance with the Endangered Species Act (ESA) Section 10(a)(1)(B) permit (aka Incidental Take Permit [ITP]) requirements.

1.2 Organization of This Draft Environmental Impact Statement

The remainder of Chapter 1 discusses the purpose and need for this document and the regulatory context for the proposed action. Chapter 2 summarizes the proposed action and presents the alternatives evaluated in this Draft Environmental Impact Statement (DEIS). The affected environment for each resource area is described in Chapter 3, and the environmental consequences and cumulative impacts are described in Chapter 4. The remaining chapters include a list of references (Chapter 5), a list of preparers and contributors (Chapter 6), and a glossary of terms and acronyms (Chapter 7). This DEIS is being prepared for the Town of Marana Draft Habitat Conservation Plan (HCP). All

figures referenced in the document are located in Appendix A. The full text of the Town of Marana Draft HCP is incorporated as Appendix B into this document.

1.3 Purpose and Need for Action

This Environmental Impact Statement (EIS) is being prepared to respond to the Town's application to the U.S. Fish and Wildlife Service (Service) for an ITP for the proposed covered species related to activities that have the potential to result in the 'take'¹ of species listed pursuant to the ESA. The purpose of the HCP process and subsequent issuance of an ITP is to authorize the incidental take of threatened or endangered species, not to authorize the underlying activities that result in take.

An HCP may also include conservation measures for candidate species, proposed species, and other species not listed under the ESA at the time an HCP is developed or an ITP application is submitted. This can benefit the permittee by ensuring that the terms of an HCP will not change over time with subsequent species listings. It can also provide early protection for many species, ideally prevent subsequent declines, and in some cases the need to list such species.

The Town's proposed HCP identifies methods to mitigate, to the maximum extent practicable, the anticipated effects of the activities covered by the ITP while striving to balance the protection and conservation of the Town's unique natural resources with on-going economic development and urbanization. The HCP seeks to protect and conserve the species covered by the ITP as well as their habitats for the continuing benefit of the people of the United States and to provide means to conserve the ecosystems depended on by the covered species. The intent of the HCP is to ensure the long-term survival of the covered species through protection and management of the species and their habitats as well as to ensure compliance with the ESA, National Environmental Policy, and other applicable laws and regulations.

The need for this action is based on the potential that activities proposed, permitted, or otherwise allowed by the Town on lands owned and/or under its jurisdiction could result in the take of covered species, thus requiring an ITP. The proposed permit would allow approved incidental take that is consistent with the conservation guidelines in the Town's HCP.

¹ 'Take' is defined in the ESA to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." This is discussed further in Section 1.4.

1.4 Endangered Species Act, Sections 9 & 10

The ESA is intended to provide a means for protecting and conserving species listed as either endangered or threatened, and for conserving the ecosystems upon which listed species depend. To be protected under the ESA, a species must be listed by the Service as endangered or threatened. A species is considered endangered if it is determined to be in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is found that the species is likely to become endangered within the foreseeable future.

Section 9 of the ESA prohibits the take of an endangered species. Section 10 of the ESA allows the Service to issue an ITP to a non-Federal entity for incidental take of a Federally listed species, where “incidental take” is defined as take that is “incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.”

Permit issuance criteria prescribed in 50 Code of Federal Regulations (CFR) 17.22(b)(2), 50 CFR 17.32(b)(2) and Section 10(a)(2)(B) of the ESA State:

- The taking must be incidental.
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.
- The applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided.
- The taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild.
- Other measures may be required as necessary or appropriate for the purposes of the HCP.

An HCP submitted in support of a Section 10 permit application must specify:

- The impact that will likely result from the taking.
- Steps the applicant will take to monitor, minimize, and mitigate such impacts; the funding available to implement such steps; and the procedures to be used to deal with unforeseen circumstances.
- Alternative actions to such taking considered by the applicant and the reasons why such alternatives are not proposed to be used.
- Other measures that may be required as necessary or appropriate for the purposes of the plan.

The Service believes that the biological goals and objectives should be consistent with recovery but in a manner that is commensurate with the scope of the HCP. Under section 10 of the ESA, the Service does not explicitly require an HCP to recover listed species or contribute to the recovery objectives outlined in a recovery plan, but also does not intend to permit activities that preclude recovery. This approach reflects the intent of the section 10(a)(1)(B) incidental take permit process to provide for authorization of incidental take, not to mandate recovery (65 *Federal Register* [FR] 35243).

1.5 Endangered Species Act, Section 7

Issuance of an ITP is a Federal action subject to Section 7 of the ESA. Section 7(a)(2) requires all Federal agencies, in consultation with the Service, to ensure that any action “authorized, funded, or carried out” by an agency is “not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification” of critical habitat. Although the provisions of Section 7 and Section 10 are similar, Section 7 and its regulations require several considerations in the HCP process, including an analysis of indirect effects, effects on Federally-listed plants, and effects on critical habitat. The results of the Section 7 consultation are documented in Biological Opinions developed by the Service. A Biological Opinion is generally produced near the end of the ESA permitting process to document conclusions regarding the likelihood of jeopardizing the continued existence of, or adversely modifying designated critical habitat for, any listed species.

1.6 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is one of the primary laws governing the environmental protection process. It is a decision-making requirement that applies to proposals for Federal actions. The Council on Environmental Quality regulations define “major Federal action” as an action with “effects that may be major and which are potentially subject to Federal control and responsibility” including “projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by Federal agencies.” NEPA states that any Federal agency undertaking a “major Federal action” likely to “significantly affect the human environment” must prepare an EIS. An EIS must provide a “detailed statement” of the environmental impacts of the action, possible alternatives, and measures to mitigate adverse effects of the proposed actions. While NEPA does not mandate any particular result, it requires the agency to follow particular procedures in its decision-making process. The purpose of these procedures is to ensure that the agency has the best possible information to make an “intelligent, optimally beneficial decision” and to ensure that the public is fully apprized of any environmental risks that may be associated with the preferred action.

Issuance of an ITP under Section 10(a)(1)(B) is a Federal action subject to NEPA compliance. Although ESA and NEPA requirements overlap considerably, the scope of NEPA goes beyond that of the ESA by considering the impacts of a Federal action not only on fish and wildlife resources, but also on other resources such as water quality, socioeconomics, air quality, and cultural resources. The EIS process culminates in issuance of a Record of Decision (ROD). The ROD documents the alternative selected for implementation as well as any conditions that may be required, and summarizes the impacts expected to result from the action.

1.7 Proposed Federal Action

The Federal action requested by the Town is the issuance by the Service of an ITP for listed and sensitive species in the Town boundaries pursuant to Section 10(a)(1)(B) of the ESA. The Town has developed and will implement an HCP as required by Section 10(a)(2)(A) of the ESA. The HCP will provide measures to minimize and mitigate the effects of the taking on listed and sensitive species and their habitats.

The biological goal of the HCP is to “avoid, minimize, and/or mitigate the impacts on specified species that could occur as a result of planned urban development and associated capital improvement projects (CIPs) expected to occur within the Town over the next 25 years.”

Activities proposed for coverage under the proposed ITP include lawful activities that would occur consistent with the Town's General Plan and include, but are not limited to, maintenance and operation of Town facilities, infrastructure and open-space system, implementation of CIPs, and issuance of discretionary land-use related permits, including those for residential and commercial development.

The Town proposes an ITP for 13 vulnerable species (Table 1.1) that would be protected within the proposed Permit Area, which includes approximately 67,987 hectares (ha) (168,000 acres [ac]) of land within the Town boundaries. The 13 species proposed for coverage include two Federally listed species, the lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*) and southwestern willow flycatcher (*Empidonax traillii extimus*). In addition, the Town will seek to address and cover the yellow-billed cuckoo (*Coccyzus americanus* spp. *occidentalis*) and Mexican garter snake (*Thamnophis eques megalops*), which are candidates for listing. The Town is also seeking to address and cover additional rare and/or sensitive species that occur within the HCP planning area, including the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), lowland leopard frog (*Rana yavapaiensis*), talus snail (*Sonorella* spp.), Tucson shovel-nosed snake (*Chionactis occipitalis klauberi*), ground snake (*Sonora semiannulata*), Sonoran desert tortoise (*Gopherus agassizii*), Merriam's mesquite mouse (*Peromyscus merriami*), burrowing owl (*Athene cunicularia*), and the pale Townsend's big-eared bat

(*Corynorhinus townsendii*). These non-listed species were selected for coverage under the HCP based on the criteria that they were likely to occur within the Town boundaries, likely to be impacted by activities covered under the HCP, and likely to be listed as threatened or endangered in the future. The rare and/or sensitive species proposed for coverage under the HCP included in Table 1.1 will be considered as if they were Federally-listed and will be automatically permitted for incidental take should they be listed as Federally threatened or endangered species during the term of the ITP. Numerous other listed and sensitive species for which the Town of Marana is not seeking permit coverage will also benefit from the conservation measures provided in the HCP through protection of similar or overlapping habitat conditions and ecosystem functions.

**TABLE 1.1
 SPECIES PROPOSED FOR ITP COVERAGE**

Common Name	Scientific Name	Federal Status
Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuena</i>	Endangered
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered, MTBA
Yellow-billed cuckoo	<i>Coccyzus americanus</i> spp. <i>Occidentalis</i>	Candidate, MTBA*
Mexican garter snake	<i>Thamnophis eques megalops</i>	Candidate
Cactus ferruginous pygmy-owl	<i>Glaucidium brasilianum cactorum</i>	Petitioned, MBTA*
Lowland leopard frog	<i>Rana yavapaiensis</i>	-
Talus snail	<i>Sonorella</i> spp.	-
Tucson shovel-nosed snake	<i>Chionactis occipitalis klauberi</i>	Petitioned
Ground snake	<i>Sonora semiannulata</i>	-
Sonoran desert tortoise	<i>Gopherus agassizii</i>	Petitioned
Merriam's mesquite mouse	<i>Peromyscus merriami</i>	-
Burrowing owl	<i>Athene cunicularia</i>	MBTA*
Pale Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	-

* MTBA = Migratory Bird Treaty Act

1.8 Environmental Review Process

1.8.1 Process Steps

The EIS process began with internal and interagency discussions to address key components of alternatives, to develop the level of detail for impact and cumulative analysis, and to prepare the DEIS framework and schedule. Public input was solicited during a 60-day public scoping period. Three public scoping meetings were also conducted to provide general information to interested parties and to solicit input on issues and concerns related to the HCP planning process and its potential environmental effects (Section 1.8.2—Scoping). Written and verbal comments received

during the public scoping period were used to identify the issues of concern addressed in this DEIS. Three public meetings are scheduled for April 2, 15, and 16, 2009, after the DEIS and HCP are made available to the public through a *Federal Register* notice.

Following the public review period, a Final EIS (FEIS) will be prepared. The FEIS will be an edited version of the DEIS, based primarily on input received during the public comment period. The FEIS will also include a summary of the public process, and all comment letters and responses. Upon its completion, the FEIS will be distributed for a 30-day review period, which will be announced through the same venues used for the DEIS.

After the FEIS review period has been completed, the Service will conduct a review of the FEIS to evaluate project alternatives and to make a permit decision on the proposed action. The final decision-making process and analysis will be disclosed in an ESA Section 10—Findings document and a NEPA ROD.

1.8.2 Scoping

The Service's formal scoping process began on June 21, 2007 with the publication of a *Notice of Intent to Prepare an Environmental Impact Statement; Announcement of Public Scoping Meeting and Request for Comments* in the 72 FR 34271. The notice provided information on the project and EIS process and schedule, and announced the dates, times, and locations of three public scoping meetings (July 9, 11, and 24, 2007). The scoping meetings were conducted to provide general information to interested parties and to solicit input on issues and concerns related to the HCP planning process and its potential environmental effects. A total of 28 people attended the scoping meetings.

Fifteen written comment forms were received from the public during the scoping meetings. In addition, three comment letters were received by U.S. mail. Because many of the comment forms addressed multiple issues, a total of 68 individual comments were identified. The scoping process identified a variety of issues associated with the proposed action, including:

- Air Quality
- Compliance with Authorizing Legislation
- Coordination with Other Jurisdictions
- Projects and Studies
- Cultural Resources
- Definition of Alternatives

- Implementation of HCP
- Land Use and Management
- Public Health and Safety
- Public Outreach and Involvement
- Socioeconomic Impacts
- Species' Biology and Habitat
- Water Resources

A complete discussion of the scoping process, comments received, and issues identified are presented in the Scoping Report for this project, included as Appendix C.

1.9 Public Involvement

The Town initiated its conservation planning process in December 2002 and has included elements of public involvement throughout the process since that time. This has included a series of open public meetings that are planned to continue through ITP issuance. Meeting notices, schedules, agendas, and minutes are also posted on the Town's website for the HCP (<http://www.marana.com/index.asp?nid=193>).

The Town has encouraged public involvement in scientific studies as well. One example of this is the *Bats and Hummingbird Feeders Study* (Arizona Game and Fish Department [AZGFD] Unpublished data) conducted in 2007 and 2008. This study is a collaborative effort between the Town, the Service, AZGFD, Arizona–Sonora Desert Museum, and volunteer citizen–scientists in the western Tucson Basin. Data collected from this study will be used to better understand the lesser long-nosed bat, a species listed as endangered under the ESA, and will be used by both the Town and the City of Tucson in development of their HCPs.

Volunteers who have signed up to participate in this study input their data by either printing out hard copies of data forms and turning them in at the end of the field season or inputting the data on the Town's website throughout the field season. Information and instructions on how to gather and report data are located on a web-link on the Town's website.

1.9.1 Advisory Groups

The Town established both a Stakeholder Working Group (SWG) and a Technical Biology Team (TBT) to guide the HCP's development. These two advisory groups have

been instrumental in the planning process. They have provided both invaluable technical input and perspective on how the Town HCP fits in with other regional conservation plans and objectives. Members of both groups were invited to participate by Town management staff and serve under the direction of the Town Manager's office. Members of the TBT and the SWG are listed in Chapter 6—List of Preparers and Contributors. All TBT and SWG meetings are open to the public.

1.9.1.1 Stakeholder Working Group

For the SWG, the Town sought to gather a diverse group of stakeholders who would provide varied perspectives on the conservation strategies and ultimate implementation of the HCP. The stated purpose of the SWG, as written in its charter is that group members:

share a common interest in balancing the biological integrity of natural ecosystems with economic development interests through regional conservation planning. Efforts to coordinate conservation actions among local, State and Federal agencies, organizations and private landowners are well established in Pima County. The Marana regional planning effort seeks to continue coordination among interested parties and to establish a framework for collaborative conservation planning within the planning area.

1.9.1.2 Technical Biology Team

For the TBT, the Town sought to gather a group of people with relevant technical backgrounds, including expertise in specific endangered species, hydrology, herpetology, landscape and reserve design, biology, ecology, geology and geomorphology, and riparian ecosystems of southern Arizona. At the request of the Town and the TBT, other biological scientists have also provided their expertise and collected detailed Town-specific data on species, such as the Tucson shovel-nosed snake, the cactus ferruginous pygmy owl, the lesser long-nosed bat, and other species proposed for coverage by the HCP. This additional expertise, knowledge base, and field survey data have contributed to the HCP being developed with the "best available science."

The stated purpose of the TBT, as written in its charter is:

to bring the best available science to bear on the development of conservation recommendations that will assist the SWG with attaining the goals they have established for the Town of Marana Habitat Conservation Planning project. Specifically, these recommendations will provide the SWG, Town of Marana and other jurisdictions, at their discretion, with the technical information to assist with the development of a Habitat Conservation Plan, and other appropriate land use policies.

1.10 Relationships to other Plans, Regulations, and Laws

Many Federal and State statutes, regulations, and policies govern the activities proposed for ITP coverage under the Town's HCP. The major Federal and State permits and regulatory consultation procedures that may be required as a result of any of the proposed alternatives are summarized below.

1.10.1 Federal Regulatory Context

Development of the Draft HCP and related DEIS are regulated primarily by the ESA and NEPA, as described in Section 1.3—Purpose and Need for Action. All other Federal regulatory requirements would still be in effect and other Federal permits and consultations that may be required over the term of the proposed ITP are summarized below.

The Service would conduct a programmatic consultation with the United States Army Corps of Engineers (Corps) and the Federal Highway Administration to evaluate the range of covered activities included in the HCP that have a nexus to these Federal agencies. The Service would also consult separately with the Bureau of Reclamation (BOR) and the Federal Aviation Administration to review the proposed BOR Regional Park and airport infrastructure improvement activities. Through this process, the Town and landowners participating in the HCP would be covered for any Section 7 regulatory requirements related to covered activities.

1.10.1.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA), as amended (Service Memo February 9, 1996), prohibits the take of any migratory bird or any part, nest, or egg of any such bird. This act applies to all persons and organizations in the United States, including the Service. While Section 10 of the ESA allows the Service to grant a permit that allows the incidental take of endangered species, none of the regulations promulgated under the MBTA expressly provide for permits for incidental take.

In order to allow incidental take of ESA-listed migratory birds when such incidental take has been judged permissible under the ESA and to remove the threat of prosecution under the MBTA, the Service recognizes an ITP to concurrently serve as a Special Purpose Permit under 50 C.F.R. § 21.27. This Special Purpose Permit allows the take of migratory species in the amount and/or number and subject to the terms and conditions specified in the ITP. Any such take would not be in violation of the MBTA. Take of migratory birds not included in the ITP as a result of a project alternative evaluated in this DEIS would require consultation with the Service.

1.10.1.2 Section 404, Clean Water Act

The Corps requires project applicants to obtain a Clean Water Act of 1972 (CWA) Section 404 permit, if a proposed action would result in the discharge of dredged or fill material into waters of the United States, including wetlands. Authorization would have to be obtained from the Corps if implementation of any of the covered activities would require dredging or placement of fill in waters of the United States.

1.10.1.3 Section 401, Clean Water Act

Section 401 of the CWA requires Federal agencies to ensure that their proposed actions, including issuance of a permit, do not violate State water quality standards. In Arizona, the Arizona Department of Environmental Quality (ADEQ) is responsible for determining if an action meets State water quality standards and is eligible for water quality certification. Consideration of a Section 404 permit is an action that requires evaluation for water quality certification. If a Section 404 permit is required to implement any of the covered activities, water quality certification under Section 401 would also be required.

1.10.1.4 Section 106, National Historic Preservation Act

The National Historic Preservation Act of 1966 (as amended) and its implementing regulations (36 CFR 800) require Federal agencies to consider impacts to cultural resources before undertaking actions. If cultural resources meet certain criteria, they are considered historic properties eligible for inclusion in the National Register of Historic Places (NRHP). If a proposed project would alter or impact the characteristics for which the resources are eligible, measures must be developed and implemented to minimize or mitigate the impacts. Implementation of the project alternatives described in this DEIS may require review in accordance with the Town's Cultural Resource Ordinance (Title 20) and consultation with the Arizona State Historic Preservation Officer (SHPO) prior to implementation as described in section 3.9—Cultural and Historic Resources

The Service will meet its obligations under Section 106 of the National Historic Preservation Act through the Town's existing Cultural Resource Ordinance and through a Programmatic Agreement with the Arizona SHPO. The Programmatic Agreement will facilitate consultation required under Section 106 as applied to the covered activities listed in the HCP.

1.10.2 State and Local Regulatory Context

All applicable State and Town regulatory requirements for implementation of the project alternatives would be in effect. Major State and local policies are summarized below.

1.10.2.1 Arizona Private Property Rights Protection Act

In November 2006, Arizona voted to adopt the Private Property Rights Protection Act (PPRPA), commonly known as Proposition 207, one of the strongest property rights protections in the nation. It was designed to counter the two biggest perceived threats to private property rights, eminent domain abuse and regulatory takings. Within the context of the HCP, the regulatory takings component is most pertinent.

The PPRPA requires governments to compensate landowners when new land use regulations reduce the fair market value of their properties. The PPRPA exempts several categories of regulations from its provisions: (1) public health and safety regulations; (2) regulations that address historically recognized public nuisances; (3) regulations to limit pornography, liquor sales, and other adult-oriented businesses; (4) laws that establish locations for utility facilities; (5) regulations adopted to fulfill a Federal requirement; and (6) all pre-Proposition 207 land use laws (Arizona Revised Statutes Title 12, Chapter 8, Article 2.1). Given that regulatory takings frequently occur in conjunction with zoning regulations covering development on agricultural land or open space, the issue is especially important in rural communities like the Town of Marana.

While some of the Conservation Measures of the Draft HCP include revising and updating portions of the Town's existing Land Development Code (LDC), the Town would retain the authority to apply conditions to discretionary actions on a case-by-case basis. If the revisions to the Town's LDC are not passed by the Town Council, the Town will develop Policy Guidance Documents to ensure full and consistent application of HCP conservation measures. Non-discretionary actions may also be included in HCP and covered by the ITP through voluntary inclusion.

In early 2007, the League of Arizona Cities and Towns began encouraging its member governments to require property owners seeking a rezoning or conditional use permit to sign waivers agreeing not to seek future PPRPA claims for the action requested. Many cities and counties have begun to adopt waiver requirements as a precondition to rezoning and permit approval; the Town is confining its approach to asking the property owners to sign waivers stating that they will not to sue the city for taking the specific action requested.

1.10.2.2 Growing Smarter Act and Growing Smarter Plus

In 1998, the Arizona Legislature passed the Growing Smarter Act, which clarified and strengthened planning elements in the required general plans of municipalities and counties and added four new elements, namely: Open Space, Growth Areas, Environmental Planning, and Cost of Development. The act also placed Proposition 303 on the 1998 ballot, which provided \$20 million per year for 11 years to match funds invested by communities and others in the purchase of State Trust lands for open space and in providing incentives for State and Federal land lessees to maintain open space and wildlife habitat.

Growing Smarter Plus was enacted in 2000 and includes, among other things, a requirement for larger and fast-growing cities to obtain voter approval of their general plans at least once every 10 years and to include a water resources element in their plans. It also requires the establishment of a development rights program to purchase, lease, or transfer development rights of private lands.

1.10.2.3 Arizona State Land Department Planning Goals

Future land use within the Town will also need to consider requirements of the Arizona State Land Department (ASLD). Formed in 1915, the ASLD was established to manage the Land Trust, conduct sales of property, and maximize revenues to support Arizona schools. All uses of the land must benefit the Trust, a fact that distinguishes it from the way that other public lands, such as parks or national forests, may be used. While public use of State Trust Land is not prohibited, it is regulated to ensure protection of the land and to provide reimbursement to the beneficiaries for its use. Because approximately 60 percent of the undeveloped land within the Town is State Trust Land, future development in the Town will be significantly affected by the disposition of those land areas. Currently, ASLD is developing land-use concepts for its land holdings in the Tortolita fan area. No plans are yet available for public or Town review.

1.10.2.4 Town of Marana General Plan

The Town of Marana General Plan (TOM 2007a) is the primary tool in coordinating issues that must be considered in community planning. Town managers and decision makers refer to the General Plan for administrative, financial, and regulatory policy, and for direction to staff and property owners about acceptable development practices. The 2007 General Plan elements include Land Use, Circulation, Growth Areas, Public Facilities, Cost of Development, Environment, Recreation and Open Space, Water Resources, Economic Development, and Housing.

The Town of Marana Council adopted the current General Plan in December 2007 and will update the plan in 2009 following the completion of the HCP. The 2009 update will

incorporate specific measures outlined in the HCP related to land use, conservation zones, conservation easements, riparian habitat, wildlife movement corridors, environmentally sensitive roadway design guidelines, and other areas.

Chapter 2.0 Description of Alternatives

2.1 Overview of Alternatives Considered

Since the onset of the Town's HCP planning process in 2002, a broad spectrum of alternative scenarios have been discussed in public, technical, advisory, and staff meetings and working group sessions. Conceptual approaches have ranged from including only Town projects to including all projects and encouraging voluntary participation; from covering only Federally listed species to a broader mix of species and habitats. The 2004 preliminary Draft HCP identified a preferred alternative that covered any residential, commercial and industrial development permitted by the Town along with the Town's operations and maintenance, and proposed coverage for six species.

The final set of alternatives analyzed is described below, along with several alternative approaches that have not been analyzed. Common to all alternatives are the Permit Planning Area, Permit Area, and the duration of the ITP.

2.2 Area Covered and Duration of Permit

The HCP planning area (approximately 67,987 ha [168,000 ac]) includes the lands within the incorporated area of the Town (Permit Area, approximately 30,958 ha [76,500 ac]) and adjacent lands considered during the development of the HCP, as shown on Figure 2.1. The HCP will not affect existing developed lands; however, it will apply to any CIP activities, such as road widening, carried out within developed areas. Areas where mitigation lands may be located are identified in the conservation measures detailed within the HCP.

Although the Town does not currently have any annexation plans, it is the intent of the Town to apply the terms and conditions of the HCP to lands annexed by the Town during the term of the ITP. All annexed lands would be evaluated by the Town, TBT, and the Service, and the applicable HCP conservation measures would be implemented based on the presence of covered species or their habitat within the annexed area. The Town would then work with the Service to amend the ITP through the approved process (see HCP Section 5.3) to include the annexed area and appropriate covered activities expected to occur on annexed lands. Because future activities on annexed lands are not addressed in the HCP, or the associated NEPA analysis documents, these documents would need to be revised or new versions prepared addressing the proposed amendment.

Under all alternatives analyzed, the Town will be the ITP holder and will be solely responsible for ensuring implementation of the HCP measures. The ITP will be in effect for a period of 25 years. This period encompasses the planned future growth in the Town.

The ITP may be renewed if the Town files a renewal request and the request is on file with the issuing Service office at least 30 days prior to the permit's expiration. The permit will remain valid while the renewal is being processed. The Town may not take listed species during the renewal process beyond the quantity authorized by the original permit.

2.3 Alternatives Analyzed in Detail

Three alternative management strategies have been identified for detailed analysis in this DEIS, including the proposed HCP (Alternative C). These alternatives are described below, and are compared and summarized in Table 2.1.

**TABLE 2.1
HCP ALTERNATIVES**

Description	Alternative		
	A	B	C
No HCP (ESA Compliance on a Project-by-Project Basis)	✓		
Projects & Activities Covered: Capital Improvement Projects		✓	✓
Projects & Activities Covered: Discretionary Actions			✓
Projects & Activities Covered: Voluntary Inclusion		✓	✓

Alternatives B and C vary primarily in the aspect of participation and therefore in the extent of covered activities.

2.3.1 Alternative A

Alternative A represents the “No Action” Alternative. Under this alternative, the Town would not proceed with the application for a Section 10(a)(1)(B) ITP. Each individual project or action, whether proposed by the Town or others, would be evaluated for its unique ITP needs on a project-by-project basis. This alternative is the baseline against which the effects of the other project alternatives are compared, as described in Chapter 4—Environmental Consequences.

2.3.2 Alternative B

Alternative B represents an alternative in which participation in the HCP would be limited to the Town—to cover its public works and capital improvement projects—and to private entities on a voluntary basis. Under voluntary inclusion, the Town would issue a Certificate of Inclusion to proponents of non-discretionary actions stipulating that if they abide by the conservation measures included in the HCP which are applicable to that property, they will be covered by the ITP. The included properties will be mapped and monitored for compliance in the same manner as other HCP lands.

This alternative would therefore not cover other entities' actions or projects that could be granted discretionary approval by the Town, except on a voluntary basis.

2.3.3 Alternative C

Alternative C represents an alternative in which participation in the HCP would include the Town's CIP projects and private landowners whose land development activities (i.e. residential, commercial, and industrial development [such as sand and gravel extraction from the Santa Cruz River]), are subject to the discretionary decisions of the Town (e.g., rezoning approvals). It would also include, on a voluntary basis, activities of landowners that are non-discretionary. Alternative C represents the Town's proposed HCP for the purposes of discussions in this document.

The HCP identifies 1,031 ha (2,547 ac) of impacts to modeled habitat resulting from the Town's CIP activities and 8,329 ha (20,582 ac) of impacts from development. A minimum of 9,054 ha (22,373 ac) of modeled habitat would be protected as natural undisturbed open space (NUOS). However, because the HCP assumes that all currently entitled lands would be developed, the total amount of NUOS may ultimately be higher, depending on the level of voluntary participation in the HCP by proponents of non-discretionary actions (voluntary inclusion). Within the Permit Area, a combined total of 17,406 ha (43,010 ac) of habitat was modeled for all 13 covered species. Figure 2.2 depicts this combined habitat in relation to CIP projects, and Figure 2.3 depicts it in relation to existing development and entitled lands.

Among the conservation measures outlined in the HCP is the establishment of four Conservation Zones (Figure 2.4). Within each zone, certain quantities of disturbance and set-aside areas are stipulated. The zones were developed based on the importance of habitat for covered species, with riparian habitat and NUOS being given the highest priority and therefore the highest levels of protection. In addition to the Conservation Zones, the HCP identifies wildlife linkages arranged in a southwest–northeast orientation across Tangerine Road and Conservation Zones 2, 3, and 4. These linkages would have a target of 95-percent protection. Only the generalized boundaries and locations of these

linkages are depicted in the HCP. A brief summary of the Conservation Zones is presented below.

Zone 1 would include riparian areas along the Santa Cruz River and set a goal of 95-percent protection from ground disturbance resulting from activities permitted under Title 21 of the Marana Land Development Code. Zone 1 encompasses 1,411 ha (3,486 ac). Under Alternative C, 70 ha (174 ac) would be subject to impacts, and 1,340 ha (3,312 ac) would be protected as NUOS.

Zone 2 would include the Arizona Upland Subdivision of the Sonoran Desertscrub Biome (Brown 1994) on the Tortolita Fan to the east of Interstate 10 and the Central Arizona Project (CAP) canal. ASLD parcels that are sold to private entities requesting an up-zoning—if a permanent reserve can not be developed or until such a reserve is developed—are required to conserve 80 percent of the parcel in perpetuity as NUOS.

These NUOS areas would include those portions of the parcel that support the highest habitat values, including riparian areas, and would be configured to complement any adjacent NUOS, as well as provide north–south habitat connectivity across the Tortolita Fan. Zone 2 encompasses 10,548 ha (26,064 ac), of which 1,757 ha (4,341 ac) are already developed. Under Alternative C, between 4,292 and 4,887 ha (10,606 and 12,076 ac) would be subject to impacts and between 5,661 and 6,256 ha (13,988 and 15,458 ac) would be protected as NUOS.

Zone 3 would include areas that have existing development and for which further development is planned. Zone 3 would require the protection of between 40 and 70 percent of each parcel as NUOS, with riparian habitat and areas adjacent existing NUOS to be given the highest priority. Parcels with less than 70 percent of their areas protected as NUOS would require mitigation for the additional impacts. Zone 3 encompasses 2,894 ha (7,152 ac), of which 461 ha (1,139 ac) are already developed. Under Alternative C, between 1,140 and 1,913 ha (2,817 and 4,727 ac) would be subject to impacts and between 981 and 1,762 ha (2,425 and 4,355 ac) would be protected as NUOS.

Zone 4 would include areas adjacent to Tangerine Road planned for 100 percent future development outside three wildlife linkages. The target width of each linkage would be 305 m (1,000 ft), as allowed by existing constraints, with a goal of 95-percent protection, except for future Tangerine Road improvements. The boundaries of the wildlife linkages would be established such that all parcels would retain opportunities for allowed land use. There are no NUOS goals established for Zone 4, outside of the designated linkages, because the proposed development limits and NUOS objectives within all of the other zones, as well as the three wildlife linkages extending across Tangerine Road (Figure 4.1) would mitigate the proposed impacts within the entire permit area as a whole. Zone 4 encompasses 1,994 ha (4,927 ac), of which 581 ha (1,435 ac) are

already developed. Under Alternative C, 1,573 ha (3,887 ac) would be subject to impacts, and 421 ha (1,040 ac) would be protected as NUOS within the linkages.

Other conservation measures in the HCP would include revisions to the Town's existing LDC. If the revisions to the LDC detailed below are not passed by the Town Council, the Town would retain the authority to apply conditions to discretionary actions on a case-by-case basis. In that case, the Town would develop policy guidance documents to ensure full and consistent application of HCP conservation measures.

Title 17 (Environmental Resource Protection, Native Plant Protection, Landscape Requirements) would be revised to provide more detailed guidance for the Site Resource Inventory and pre-construction survey requirements, native plant and riparian habitat protection and mitigation, and invasive species control requirements. The Town would also adopt a Riparian Habitat Map (figure 2.5) to accompany Title 17. For project impacts to mapped riparian habitat that are less than 0.4 ha (1 ac), impacts may be mitigated through the appropriate replacement of impacted plants as outlined in the existing native plant mitigation sections of Title 17.

For impacts to mapped riparian habitat greater than 0.4 ha (1 ac), the mitigation requirements in Table 2.2 would apply. Revisions to Title 17 would also require impacts to riparian habitat within Zone 1 to be mitigated in Zone 1, while impacts outside of Zone 1 would be mitigated with like habitat within any Zone at the ratios specified in the Table 2.2.

Conservation of existing riparian habitat would be defined to mean that mitigation would occur through the permanent protection (acquisition, easement, management agreement, etc.) of offsite riparian habitat that already exists in a natural state. Restoration would be defined to mean that a degraded offsite parcel would be restored to functional riparian habitat of the type impacted by the covered activity. Implementation and determination of effectiveness of both types of mitigation would require management and monitoring provisions. Mitigation may occur in the form of in-lieu fees at the indicated ratio, if an appropriate mitigation bank or project has been established. Fees would be based on current land values and the per acre cost of restoration. Mitigation proposed outside of the Permit Area would be evaluated on a case-by-case basis.

TABLE 2.2
TITLE 17 MITIGATION REQUIREMENTS FOR IMPACTS TO MAPPED RIPARIAN HABITAT

Location of Impacts	Conservation of Existing Riparian Habitat	Restoration of Riparian Habitat	Location of Mitigation
Within Zone 1	1.5:1	3:1	Within ½ mile
	2:1	4:1	Outside ½ mile
Outside of Zone 1	1.5:1	2.5:1	Within ½ mile
	2:1	3.5:1	Outside ½ mile

Title 19 (Grading and Hillside) would also be revised to provide more detailed guidance on protection of slopes over 15 percent from both direct impacts from development as well as indirect impacts from invasive species.

In addition to revising existing codes, conservation measures in the HCP would include the establishment of Burrowing Owl Management Areas (BOMAs), the development of an educational program to distribute information on the requirements and benefits of the HCP, and the adoption of an Environmentally Sensitive Roadway Design Guideline (ESRDG). The ESRDGs would require a detailed evaluation and consideration of biological, cultural, and visual resources in the design, construction, and mitigation of road and utility projects on designated roads. The ESRDGs will be implemented for all road widening and new road construction, and associated utilities, on public roads that meet any of the following criteria: (1) within or crossing an HCP Conservation Zone, (2) within or crossing the Tucson Mountains – Tortolita Mountains Linkages as identified by the Arizona Wildlife Linkages Working Group (Beier et al. 2006), (3) near Wildland Blocks as identified by the Arizona Wildlife Linkages Working Group (Beier et al. 2006), (4) within or crossing a Pima County High or Moderate Archaeological Sensitivity Zone or Priority Cultural Resource, (5) identified as a Historic Roadway or Route, or (6) identified as a Pima County scenic route.

The Town would also monitor compliance with the terms and conditions of the ITP and the effectiveness of the conservation measures. Monitoring would also be used to assess the need for adaptive management in response to information gained during Monitoring Plan implementation and to relevant changed circumstances.

The Monitoring Plan would include habitat-based monitoring focusing on changes in vegetation and other landscape features such as hydrological conditions, soils, or landform which provide habitat for the species covered under the HCP as well as compliance with the NUOS requirements in each Conservation Zone. These habitat-based monitoring efforts would be tailored to each land form (Tortolita Fan, Santa Cruz River, Valley Bottom Lands) within the Town. Species-specific monitoring, such as protocol surveys, would also be utilized.

Adaptive management would be based on annual reports and data gathered from monitoring and new research as it becomes available. The first two years of monitoring data would be used to establish baseline conditions, because the Town does not currently have extensive baseline data for the covered species and habitat being monitored. During the first two years of monitoring, the TBT would review the monitoring data and recommend success criteria for monitoring. After the second year of monitoring, the TBT would identify recommended thresholds for adaptive management.

Based on the results of monitoring, the Town and the Service would be able to determine how well the conservation measures are meeting the biological goals and objectives, and then, if necessary, determine the changes in management or implementation needed to increase success. If monitoring indicates that conservation goals established for covered species in the HCP are not being met, the TBT would develop adaptive management recommendations for submittal to Marana management and the Town Council. Adaptive management measures could include, among other actions, additional monitoring, research, or surveys.

For a more detailed discussion of monitoring and adaptive management, refer to Chapter 6 of the HCP.

2.4 Alternatives Considered But Not Analyzed

Other HCP concepts have been discussed and explored, but have not been brought forward as stand-alone, viable alternatives. Examples include:

- Partnering with Pima County as a co-signator to their proposed ITP. The Town determined it was in their best interest to develop an HCP in support of an ITP for which they would be the sole permittee.
- Partnering with Pima County and the City of Tucson as collaborators in support of conservation needs in Avra Valley. Discussions are underway regarding the opportunities to strengthen conservation measures and gather additional information on the biological resources in this area. This collaboration may become formalized and made part of the Town's HCP and ITP.
- Adopting the Conservation Lands System that was developed for the Pima County Draft Multi-Species Conservation Plan (PCDMSCP; Pima County 2006). The Town relied on much of the information generated by the PCDMSCP, which was shared by Pima County. The information and elements most relevant to the Town's resources and circumstances have been incorporated into Alternatives B and C. The Town has been able to use the landscape-level information from Pima County while refining it through species surveys and habitat analysis specific to the area covered by the HCP. Concerns voiced by stakeholders who have participated in the PCDMSCP and the Town's HCP have been recognized, carefully considered, and discussed.
- The Town has coordinated with Pima County, the City of Tucson, and the Arizona Wildlife Linkages Working Group to ensure that open space and wildlife linkages described within the HCP provide continuity with other jurisdictions' conservation measures.

- Covering only the Town's CIP activities in the ITP. The Town recognized that due to the limited footprint (i.e., hectares) of Town facilities and activities, the conservation value of the HCP could be maximized with the participation of private land owners, either through voluntary inclusion or the discretionary action approval process.

3.0 Affected Environment

3.1 Physical Environment

The three major landform features of the Town include the Tortolita Fan leading up to the Tortolita Mountains and located east of Interstate 10 and the CAP canal, the Santa Cruz River, and the alluvial floodplain associated with the Santa Cruz River (Figure 3.1).

The Tortolita Fan, or bajada, extends over much of the north central and eastern portions of the Town. The Santa Cruz River runs in a northwesterly direction through the Town west of Interstate 10. The width of the river is constricted in many places by bank protection and flood control measures, although in some reaches the river is unconstrained and the natural floodplain is relatively wide. The alluvial floodplain area is relatively flat with alluvial soils deposited from the Santa Cruz River or from runoff from the Tortolita Mountains and Fan. The Santa Cruz River has perennial flow in the areas with effluent.

3.1.1 Geology and Soils

The Town is situated within the Basin and Range physiographic province. Throughout this province, mountains tend to be relatively long, rugged, low, and widely scattered. They are semi-parallel, trending northwest/southeast. Igneous, sedimentary, and metamorphic rocks are all present (Bates and Jackson 1987). The Tortolita Mountains consist primarily of Cretaceous and Tertiary igneous rocks and the Tucson Mountains consist primarily of Cretaceous igneous rocks.

The alluvial deposits comprising the basin are the eroded remnants of the surrounding mountain ranges. Most of these valleys have a deep alluvial soil structure. Over time, they have been filled with thousands of feet of water-bearing layers of gravel, sand, and clay beds. These are the alluvial containers of desert aquifers (Richardson and Miller 1974; Chronic 1983). The primary basin-fill deposits consist of (from youngest to oldest): Recent Alluvium (Quaternary), Fort Lowell Formation (Quaternary), and Tinaja beds (Tertiary) (CAP 2008).

The Recent Alluvium occurs from ground surface to depths ranging from 9.8 meters (m) to 25.6 m (32 to 84 feet [ft]). The Recent Alluvium consists of an upper interval of mostly fine to medium-grained floodplain deposits, an intermediate interval of medium-grained stream deposits, and a lower interval of coarse-grained, gravelly stream deposits.

The Fort Lowell Formation consists of unconsolidated to poorly consolidated clayey, sandy gravel and clayey, gravelly sand with inter-bedded, fine-grained intervals.

Throughout most of the basin, the Fort Lowell Formation is 91 to 122 m (300 to 400 ft) thick.

The Tinaja beds are the principal water-bearing strata in the area. The beds are differentiated into three units: upper, middle, and lower. The upper Tinaja beds consist of unconsolidated to poorly cemented gravel to clayey silt, but in the uppermost part, the grain size is coarse and similar to the overlying Fort Lowell Formation. The middle Tinaja beds consist primarily of moderately cemented gypsiferous and anhydritic clayey silt and mudstone. The lower Tinaja beds consist of moderately to firmly cemented gravel and conglomerate to clayey silt and mudstone. The overall thickness of the Tinaja beds is estimated to exceed 457 m (1,500 ft) (CAP 2008).

3.1.2 Elevation and Drainage

Elevations within the Town range from 580 m (1,900 ft) at the Santa Cruz River channel to 1,330 m (4,360 ft) above mean sea level in the Tortolita Mountains. While some perennial and intermittent springs do occur within the Tortolita Mountains, most watercourses throughout Pima County are ephemeral, flowing only for short periods in response to seasonal rains. They typically have pattern braided channels and are frequently delineated by mesquite (*Prosopis* spp.), acacia (*Acacia* spp.), ironwood (*Olneya tesota*), and other vegetation that occurs at higher densities and in larger sizes than in adjacent upland areas. Many of these washes drain southwest from the Tortolita Mountains across the Tortolita Fan, although the CAP canal has functionally separated the floodplain at the base of the bajada from the basin bottom and Santa Cruz River (see Figure 3.1).

The main watercourse within the Town, the Santa Cruz River, flows to the north and northwest, eventually draining into the Gila, Salt, and Colorado rivers. The Rillito River and Cañada del Oro Wash are major ephemeral tributaries that contribute water flow and sediment to the Santa Cruz River. Prior to the late 1800s, rivers such as the Santa Cruz meandered broadly within wide, vegetated floodplains. However, the trend beginning in the late 1800s and continuing into the 1900s throughout the arid southwest has been for river floods to erode and channels to widen, creating deeply incised channels that often have little vegetative definition. This is thought to have resulted from a combination of factors including overgrazing by cattle, drought, devegetation (e.g., woodcutting for building materials and fuel; clearing for cultivated fields), lowering of groundwater levels, and water diversions. Tucson originally grew from settlements along the Santa Cruz River where water flowed year-round.

Except for flood events, all of the water in the Santa Cruz River is discharged from two wastewater treatment plants located at Ina and Roger roads. According to ADEQ, the portion of the Santa Cruz River that flows through the Town is classified as Effluent Dominated Waters. Approximately 52,539 acre-feet (af) of wastewater were discharged

into the Santa Cruz River in 1997 (Pima County 2008). At times, very little effluent is in the channel due to daily variations in wastewater releases. The distance the water travels downstream from the treatment plants is related to the effects of flood events and subsequent infiltration rates. Typically, the river bottom is covered by a dense algal mat that inhibits the infiltration of water. Flood events scour the sediments, removing the algal layer and increasing the infiltration rate. Following such events, the channel geometry stabilizes, and infiltration rates decrease as the algal layer redevelops (Galyean 1996). The algal layer can reform within several days. Consequently, the extent of perennial flow varies from approximately 6 kilometers (km) (3.7 miles [mi]) to over 40 km (24.8 mi) (Lacher 1996).

The Santa Cruz River has experienced major flood events in the recent past. On October 2, 1983, a flow of 65,000 cubic feet per second (cfs) was recorded that widened the river channel, scoured the floodway, and removed vegetation. In January 1993, two separate peak flows of 39,000 and 40,000 cfs occurred just 10 days apart.

3.1.3 Climate

Winter temperatures range from an average low of 3 degrees Celsius (°C) (38 degrees Fahrenheit [°F]) to an average high of 19°C (67°F). In the summer, the average low is 22°C (71°F), and the average high is 38°C (101°F) (National Oceanic and Atmospheric Association 1997).

The average precipitation at the Tucson Airport is between 28 and 30 centimeters (cm) (11 and 12 inches [in]) per year. However, actual precipitation in the Town is variable as a result of its elevation differences. Lowe (1964) estimated that an increase in elevation of 305 m (1,000 ft) results in a 10 to 13 cm (4 to 5 in) increase in annual precipitation. Thus, the Tortolita Mountains and upper bajada likely receive more precipitation than the valley bottom. Precipitation occurs in a bi-seasonal pattern distributed between the summer monsoons and winter storms.

The summer rainstorms, influenced by tropical weather patterns from the Gulfs of Mexico and California, are intense, brief, and localized. These storms are especially dramatic when accompanied by high winds, sweeping clouds, lightening, and thunder. Winter precipitation is less intense, less localized, and more variable. The duration of the arid summer is a key biological constraint for many species. The summer monsoon-type rains reduce water stress during the hottest portion of the growing season, which enables more diversity in the Sonoran Desert as compared to the Mohave Desert, which is dominated by winter rainfall alone.

Although scientists believe from tree-ring data that precipitation patterns for the last century have been wetter than previously, significant periods of drier conditions are expected, and the region is currently in a decade of drought. Regional climate modeling

projects a future decrease in winter rains and an increase in year-round temperatures. While early inhabitants of this region relied on simple adaptive strategies for their survival, modern responses include extensive infrastructure and technology: groundwater pumping, large-scale water transfers, exponential increases in energy use, and extensive landscape modifications. The amount of groundwater that has been withdrawn in recent years has far exceeded the amount replenished by rainfall.

Global climatic patterns such as La Niña and El Niño affect Pima County's climate. La Niña results in drier winters and lower flows in rivers. El Niño, associated with warmer-than-usual eastern Pacific Ocean temperatures and changes in the jet streams, brings storms southward with above average precipitation in winter months, more floods, and more snow.

Climatic cycles directly and indirectly affect ecosystem function. Riparian habitat and aquatic ecosystems are particularly sensitive to climatic variations such as timing and amount of precipitation, and temperature extremes. Climatic stresses, compounded by reduced surface flows and groundwater availability, have a direct effect on the life cycles of numerous species. Grasslands affected by drought can mean economic downturns for ranchers, long-term ecological damage, and increased fire potential. Higher elevation landscape "islands" support species' refugia that are typically isolated and vulnerable to climatic changes.

3.2 Water Resources

3.2.1 Groundwater

Groundwater resources are utilized for both potable and non-potable uses. Potable uses consist of water treated for drinking, and non-potable uses include irrigation and other agricultural or industrial applications.

Groundwater is managed separately from surface water under the Groundwater Management Act, which has special provisions within Active Management Areas (AMA). The entire HCP Permit Area is within the Tucson AMA. The goal of the Tucson AMA is to attempt to reach safe yield, a balance between supply and demand, by 2020. Large new wells may be drilled only if they meet certain conditions and the owner can demonstrate that a legally defined 100-year supply exists. Small domestic wells are allowed with few or no restrictions. Within the AMA, there are rules requiring conservation measures for industry, agriculture, and water providers.

While depth to groundwater in the Tortolita Mountains can be well over 213 m (700 ft) below the surface (Arizona Department of Water Resources [ADWR] 2000), the depth to groundwater in the Santa Cruz River varies from 24 to 43 m (80 to 140 ft) deep between

Ina Road and the Rillito Narrows and is approximately 73 m (240 ft) deep from Rillito Narrows north to Red Rock. In some areas, such as in the vicinity of Avra Valley Road, the regional water table is substantially higher. Nevertheless, the depth to groundwater is great enough to have resulted in a hydraulic disconnection between surface flows in the Santa Cruz River and groundwater.

3.2.1.1 Water Recharge

There are now three water recharge facilities in the Town with another facility being considered to meet future demands. There is capacity, as reserved by Intergovernmental Agreement (IGA), in the Lower Santa Cruz Recharge Project and the Avra Valley Recharge Project. Through the Cortaro–Marana trust, additional capacity could become available in the High Plains recharge project. The BKW Farms and Cortaro–Marana Irrigation District (CMID) Groundwater Savings Facilities, as well as effluent recharge in the Santa Cruz River, also function as recharge. The Town continues to pursue additional recharge facilities to balance water use and recharge. These activities meet the requirements of the Town for direct use of renewable water supplies or recharge water to offset the use of groundwater (Town 2007a).

3.2.1.2 Potable Uses

It is estimated that the capacity of existing potable water wells, excluding Tucson Water's wells within the current Town boundaries, can provide approximately 34.08 million liters (L) (9.0 million gallons [gal]) of water per day or 10,200 af of water per year. The historic water use rate for the Town, including summer peak demands, is 481 L (127 gal) of water per person per day. The water supply from these wells can support approximately 60,000 people. The Town's population as of 2006 was approximately 36,000. Water needs are projected to increase to 25,000 af during the next 20 years. To provide that amount of water, the Town will use CAP "excess" water quantities to recharge the groundwater in the Lower Santa Cruz Recharge Project. When combined with possible future increases of the Town's CAP allotment, treatment of effluent for potable water use, more efficient water reuse, and recharge programs that include effluent, the Town will have the necessary water supply for the projected population levels over the next 20 years (Town 2007a).

3.2.1.3 Non-potable Uses

Irrigation wells for agriculture are owned by the CMID/ Cortaro Water Users Association. They are responsible for delivery of non-potable water for agriculture. As agricultural land is developed, those wells may be reconditioned and brought to potable water standards. In the future, CMID water, along with CAP water and effluent, should provide irrigation water for agriculture, parks, and for landscaping.

3.2.2 Surface Water

Surface water resources for the Town include stormwater runoff, CAP water, and treated wastewater (effluent). The Town is a member of the Water Conservation Alliance of Southern Arizona (CASA). Water CASA is an umbrella organization for smaller water providers to implement water conservation techniques.

3.2.2.1 Stormwater Runoff

The Town is planning to increase its capture and use of stormwater runoff through the construction of Alternative Agricultural Storage Basins. These basins would initially collect stormwater for non-potable uses, such as irrigation of common areas, parks, medians, etc.

3.2.2.2 Central Arizona Project

Recently, water from the Colorado River via the CAP canal, has been used to supplement groundwater for customers of Tucson Water and some other users. This new source will help to prolong the supply of water for domestic use, agriculture, and industry. In December 2007, the Secretary of the Interior signed a ROD for the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead* (U.S. Department of the Interior 2007). This agreement between the seven Colorado River basin states implements interim operational guidelines to meet the challenges of the current drought in the lower Colorado River basin and, potentially, low-water conditions caused by continued drought or other causes in the future. The rules identify the circumstances and extent of shortages that will be shared; provides for the joint operation of the two major reservoirs to reduce the risk and severity of shortage; and provides for conservation and augmentation activities within and between the upper and lower basin states.

The Town currently recharges its CAP water within State-permitted facilities such as the Lower Santa Cruz Recharge Project and the Avra Valley Recharge Project. These recharge activities contribute to the Town's ability to maintain its assured water supply designation through recovery and by accumulating credits in compliance with State laws.

Based on the Pima Association of Governments' (PAG) population projections, the Marana Municipal Water Department will need to provide water for approximately 100,000 people in the year 2030. To provide water to 100,000 citizens and retain the assured water supply status with the ADWR, the Town purchases CAP "excess" water quantities to recharge in the Lower Santa Cruz Recharge Project for long-term storage credits. When and if any additional CAP contract water is purchased, these contracts will increase the Town's CAP allotment significantly.

The Bureau of Reclamation (BOR) is conducting studies to determine infrastructure needed to provide reliability to Tucson area CAP users. For the northwest Tucson water providers (Oro Valley, the Town, Metro Water, and the Flowing Wells Irrigation District) a potential additional 160-acre water retention facility is being investigated to help assure a reliable water supply (BOR 2008 website; Town 2007a).

3.2.2.3 Effluent

The Pima County Regional Wastewater Reclamation Department (PCRWRD) currently provides design, management, and maintenance of the sanitary sewer system for all of Pima County, including the conveyance system and treatment system. The department manages two treatment facilities within the Town limits; the Marana Wastewater Treatment Facility (WWTF) and the Ina Road WWTF.

In 2007, the Marana WWTF discharged a total of 188.06 af of effluent into the Santa Cruz River and utilized an additional 31.93 af of effluent for on-site landscape irrigation and industrial usage. In the future, the PCRWRD will be able to discharge all of the effluent into the Santa Cruz River by complying with the Arizona Pollution Discharge Elimination System (AZPDES) requirements. The Ina Road WWTF discharged a total of 27,856.26 af of effluent into the Santa Cruz River and utilized an additional 21.34 af of effluent for on-site use (Pima County 2008).

Under an IGA between the City of Tucson and Pima County, up to 10,000 af of treated effluent per year (af/yr) may be set aside specifically to support riparian restoration projects. However this effluent is not dedicated to the channel of the Santa Cruz River and can be delivered off-site via the reclaimed water system. Up to 5,000 af/yr were available until 2005; the amount can rise thereafter to 10,000 af/yr if there is sufficient demand. As the need for additional water and the value of the effluent increase, more wastewater is likely to be reused. Therefore, it can be reasonably assumed that at some point in the 25-year duration of the ITP, effluent may no longer be released into the Santa Cruz River.

3.2.3 Water Quality

3.2.3.1 Groundwater Quality

The Town's drinking water source is groundwater from the Lower Santa Cruz portion of the Tucson Basin Aquifer. Under Section 1424(e) of the Safe Drinking Water Act, the U.S. Environmental Protection Agency (EPA) designated the Upper Santa Cruz and Avra Valley Basin, which underlies the Town, as a sole source aquifer in 1984 (47 FR 2948). This designation means that the area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health.

The Town's groundwater supply is tested and regulated by ADEQ/Pima County Department of Environmental Quality and the annual consumer confidence report. Water quality is continuously monitored for public protection, health, and safety.

The most frequently reported groundwater contaminant in the Town area is nitrate resulting from use of fertilizers for agriculture production and from septic systems. The most current testing does not indicate that agricultural chemicals, other than nitrates and nitrites, have leached into the aquifer. As agricultural fields have been developed for new subdivisions and other uses, testing shows that nitrate levels have decreased. The most recent Water Quality Report for the Town Municipal Water System (Town 2007b) indicates no violations of the EPA's Safe Drinking Water Standards.

3.2.3.2 Surface Water Quality

Stormwater

Stormwater runoff water quality is addressed in the Town's Stormwater Management Plan. This plan was developed to comply with the requirements of the AZPDES Small Municipal Separate Storm Sewer System general permit for stormwater discharges. The Town completed implementation of the plan in 2007. Additionally, a Town Stormwater Ordinance (Title 25) was prepared and adopted in 2007.

CAP Water

The Colorado River and Lake Pleasant are two basic sources of CAP water. As previously mentioned, the Colorado River is the main source of CAP water, but Agua Fria River inflow from rainfall/runoff on the Lake Pleasant watershed mixes with Colorado River water that is stored in the reservoir. The CAP has determined that Colorado River water displays many of the usual characteristics of river water. It typically has higher total dissolved solids levels of calcium, magnesium, bicarbonate, sodium, and sulfate than some sources of groundwater. The CAP does not provide potable water directly to the public, but is instead a raw water supplier of Colorado River water to municipal water companies who are then responsible for treatment and delivery for domestic use (CAP 2007).

Effluent

The chemical composition of effluent is directly related to the types of treatment processes and generally remains constant over a long period of time. It is possible to have variations in effluent quality reflecting diurnal or seasonal patterns associated with influent entering the treatment plant.

Presently, the PCRWRD is under a mandate from ADEQ to decrease the amount of nitrogen and ammonia in its discharged effluent. Although nitrogen is helpful in plant growth, it is harmful to aquatic life. At the present time, the Marana WWTF is disinfecting the effluent with hypochlorite and then re-treating the effluent with sodium bisulfate to reduce the chlorine content to meet the current discharge standards of "B+". This

effluent is also denitrified. To comply with future regulatory permit requirements, the PCRWRD is now designing an ultraviolet disinfection system with a sand filtration unit for the Marana WWTF. When completed, the facility will be able to treat the effluent to “A+” standards (Pima County 2008).

Although the chemical and physical composition of effluent is fairly constant at the point of discharge, these characteristics can also vary with distance downstream of the discharge as in-stream physical, chemical, and biological processes modify the chemistry. In effluent-dominant waters such as the Santa Cruz River, the water quality also depends on how much in-stream flow from storm events is available for mixing.

3.3 Biological Resources

This section discusses the existing biological resources within the Town. General vegetation and wildlife species, species afforded protection under the ESA, Wildlife of Special Concern in Arizona, Arizona Department of Agriculture listed plants, and invasive species are addressed.

3.3.1 Vegetation

Vegetation within the Town is associated closely with the three major landforms: Tortolita Mountains and Fan, Santa Cruz River, and Valley Bottom.

3.3.1.1 Tortolita Mountains and Fan

Vegetation of the Tortolita Mountains and Fan is characteristic of the Arizona Upland Subdivision of the Sonoran Desertscrub Biome (Brown 1994). Plant associations of the paloverde–cacti–mixed scrub series cover most of the mountains and fan (Figure 3.2; Table 3.1).

TABLE 3.1
PLANT ASSOCIATION COVER TYPES IN THE TOWN

Plant Association/Land Cover Type	Hectares (Acres)	Percent
Creosote–Bursage	1,411 (3,487)	5
Cottonwood-Willow	59 (146)	<0.1
Mesquite	114 (282)	<0.1
Paloverde–Cacti–Mixed Scrub	15,262 (37,713)	56
Xeroriparian	3,114 (7,695)	11
Developed	7,390 (18,260)	27
TOTAL	27,350 (67,593)	100

The vegetation of this series is dominated by leguminous trees with an overstory of saguaro cactus (*Carnegiea gigantea*). Common trees include foothill paloverde (*Parksinsonia microphylla*), ironwood, and velvet mesquite (*Prosopis velutina*). Typically there are one or more layers of shrubs and perennial succulents. High shrub-layer vegetation commonly includes acacias (*Acacia* spp.), desert hackberry (*Celtis pallida*), graythorn (*Ziziphus obtusifolia*), and prickly pear (*Opuntia* spp.). Lower shrub-layer vegetation often includes creosote bush (*Larrea tridentata*), triangle-leaf bursage (*Ambrosia deltoidea*), and white bursage (*Ambrosia dumosa*).

A relatively small portion of the fan is creosote–bursage (see Table 3.1), more representative of the Lower Colorado River Valley Subdivision of the Sonoran Desertscrub Biome. Ground cover in this area consists of perennial and annual grasses and forbs.

Xeroriparian vegetation is well developed in the numerous washes (drainageways) traversing the fan. These washes often support large trees, commonly including ironwood, blue paloverde (*Parkinsonia florida*), velvet mesquite, and desert hackberry. Some isolated patches of the fan, typically near springs, support more hydro-riparian vegetation that can include Fremont cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), and seepwillow (*Baccharis salicifolia*). Under the HCP, the Town would adopt a riparian habitat map (Figure 2.5) that would be linked to the revised Title 17 of the Town’s Land Development Code (see Section 2.3.3 for details).

The Tortolita Fan supports a high-quality ironwood forest (Arizona–Sonora Desert Museum; ASDM 2000). As mentioned, these trees grow in both washes and inter-wash upland areas. They tend to be larger in the washes. Recently, ASDM (2003) summarized the ecological importance of ironwoods in *Biological Survey of Ironwood Forest National Monument*. They identified the ecological function of ironwood as including the role of “nurse plants,” because ironwoods provide safe areas for seed dispersal, protect seedlings from temperature extremes and large herbivore predation, and enrich soils with nutrients, particularly nitrogen. As ironwoods can persist for as long as 800 years, they can function in this important role for extended periods (ASDM 2003).

3.3.1.2 Santa Cruz River Corridor

The current hydro-riparian vegetation of the Santa Cruz River floodway is dominated by cottonwood–willow habitat, the rarest habitat type in the southwest U.S. (Krueper 1996). In the stretch of the Santa Cruz River within the Town, the cottonwood-willow habitat is maintained entirely by the effluent discharged from the Ina and Roger Road treatment plants (see Figure 3.2). A riparian corridor can function as an important source of materials both to the aquatic habitat and the adjacent uplands. The sediment delivered from uplands during rain events, or produced during flood-caused scour, can provide new sites for vegetation to quickly re-establish after a flood event. Baker (2000)

conducted a vegetation study focused on the Santa Cruz River in the Town and attributed a 46-percent loss of willow woodland to the 1993 floods. Baker (2000) also found that the Gooding willow vegetation was approximately six years old, suggesting that the 1993 floods also provided opportunities for new seedlings to establish.

Based on Baker's (2000) study, other hydro-mesic vegetation along the river includes velvet mesquite, tamarisk (*Tamarix* spp.), burrobrush (*Ambrosia* sp.), desert broom (*Baccharis sarothroides*), and bermuda grass (*Cynodon dactylon*). While much of the floodway has been disturbed, vegetation associations in the uplands adjacent to the river include creosote bush, desert saltbush, and blue paloverde.

The Town has also taken part in the Tres Rios del Norte Feasibility Study (TRDN) and planning process since 2001. The TRDN is a collaborative effort between the U.S. Army Corps of Engineers (Corps), Pima County Regional Flood Control District (PCRFCDD), City of Tucson–Tucson Water, and the Town. The goal of TRDN is to conduct ecosystem restoration along 29 km (18 mi) of the Santa Cruz River. The initial Feasibility Study is nearing completion, and the current goal is to begin construction in 2012.

3.3.1.3 Valley (Basin) Bottom Lands

Well over half of the Valley Bottom Lands in the Town is in active agriculture, developed (i.e., Marana Regional Airport, commercial and residential development), or otherwise disturbed (e.g., abandoned agriculture, mining pond). Although specific crop types and the extent of area in active production vary from year to year, about 4,620 ha (11,417 ac) are in agriculture. The vegetation in relatively undisturbed areas is representative of both the Lower Colorado River Valley and Arizona Upland subdivisions of the Sonoran Desertscrub Biome. The most widespread native plant associations are those of paloverde–mixed cacti, creosote–bursage, saltbush, and mixed scrub (see Figure 3.2).

3.3.2 Wildlife

Wildlife occurrence information was cross-referenced with the extent of suitable habitat within or adjacent to the Town to determine which wildlife species could occur in the study area. If a species is known to occur or there is suitable habitat to support the species within the Permit Area, it was assumed that the species was present and could be potentially affected by the proposed alternatives. Common wildlife species in the Town are listed in Table 3.2.

**TABLE 3.2
COMMON WILDLIFE SPECIES IN THE TOWN OF MARANA**

Mammals	
Bobcat	<i>Lynx rufus</i>
Coyote	<i>Canis latrans</i>
Desert cottontail	<i>Sylvilagus audubonii</i>
Ground squirrels	<i>Ammospermophilus</i> and <i>Spermophilus</i> spp.
Javelina	<i>Tayassu tajacu</i>
Kangaroo rats	<i>Dipodomys</i> spp.
Mule deer	<i>Odocoileus hemionus</i>
Pocket mice	<i>Perognathus</i> spp.
Raccoon	<i>Procyon lotor</i>
Striped skunk	<i>Mephitis mephitis</i>
White-throated woodrat	<i>Neotoma albigula</i>
Birds	
Abert's towhee	<i>Pipilo aberti</i>
Bell's vireo	<i>Vireo belli</i>
Cactus wren	<i>Campylorhynchus brunneicapillus</i>
Gambel's quail	<i>Callipepla gambelii</i>
Gila woodpecker	<i>Melanerpes uropygialis</i>
Great blue heron	<i>Ardea herodias</i>
Great-horned owl	<i>Bubo virginianus</i>
Greater roadrunner	<i>Geococcyx californianus</i>
Harris's hawk	<i>Parabuteo unicinctus</i>
House finch	<i>Carpodacus mexicanus</i>
Killdeer	<i>Charadrius vociferous</i>
Lucy's warbler	<i>Vermivora luciae</i>
Mallard	<i>Anas platyrhynchos</i>
Mourning dove	<i>Zenaida macroura</i>
Northern shoveler	<i>Anas clypeata</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Turkey vulture	<i>Cathartes aura</i>
White-winged dove	<i>Zenaida asiatica</i>
Yellow-rumped warbler	<i>Dendroica coronata</i>
Reptiles and Amphibians	
Common kingsnake	<i>Lampropeltis getula</i>
Couch's spadefoot toad	<i>Scaphiopus couchii</i>
Eastern fence lizard	<i>Sceloporus undulates</i>
Gopher snake	<i>Pituophis melanoleucus</i>
Northern tree lizard	<i>Urosaurus ornatus</i>
Side-blotched lizard	<i>Uta stansburiana</i>
Sonoran Desert toad	<i>Bufo alvarius</i>
Western diamondback rattlesnake	<i>Crotalus atrox</i>
Western whiptail lizard	<i>Cnemidophorus tigris</i>

3.3.3 Species Covered by the HCP

Thirteen species proposed for coverage by the Town HCP are listed in Table 3.3 and discussed below.

**TABLE 3.3
SPECIES PROPOSED FOR COVERAGE IN THE TOWN OF MARANA'S HCP**

Species—Common Name	Species—Scientific Name	Federal Status
Western burrowing owl	<i>Athene cunicularia</i>	MBTA
Cactus ferruginous pygmy-owl	<i>Glaucidium brasilanum cactorum</i>	Petitioned, MBTA
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered, MBTA
Western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate, MBTA
Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuenae</i>	Endangered
Merriam's mesquite mouse	<i>Peromyscus merriami</i>	None
Pale Townsend's big-eared bat	<i>Corynorhinus townsendii pallenscens</i>	None
Ground snake (valley form)	<i>Sonora semiannulata</i>	None
Mexican garter snake	<i>Thamnophis eques megalops</i>	Candidate
Sonoran Desert tortoise	<i>Gopherus agassizii</i>	Petitioned
Tucson shovel-nosed snake	<i>Chionactis occipitalis klauberi</i>	Petitioned
Lowland leopard frog	<i>Rana yavapaiensis</i>	None
Talus snail	<i>Sonorella spp.</i>	None

Endangered: Species listed by the Service under the ESA as being in imminent jeopardy of extinction.

Candidate: Species for which the Service has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.

3.3.3.1 Western Burrowing Owl

Over the past 50 years, western burrowing owl populations have generally been experiencing declines throughout their range in North America (Klute et al. 2003). The burrowing owl is listed by the Service as a species of concern and is protected by the MBTA and Arizona Revised Statute (ARS) Title 17. Threats to burrowing owls include reduced burrow availability because of prairie dog and ground squirrel control programs, conversion and urban development of natural habitat and agricultural lands, overgrazing and subsequent shrub encroachment, and urbanization, which increases predation by domestic and/or feral animals or children and potential for vehicle strikes.

Burrowing owls inhabit open areas, such as grasslands, pastures, coastal dunes, desert scrub, and the edges of agricultural fields. They also inhabit golf courses, airports, cemeteries, vacant lots, and road embankments or wherever there is sufficient friable soil for a nesting burrow (Haug et al. 1993). Burrows are a critical habitat requirement for burrowing owls. Owls use burrows for nesting and also require access to alternate burrows to provide escape cover for adults and fledglings. Because they do not excavate their own burrows, burrowing owls are dependent on fossorial mammals to create burrows. Burrowing owl nesting density appears to be strongly dependent on local

burrow distribution and also may be influenced by foraging habitat quality. Modeled habitat for burrowing owls was developed by the TBT by considering locations of known occurrences as well as landform, development, and vegetation community.

Burrowing owls in northern Arizona generally migrate south during the winter, while in southern Arizona, many are year-round residents (Phillips et al. 1964). While burrowing owls are known to occur within the Town, local and regional movements of burrowing owls are largely unknown. Whether owls move between activity areas in Tucson and Phoenix is undetermined. However, given the Town's central position between these two breeding population segments in Arizona, its proximity to Mexico, the apparent availability of suitable habitat within the Town, and the documented presence of this owl breeding within the Town limits, it is reasonable to conclude that portions of the Town's planning area provide habitat for this species.

In 2003, AZGFD found one adult pair with two juveniles within the Town limits during their survey (Alanen 2003). A survey conducted by Marana staff in April and one in June 2008, resulted in additional burrowing owls detected within the Town limits. Three pair and three young of the year burrowing owls were detected.

3.3.3.2 Cactus Ferruginous Pygmy-Owl

The cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) was listed as an endangered species in 1997. Following a series of lawsuits, the Service removed the pygmy-owl from the endangered species list in 2006. In 2007, the Service was petitioned to list the species again based on additional genetic, taxonomic, and threats information. Specifically, the petition relies largely on a recently proposed scientific reclassification of the pygmy-owl to *Glaucidium ridgwayi cactorum* based on Proudfoot et al. (2006a, 2006b) and König et al. (1999). This proposed reclassification recognizes the *cactorum* subspecies in southern Arizona, and Sonora and Sinaloa, Mexico, as distinct and defined by a smaller range than the subspecies recognized in 1997. In May 2008, the Service issued the 90-day finding in response to the petition and found that the pygmy-owl may warrant Federal protection under the ESA and initiated a 12-month status review (73 FR 31418). The pygmy-owl still remains protected by the MBTA and ARS Title 17. Low population numbers, long-term drought, loss and modification of habitat, disease, and predation are thought to be the primary threats to pygmy-owls (73 FR 31418).

Pygmy-owls can be found in fairly dense thicket or woodland areas of the Sonoran desert. The presence of trees or saguaros large enough to support cavities (mesquite, hackberry, ironwood, and paloverde) is very important. Smaller trees and shrubs are also critical to their survival, for they provide shelter and can provide habitat for the owl's natural diet of birds, lizards, insects, and small mammals. Modeled habitat for pygmy-

owls was developed by considering locations of known occurrences as well as by rating hydrology, vegetation, slope, elevation, and landform.

The total number of pygmy-owls in Arizona is unknown due an inconsistent and incomplete survey effort. Some areas of Arizona have not been surveyed for the presence of pygmy-owls, some have been surveyed once or occasionally, but there are some areas, particularly in northwest Tucson, that have had a fairly consistent survey effort over the past ten years. Specifically, AZGFD conducted surveys with the Town boundaries in 2003 and 2004. In addition, during the time the pygmy-owl was listed, surveys were conducted at the request of private developers and local governments as part of their efforts to comply with ESA requirement. The occupancy history of pygmy-owls within the Town has benefited from this survey effort and there is a relatively reliable record of pygmy-owl occupancy to inform the development of this HCP. While there are currently no known pygmy-owl locations within the Town, since 1995 there have been a total of 14 pygmy-owl territories within the HCP planning boundary.

The last known pygmy-owl within this area was taken into captivity in 2006 as part of AZGFD's captive breeding research project. In addition to the northwest Tucson area, pygmy-owls have also been found in (Service 2008, unpublished data):

- Tucson Mountains—unknown breeding status
- Rincon Mountains—unknown breeding status
- Organ Pipe Cactus National Monument—nesting
- Tohono O'odham Nation—nesting
- Altar Valley—nesting
- Southern Pinal County—nesting
- Roskrige Mountains—nesting

3.3.3.3 Southwestern Willow Flycatcher

The southwestern willow flycatcher was Federally listed as endangered in February 1995 and is protected by the MBTA and Arizona State law (ARS Title 17). A final recovery plan for the southwestern willow flycatcher was approved in 2002 (Service 2002), and critical habitat was designated in 2005 (70 FR 60885). The flycatcher is endangered primarily due to riparian habitat reduction, degradation, and elimination as a result of agricultural and urban development. The southwestern willow flycatcher is also affected by predation and by brood parasitism by cowbirds. The invasion of non-native plants has affected the availability and quality of available flycatcher habitat.

The southwestern willow flycatcher nests and forages in dense riparian habitat along streams, rivers, lakesides, and other wetlands. Some of the more common plant species used for nesting include willow, boxelder (*Acer negundo*), tamarisk, Russian olive (*Elaeagnus angustifolia*), buttonbush (*Cephalanthus occidentalis*), cottonwood, and mesquite. Migration habitat is believed to primarily occur along riparian corridors. Habitat occurs at elevations below 2,590 m (8,500 ft). It is found throughout the southwest in portions of California, Nevada, Utah, Arizona, New Mexico, Texas, Colorado, and Mexico (Service 2006). Modeled habitat for southwestern willow flycatchers was developed by considering hydrology and vegetation, specifically tropical-subtropical swamp, Sonoran deciduous swamp, and riparian scrub series.

While no southwestern willow flycatchers are currently known to occur within the Town, the Town does contain areas of potential habitat, especially migration habitat. In addition, restoration projects along the Santa Cruz River in the Town have the potential to provide or enhance flycatcher habitat in the future.

3.3.3.4 Western Yellow-Billed Cuckoo

The western yellow-billed cuckoo is Federally listed as a candidate species under the ESA and is protected by the MBTA and ARS Title 17. It was petitioned for Federal listing as a Distinct Population Segment in the west, and listing was found to be warranted in 2001, but was precluded by higher priority listing actions. The loss, degradation, and fragmentation of riparian habitat have been identified as the primary factors causing yellow-billed cuckoo declines in the western United States.

Western yellow-billed cuckoos appear to require large blocks of riparian habitat for nesting. Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat in areas where the species has been studied in California (Laymon et al. 1993). This species will also utilize narrow, and often widely separated, cottonwood–willow galleries, mesquite bosques, and stands of salt cedar as non-nesting and migratory habitat. In the west, the species is usually found at elevations less than 2,011 m (6,600 ft) (Service 2001a). Modeled habitat for yellow-billed cuckoos was developed by considering locations of known occurrences as well as hydrology and vegetation, specifically tropical-subtropical swamp, Sonoran deciduous swamp, and riparian scrub series.

No breeding pairs of yellow billed cuckoos have been documented in the Town, although breeding is suspected at Simpson Farm, approximately 1.6 km (1 mi) west of the Town along the Santa Cruz River. Surveys by the Tucson Audubon Society (TAS) detected three cuckoos in 2004, six in 2005, and two in 2006 (Scott Wilbor, TAS, pers. comm., April 18, 2007). No nests were confirmed, but the surveyors suspected two nests in 2005, and one in 2006. A yellow-billed cuckoo was reported by several birders at Sweetwater Wetlands in July 2008. Other historic records include sightings on the Santa

Cruz near Avra Valley Road, Sanders Road, and San Xavier Mission, as well as along Tanque Verde Wash in the Rincon Mountains, and even within commercial areas of the City of Tucson. In addition, restoration projects along the Santa Cruz River in the Town have the potential to provide or enhance cuckoo habitat in the future.

3.3.3.5 Lesser Long-Nosed Bat

The lesser long-nosed bat was listed as Federally endangered in 1988 (53 FR 38456), and a final recovery plan was approved in 1997 (Service 1994). This species is also protected by Arizona State law (ARS Title 17). Population declines can be tied to loss of forage (e.g., agave harvest, over-grazing, drought, non-native invasive species, habitat conversion) and loss or disturbance of roost sites. Large numbers of lesser long-nosed bats congregate at relatively few roosts, increasing their vulnerability.

The lesser long-nosed bat is migratory and found in Arizona and New Mexico from April to October, after which it migrates south into Mexico and Central America for the winter. While in the United States, the lesser long-nosed bat gives birth to one pup a year. The lesser long-nosed bat is found in the low deserts, where it feeds on the nectar and fruit of the saguaro and organ pipe cacti, and up to pine-oak woodlands, where it feeds on nectar of the agave plant. Its elevation range is 480 to 3,450 m (1,600 to 11,500 ft). Lesser long-nosed bats roost in caves, abandoned mines, and occasionally unoccupied buildings (Service 2001b). Modeled habitat for lesser long-nosed bats was developed by ranking elevation, slope, carbonates, and vegetation, specifically Sonoran Desertscrub.

Suitable foraging habitat consisting of widespread stands of saguaro cacti is found within a significant portion of the Town, and based on ongoing telemetry studies, lesser long-nosed bats are known to forage at hummingbird feeders within the Town limits (AZGFD, unpublished data).

Bats have been recorded flying as far as 64 km (40 mi) (one way) from roost sites to forage sites. No roost sites for the lesser long-nosed bat are known within the Town; however, there are several within 64 km (40 mi) of the Town. There is at least one mine in the north end of the Tucson Mountains 2.4 km (1.5 mi) south of the Town that may have some potential, but there are no documented lesser long-nosed bat records from this site. There is also a newly discovered roost on the south side of the Catalina Mountains, approximately 16 km (10 mi) east of the Town. While all of the known day roost sites in Pima County are protected by land management agencies, many night roosts, where bats rest between foraging bouts, are likely occur across the landscape, including within the Town.

3.3.3.6 Merriam's Mesquite Mouse

The Merriam's mesquite mouse has no Federal status under the ESA, but is protected by Arizona State law (ARS Title 17). The greatest threat to Merriam's mesquite mouse is the loss and degradation of mesquite forest and other dense woodland habitats. Fragmentation of riparian habitat and predation by house cats likely also affect populations of Merriam's mesquite mouse.

Historically, Merriam's mesquite mouse was found in the large mesquite forests along rivers throughout Pinal, Pima, and Santa Cruz counties in Arizona and into Sonora, Mexico (Hoffmeister 1986). These mice apparently select areas with dense stands of mesquite (bosques), but have also been found in thick stands of cholla, prickly pear, palo verde, and grasses.

It is apparent from Kingsley's (2006) more recent work that Merriam's mesquite mouse is not found only in large mesquite bosques, but in a wider variety of mesquite-dominated communities on floodplain soils, including xeroriparian areas of semidesert grasslands and Sonoran Desertscrub. Based on this analysis, suitable habitat for this species remains within the Town along the Santa Cruz River floodway and may extend up into mesquite-dominated tributaries. The most recent trapping effort within Pima County (Kingsley 2006) did not utilize trapping sites within the Town limits, but did document a Merriam's mesquite mouse along the Santa Cruz River approximately 1.6 km (1 mile) west of the Town. Modeled habitat for the Merriam's mesquite mouse was developed by considering locations of known occurrences as well as vegetation, specifically Sonoran deciduous swamp, mesquite woodlands, and riparian scrub series.

3.3.3.7 Pale Townsend's Big-eared Bat

The pale Townsend's big-eared bat has no Federal status under the ESA, but is protected by Arizona State law (ARS Title 17). The populations of pale Townsend's big-eared bat appear to be declining throughout its range. Disturbance of roosts (both summer and hibernation) and loss/fragmentation of foraging habitat are the primary threats to this species (AZGFD 2003a). The largest known colony in Arizona (Stanton Cave in the Grand Canyon) disappeared in the 1970s following archaeological excavations in the cave and fencing at its entrance that prevented the use of the cave by the bats.

The pale Townsend's big-eared bat is found primarily in the western United States, as well as western Canada and Mexico. They generally roost in mines and caves, and occasionally in buildings. For hibernation, they prefer roosts with temperatures between about 0°C and 12°C (32°F and 54°F). This bat feeds primarily on small moths it catches in flight, but may also glean insects off vegetation while in flight (AZGFD 2003a). Modeled habitat for pale Townsend's big-eared bats was developed by ranking elevation, slope, aspect, hydrology, and vegetation.

While there are no known pale Townsend's big-eared bat roosts in the town limits, known and potential roosts occur in Colossal Cave Mountain Park, Tucson Mountain Park, and Saguaro National Park. Foraging habitat occurs throughout the Town within all modeled suitable habitat.

3.3.3.8 Ground Snake

The ground snake has no Federal status under the ESA, but is protected by Arizona State law (ARS Title 17). It is primarily threatened by habitat destruction from urban and agricultural developments. Pesticides are also a likely threat. This is an uncommon snake and little information has been generated regarding population trends. The valley form is thought to be declining (Rosen, pers. comm. to D. Scalero, 4 March 1999).

This species is chiefly nocturnal and requires warm nighttime temperatures for activity and loose soil for burrowing. It is known to occur in New Mexico, Arizona, Colorado, Utah, Nevada, Texas, and Chihuahua and Sonora, Mexico. The valley form of this species is known only from Pima County. The ground snake occupies plains, valleys, and foothill habitats. Its diet includes eggs, adult vertebrates, and arthropods. Scorpions, centipedes, and black widows are common food items. Modeled habitat for the ground snake was developed by considering soils, slope, and vegetation, with soils being the primary indicator.

Rosen (2004) concluded that ground snakes formerly occupied narrow bands of habitat on the periphery of the valley center where bajada washes discharged water and fine sediment on dense xeroriparian plains. The ground snake has been documented within the Town (Rosen 2008a). Potential habitat, and possibly former habitat, includes portions of the Town and extends as far south as Avra Valley Road. The heavy soils of the valley bottom in the Town have the required soil conditions favored by the ground snake (Rosen 2003a). The population's (valley form) range in the Town region is described as extending from the Town area northwest to Eloy (RECON 2002). Rosen (2003a) uses the term "population segment" in referring to this population.

3.3.3.9 Mexican Garter Snake

In 2003, the Service was petitioned to list the Mexican garter snake and to designate critical habitat. In 2006, the Service found that the garter snake faces significant threats in the U.S., but because its status and threats in Mexico were not adequately known, the Service determined that the subspecies did not warrant protection. The Service withdrew its initial finding in May 2008 and initiated a new status review (73FR 30596) that was consistent with the legal guidance it received about determining the extinction danger of a species throughout a significant portion of its range. In November 2008, the Service found that listing the species as protected under the ESA was warranted but precluded by higher priority listing actions (73 FR 71788). The northern Mexican garter snake will

be classified as a candidate species, until a proposed rule can be prepared. This species remains protected by Arizona State law (ARS Title 17).

Primary threats to the snake are interactions with nonnative bullfrogs, crayfish, and nonnative fish that prey upon, or compete with, the northern Mexican garter snake and its native prey species. Human activities that result in the reduction, elimination, or degradation of surface water or vegetation are also significant threats, but particularly where they co-occur in the presence of nonnative species. Populations of the Mexican garter snake have decreased historically, with several local extirpations since 1950 (Center for Biological Diversity 2003).

The Mexican garter snake is found throughout south central and southeastern Arizona, and far western New Mexico, south to Oaxaca, Mexico. It is found in the Lower and Upper Sonoran Life Zones at elevations from 530 to 1,875 m (1,739 to 6,152 ft). It is usually found within 15 m (50 ft) of permanent water in areas of lush vegetation growth. Riparian areas, ponds, and cienegas are important habitats for the Mexican garter snake (Brennan and Holycross 2006). Modeled habitat for Mexican garter snakes was developed by considering primarily hydrology and secondarily vegetation, specifically tropical-subtropical swamp, Sonoran deciduous swamp, and riparian scrub series.

The Mexican garter snake is not currently known to occur within the Town, but the perennial reaches of the Santa Cruz River within the Town support checkered garter snakes (*Thamnophis marcianus*) and are also potentially suitable aquatic habitat for the Mexican garter snake. Should habitat restoration projects be implemented, improved habitat and potential for occurrence of this species in the Town may increase.

3.3.3.10 Sonoran Desert Tortoise

The Mojave population of desert tortoise is listed as Federally threatened. The Sonoran population, which occurs south and east of the Colorado River, currently has no status under the ESA, but is protected by Arizona State law (ARS Title 17). The Service was recently petitioned (October 2008) to list the Sonoran desert tortoise and to designate critical habitat. In the petition, WildEarth Guardians and Western Watersheds Project cited severe declines in the Sonoran desert tortoise population. Threats to the Sonoran desert tortoise include loss and degradation of habitat, illegal collection and vandalism, predation by feral dogs, and disease (upper respiratory tract disease, shell disease) (Service 2005).

Preferred habitat for the Sonoran desert tortoise is primarily rocky (often steep) hillsides and bajadas of Mohave and Sonoran Desertscrub, but they may encroach into desert grasslands, juniper woodlands, interior chaparral, and even pine–oak habitats. Washes and valley bottoms may be used in dispersal. Tortoises in the Sonoran population are found from approximately 300 to 2,300 m (1,000 to 7,800 ft) in elevation (Service 2005). The Sonoran population of this species is found in Arizona, and south and east of the

Colorado River, south into Sonora, Mexico. Modeled habitat for Sonoran desert tortoises was developed by considering known locations as well as geology, slope, and vegetation (i.e., Sonoran Desertscrub).

Suitable Sonoran desert tortoise habitat is found within the Town, primarily in association with the Tortolita and Tucson Mountains. However, other rock outcrops and caliche-incised washes also provide habitat. The Town is an important piece of connecting habitat for metapopulations in the Tortolitas, Desert Peak, Tucson Mountains, Silverbell Mountains, and Picacho Mountains. Dispersal likely occurs throughout the Town, with the exception of densely urbanized portions.

3.3.3.11 Tucson Shovel-nosed Snake

The Tucson shovel-nosed snake currently has no Federal status under the ESA, but was petitioned for listing in 1994. This species is protected by Arizona State law (ARS Title 17). In 2004, the Service was petitioned to list the Tucson shovel-nosed snake and to designate critical habitat. The Center for Biological Diversity cited in its petition the potential threats to the shovel-nosed snakes, including urban development, the inadequacy of existing regulations, drought, and climate change. The Service issued its 90-day finding (73 FR 43905) in response to the petition in July 2008 and found that the shovel-nosed snake may warrant Federal protection as endangered or threatened under the ESA and has initiated a 12-month status review.

This particular subspecies is rare, but the genetics of the more common western shovel-nosed snake group, of which the Tucson shovel-nosed snake is part, needs to be clarified. Threats to this species include fragmentation and loss of habitat to agricultural and urban development, off-road vehicle activities, and road mortality (AZGFD 2002a).

The Tucson shovel-nosed snake has been found in an area from northern Pima County, across southern Pinal County, and into southern Maricopa County in Arizona. Soil type is an important habitat feature for the Tucson shovel-nosed snake—it occupies sandy and loose soil. These soil types facilitate the snake's movement, which is accomplished by a swimming, sideways swaying motion under the surface of the soil. It has been found in xeroriparian scrub, creosote bush, Sonoran Desertscrub, and mesquite bosques. The Tucson shovel-nosed snake eats insects, spiders, scorpions, centipedes, and buried moth larvae.

Suitable habitat for the Tucson shovel-nosed snake has been modeled for the Town based on historic locations, as well as elevation, soils, and land use, but it is unknown whether the species persists within the Town Limits. The last record of the Tucson shovel-nosed snake in the near-vicinity of the Town was at Sanders Road and Avra Valley Road in 1982. It is unknown whether the species persists within the Town boundaries. It was not observed during surveys in 2003 initiated during the latter half of the species seasonal activity cycle (Rosen 2003c). Rosen reported a 2006 photo-

voucher specimen of a Tucson shovel-nosed snake from south of Picacho Reservoir (2008b). In 2007, during surveys in northeastern Pima County and southeastern Pinal County, Arizona, three shovel-nosed snakes were found in Pinal County; two north of Picacho Peak and one on the lowest bajada north of the West Silverbell Mountains (Rosen 2008c).

No Tucson shovel-nosed snakes were documented within Marana during a full season of surveys in 2007, or during 2008 surveys in Avra Valley (Rosen, unpublished data). In 2008, one shovel-nosed snake was found near Ajo, Arizona, one was found in the Sonoran Desert National Monument on State Route 238, and one was found on a dune in the Pinacate Biosphere Reserve, Mexico (Rosen 2008b).

3.3.3.12 Lowland Leopard Frog

The lowland leopard frog currently has no Federal status under the ESA, but is protected by Arizona State law (ARS Title 17). Population numbers and the range of the lowland leopard frog are declining and some large die-offs have occurred (RECON 2002). This species is threatened by loss and degradation of aquatic habitats, predation by non-native species including fish and bullfrogs, the invasion of the Rio Grande leopard frog, and disease (RECON 2002).

The historical range of the lowland leopard frog included the lower elevations of the lower Colorado River and its tributaries in Nevada, California, Arizona, New Mexico, northern Sonora, and extreme northeast Baja California. The current distribution is much reduced, and this species now occurs primarily in Arizona. The lowland leopard frog requires permanent water below 1700 m (5,500 ft) elevation (AZGFD 2006). Effluent-supported riparian habitat along the Santa Cruz River may contain aquatic habitat potentially suitable for lowland leopard frogs; however, water quality may be limiting. Modeled habitat for lowland leopard frogs was developed by considering primarily hydrology and secondarily vegetation, specifically tropical-subtropical swamp, Sonoran deciduous swamp, and riparian scrub series.

The lowland leopard frog has not been documented within the Town, but few efforts have been made to survey this species. The nearest confirmed location of this species to the Town is within Saguaro National Park, East Unit, in the Rincon Mountains. Potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town. Should habitat restoration projects be implemented, improved habitat and potential for occurrence of this species in the Town may increase.

3.3.3.13 Talus Snail

One species of talus snail not found within the HCP Planning Area, *Sonorella eremite*, was proposed for Federal listing as an endangered species, but the listing was

withdrawn when a conservation agreement protecting the species habitat was finalized. None of the other species or populations has any status under the ESA, but they are protected by Arizona State law (ARS Title 17). Threats to these snails include urban development, construction, vandalism, and road construction and maintenance.

Approximately thirty *Sonorella* species or local populations are recorded for Pima County. Available evidence supports the hypothesis that localized taxa are relicts of a previously widespread taxa separated by repeated episodes of isolation and dispersal as a result of past climate change.

Sonorella snails live in isolated, undisturbed areas of rock, usually limestone, and on north-facing slopes or on hilltops. Modeled habitat for talus snails was developed by mapping areas with a 15-percent slope to encompass the talus slope areas, plus a 15 m (50 ft) buffer. Most species of talus snail occupy habitat of limited size, often smaller than the footprint of a house. Therefore, even minor disturbances or disruption of habitat can affect the entire species.

Some potential talus snail habitat in the form of talus slopes does occur in the Town in the northern end of the Tucson Mountains and in areas of the Tortolita Mountains. Talus snails are known to occur in the Tortolita Mountains and may occur elsewhere, but surveys for these snails have been very limited.

3.3.4 Federal Species Not Covered by the HCP

Federally threatened and endangered species and their designated critical habitats are afforded protection under the ESA of 1973, as amended. Impacts to species that are proposed to be listed or are candidates for listing are also evaluated in case they are listed during the NEPA process. The Service's Arizona Ecological Field Office website identifies eleven endangered, five threatened, and two candidate species within Pima and Pinal Counties (Service 2008a), which will not be covered by the Town's HCP. Additionally, one species is proposed for delisting. Species excluded from further evaluation are addressed in Appendix D. No designated critical habitat for any species occurs within the Town limits.

Three endangered species from the Service's list that have the potential to occur within the Town are identified in Table 3.4 and discussed below.

**TABLE 3.4
FEDERAL SPECIES WITH POTENTIAL TO OCCUR WITHIN THE TOWN, BUT NOT
PROPOSED FOR COVERAGE IN THE HCP**

Common Name	Scientific Name	Federal Status
Gila chub	<i>Gila intermedia</i>	Endangered
Gila topminnow	<i>Poeciliopsis occidentalis</i>	Endangered
Huachuca water umbel	<i>Lilaeopsis schaffneriana recurva</i>	Endangered

3.3.4.1 Gila Chub

The Gila chub was Federally listed as endangered under the ESA in 2005 (70 FR 66663). Primary threats to Gila chub include predation by and competition with nonnative fish, bullfrogs (*Rana catesbeiana*), crayfish (*Orconectes virilis*), and habitat degradation from surface water diversions and ground water withdrawals. Secondary threats include habitat alteration, destruction, and fragmentation.

This native fish is typically found in small headwater streams, cienegas, and marshes; however, it uses diverse habitat types based on the season and age of the fish. Adults prefer deep pools with heavily vegetated margins and undercut banks, while juveniles use small riffles, pools, and undercut banks of runs. This fish has an affinity for deeper pools in slow-velocity water, which is associated with cover such as undercut banks, root wads, and in-stream debris piles. This omnivorous fish feeds on insects and relies on beds of submerged aquatic vegetation for spawning.

Five tributaries of the Santa Cruz River are known to contain populations of Gila chub, including Bear, Romero, and Sabino canyons in the Santa Catalina Mountains; Sheehy Spring in Santa Cruz County; and Cienega Creek in Pima and Santa Cruz counties (RECON 2002). Although not documented within the Town, potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town. Should habitat restoration projects be implemented, improved habitat and potential for occurrence of this species in the Town may increase.

3.3.4.2 Gila Topminnow

The Gila topminnow was Federally listed as endangered under the ESA in 1967 (32 FR 4001). In April 2007, the Service initiated a 5-year review of the species to evaluate if its classification as endangered is accurate. Threats include the introduction and spread of nonindigenous predatory and competitive fishes, water impoundment and diversion, water pollution, groundwater pumping, stream channelization, and habitat modification.

Gila topminnow occurs in small streams, springs, and cienegas below 1,350 m (4,500 ft) elevation, primarily in shallow areas with aquatic vegetation and debris for cover. This

species can tolerate relatively high water temperatures and low dissolved oxygen (Service 2008b).

The Gila topminnow was once a widespread and abundant fish in southern Arizona, but has steadily declined to a small number of disjunct populations. In Arizona, the species currently occurs in the upper Santa Cruz River, Sonoita and Cienega creeks, and the middle Gila River. The species is currently being reared at over 100 locations and has been released at almost 200 locations in efforts to reestablish populations.

Although not documented within the Town, potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town. Should habitat restoration projects be implemented, improved habitat and potential for occurrence of this species in the Town may increase.

3.3.4.3 Huachuca Water Umbel

The Huachuca water umbel was Federally listed as endangered under the ESA in 1997 (62 FR 3). Threats include watershed degradation due to livestock grazing and development, trampling by livestock, diversion of water and dewatering of habitats, and modification of flood regimes.

Habitat for this umbel includes cienegas and streams and associated vegetation within Sonoran Desertscrub, grassland or oak woodland, and conifer forest between 1,210 and 1,970 m (4,000 and 6,500 ft). The species seems to require an intermediate level of flooding frequency to keep competition manageable, but populations can be destroyed when floods are too frequent and intense. Plants are found in unshaded or shaded sites. They require perennial water, gentle stream gradients, small- to medium-sized drainage areas, and (apparently) mild winters. Huachuca water umbel is usually found in water depth of 5 to 15 cm (2 to 6 in), but occasionally in 25 cm (10 in) (Service 2001c).

This species follows a very typical metapopulation structure, with each drainage constituting a segment of the metapopulation. Density of *Lilaeopsis* plants and size of populations fluctuate in response to both flood cycles and site characteristics. In 2001, Huachuca water umbel was found in a small patch along Cienega Creek in the county reserve and in Bingham Cienega Natural Preserve. Huachuca water umbel is also known to occur in Pima County in Cienega Creek within the Las Cienegas National Conservation Area (The Nature Conservancy 2008).

Although not documented within the Town, potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town. Should habitat restoration projects be implemented, improved habitat and potential for occurrence of this species in the Town may increase.

3.3.4.4 Migratory Birds

The MBTA provides that it is unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture, or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg, or product, manufactured or not. The MBTA does not discriminate between live or dead birds and also grants full protection to any bird parts including feathers, eggs, and nests. The Service recognizes an ITP to concurrently serve as a Special Purpose Permit under 50 C.F.R. § 21.27 to allow the take of ESA-listed migratory species in the amount and/or number subject to the terms and conditions specified in the ITP. Any such take would not be in violation of the MBTA of 1918, as amended (Service Memo dated February 9, 1996).

Over 800 species are listed under MBTA. Because it contains a diversity of native vegetation communities, the Town contains potential nesting, foraging, and roosting habitat for numerous species protected by the MBTA.

3.3.5 State Species

Wildlife of Special Concern (WSC) in Arizona are those species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the AZGFD's listing of *Wildlife of Special Concern in Arizona* (AZGFD in prep). Plants listed by the Arizona Department of Agriculture are regulated under the Arizona Native Plant Law (Arizona Revised Statutes Title 3, Chapter 7).

**TABLE 3.5
 STATE SPECIES KNOWN TO OCCUR WITHIN 5 MILES OF THE TOWN**

Common Name	Scientific Name	Federal Status
Black-bellied whistling duck	<i>Dendrocygna autumnalis</i>	WSC
California leaf-nosed bat	<i>Macrotus californicus</i>	WSC
Great Plains narrow-mouthed toad	<i>Gastrophryne olivacea</i>	WSC
Tropical kingbird	<i>Tyrannus melancholicus</i>	WSC
Desert night-blooming cereus	<i>Peniocereus greggii</i>	SR
Kelvin cholla	<i>Cylindropuntia X kelvinensis</i>	SR
Pima Indian mallow	<i>Abutilon parishii</i>	SR
Staghorn cholla	<i>Cylindropuntia versicolor</i>	SR
Thornber fishhook cactus	<i>Mammillaria thornberi</i>	SR
Tumamoc globeberry	<i>Tumamoca macdougallii</i>	SR

WSC = Wildlife of special concern

SR = Salvage restricted. Those Arizona native plants not included in the Highly Safeguarded Category, but that have a high potential for theft or vandalism, as described by the Arizona Native Plant Law.

The AZGFD's On-Line Environmental Review Tool was accessed to query the Heritage Data Management System for State species known to occur within an 8 km (5 mi) buffer of the Town. This buffer is based on the *Habitat Conservation and Restoration/Land Use*

Planning project category. Ten species identified through the on-line review that have the potential to occur within the Town are listed in Table 3.5 and discussed below.

3.3.5.1 Black-bellied Whistling Duck

The black-bellied whistling duck is an AZGFD WSC and protected by the MBTA and ARS Title 17. The decline of this species has been concomitant with the decline of wetland and riparian areas, and the use of herbicides on aquatic vegetation (AZGFD 2002b).

Arizona populations, known from the Santa Cruz, San Pedro, and Sulphur Springs valleys, are considered to be migratory, whereas populations farther south are not. This species utilizes shallow water habitats along shorelines and in agricultural fields to glean vegetation and seeds, sometimes also insects and mollusks. Habitat includes riparian areas, ponds, stock tanks, marshes, and swamps. The black-bellied whistling duck is a cavity nester in thickets of willow, mesquite, or cactus (although it will also nest on the ground). This species could be expected to occur at the Ina Road WWTF, as it has been documented upstream at the Sweetwater Wetlands facility and at Ina Road bridge over the Santa Cruz River.

3.3.5.2 California Leaf-nosed Bat

The California leaf-nosed bat is an AZGFD WSC and is protected by ARS Title 17. The most important threat potentially affecting this species is usually considered to be human disturbance to roosts (AZGFD 2001).

The species feeds on large, flying insects such as grasshoppers, moths, and flying beetles. Insect larvae, especially lepidopterans, and other flightless or daytime active prey are taken from bushes and off the ground. Daytime insects are especially important during winter months. Hoffmeister (1986) reported that *M. californicus* may also feed on fruits, including those of cacti.

This species is mostly found in Sonoran Desertscrub vegetation. It primarily roosts in mines, caves, and rock shelters with large areas of ceiling and flying space. This bat is not known to hibernate, and although it may not occupy the same roost year-round, it is not known to migrate and remains active year-round. When temperatures drop to between 9° and 12°C (48° and 54°F), they do not become torpid, but regulate their body temperature to between 18° and 20°C (64° and 68°F). Sustained exposure to ambient temperatures below 26°C (79°F) results in death (AZGFD 2001). Bell et al. (1986) suggest that these bats are able to exist in temperate desert areas, because they minimize energy expenditure by using geothermally heated winter roost sites with stable year-round temperature of about 29°C (84°F) and an "energetically frugal pattern of foraging that relies on visual prey location" and detection of prey-produced sounds.

All Arizona records are from below 1,220 m (4,000 ft), with most below about 7,625 m (2,500 ft). Populations are known from inactive mines in most, if not all, of the mountain ranges in Pima County, including Tucson Mountain Park south of the Town (RECON 2002).

3.3.5.3 Great Plains Narrow-mouthed Toad

The Great Plains narrow-mouthed toad is an AZGFD WSC and is protected by ARS Title 17.

This toad spends most of its life underground during daytime during the summer rainy season and emerges from underground at night to breed in deeper pools surrounded by mesquite and grasses, and to feed (on ants). It is known to occur from mesquite semi-desert grassland to oak woodland, in the vicinity of streams, springs, and rain pools.

Until recently, this species was thought to be extirpated from the Tucson area, but has recently been discovered at several localities along the Santa Cruz River as far north as Columbus Park and in the Tucson Southlands on floodplains of the northeastern bajada of the Santa Rita Mountains (RECON 2008a). Should habitat restoration projects be implemented, improved habitat and potential for occurrence of this species in the Town may increase.

3.3.5.4 Tropical Kingbird

The tropical kingbird is an AZGFD WSC and protected by the MBTA and ARS Title 17. Southeastern Arizona provides summer breeding grounds and is the northernmost extent of the range for this species—it is known to occur on the Santa Cruz River.

The tropical kingbird occurs in riparian lowlands and often nests in cottonwoods. It is also known from open areas with scattered trees and agricultural lands (AZGFD 2003b). This species apparently coexists well with humans, and its range has expanded into human-modified landscapes. This species has been documented by the TAS at the Pinal Air Park Pecan Grove, which is just outside the Town limits.

3.3.5.5 Desert Night-Blooming Cereus

The desert night-blooming cereus is salvage restricted (SR) by the Arizona Native Plant Law. This unusual and cryptic cactus has gray withered stems above ground that look like dead sticks and a huge tuberous root below ground. It is especially well disguised, growing under not only desert shrubs and trees, especially creosote, but also mesquite, paloverde, and ironwoods. All individuals in a particular area bloom on one evening (usually mid-June), and the huge white blossoms are pollinated by the white-lined sphinx

moth. This species is known to occur throughout the desert areas, especially in creosote flats, in and around the Town, at elevations of 305 to 1,067 m (1,000 to 3,500 ft).

3.3.5.6 Kelvin Cholla

Kelvin cholla is SR by the Arizona Native Plant Law. This is a hybrid between cane cholla (*Cylindropuntia spinosior*) and chain-fruit cholla (*Cylindropuntia fulgida*) that grows in areas of desert scrub and the edges of desert grasslands, on rocky flats and slopes or rolling hills (Pinkava 1999). It is known from Gila, Pima, and Pinal counties at elevations of 549 to 945 m (1,800 to 3,100 ft). It can be expected to occur in the Town, and is known to be present in areas of Avra Valley (Wiens 1998) as well as in the Tucson Mountains (Rondeau et al. 1996).

3.3.5.7 Pima Indian Mallow

Pima Indian mallow is SR by the Arizona Native Plant Law. This weakly shrubby mallow species occurs in mesic areas in full sun within higher elevation Sonoran desert scrub, transition zone of upper Sonoran grassland communities, and Sonoran deciduous riparian forest to the Arizona Upland Subdivision. It is found on rocky hillsides, cliff bases, lower side slopes, and ledges of canyons among rocks and boulders (AZGFD 2000).

This species is known to occur in the Santa Catalina, Rincon, Silverbell, Tortolita, and Tucson mountains, and is threatened by mining, grazing, and recreation activities (AZGFD 2000). Within the Town, it can be expected to potentially occur on the southwestern flank of the Tortolita Mountains at elevations between 914 to 1,006 m (3,000 and 3,300 ft).

3.3.5.8 Staghorn Cholla

Staghorn cholla is SR by the Arizona Native Plant Law. Staghorn cholla is relatively common in desert scrub, desert flats, washes to rocky hillsides, and canyons in Pima, Pinal, and Santa Cruz counties between 579 to 1,311 m (1,900 and 4,300 ft) in elevation (Pinkava 1999). It can be expected to occur in the Town and is known to be present in areas of Avra Valley (Wiens 1998) as well as in the Tucson Mountains (Rondeau et al. 1996).

3.3.5.9 Thornber Fishhook Cactus

Thornber fishhook cactus is SR by the Arizona Native Plant Law. This species is a clumping pincushion cactus that grows at the base of creosote or bursage shrubs within the Sonoran Desert, usually in deeper soils of valleys and lower bajadas (Johnson 2004). This is an attractive species that is susceptible to recreational poaching.

Johnson (2004) notes that although this species can be locally abundant, its populations are scattered across the landscape from west of Tucson to Organ Pipe Cactus National Monument and from north of Tucson into Pinal and Maricopa counties. Within the Town, it could be expected in the western lowlands.

3.3.5.10 Tumamoc Globeberry

Tumamoc globeberry is SR by the Arizona Native Plant Law. It is a vine that grows in the shade of a variety of nurse plants along gullies and sandy washes of hills and valleys in Sonoran Desertscrub. It grows actively during the summer rain season and twines through desert shrubs and trees, dying back as temperatures get cooler. This is a perennial species with a large underground tuber, allowing it to send up new stems each year (AZGFD 2004).

Tumamoc globeberry can be expected to occur in the Town in areas of natural Sonoran Desert vegetation, especially along washes.

3.3.6 Invasive Species

Invasive species can be plants or animals that negatively impact native plants and animals by increasing competition and stress, changing fire patterns, introducing predation, and spreading disease. Invasive plant and animal species control has emerged as a significant concern in the Town and elsewhere in Arizona, especially in the past few years. Several invasive non-native species are present within the Town, and these species can be expected to increase in number and distribution over the life of the Town HCP. An invasive plant species survey of the road network within the Town conducted in July and August 2007 identified nine invasive plant species including buffelgrass (*Pennisetum ciliare*), Lehmann lovegrass (*Eragrostis lehmanniana*), Johnsongrass (*Sorghum halepense*), Russian thistle (*Salsola kali*), Bermuda grass (*Cynodon dactylon*), barnyard grass (*Echinochloa crus-galli*), tree tobacco (*Nicotiana glauca*), giant reed (*Arundo donax*), and salt cedar or tamarisk (*Tamarix* spp.) (RECON 2008b). Giant reed is an invasive species that occurs in areas along the Santa Cruz River.

In March 2008, the Town participated in a regional "Buffelgrass Eradication Day" by recruiting citizen volunteers to conduct buffelgrass removal within the Town. The activity also served to raise awareness of the threat that buffelgrass poses to our desert environment. The Northwest Fire District's Ironwood Hot Shot Crew has also volunteered clearing buffelgrass within the Town limits. The Town conducted two additional volunteer buffelgrass pulls in 2008 and will continue to hold these events monthly. Cooperative efforts such as the Pima-Santa Cruz Basin Cooperative Weed Management Area (formed in 2006) are needed, if real prevention and control are to be effective.

Control of invasive animals, especially in riparian areas and wetlands, is also important to the success of the HCP. Specifically, the control of species such as bullfrogs and crayfish could be critical to the success of any potential reoccupation or reintroduction into the Santa Cruz River of native species, such as lowland leopard frogs or Mexican garter snakes.

Although bullfrogs and crayfish were widely introduced starting in the 1920s, it was not until the 1980s that scientists determined that they contributed to the loss of native fish, frogs, and snakes. Bullfrogs are also known to kill native water snakes, bats, birds, and other creatures. The major avenues for the spread of aquatic invasive species are humans who dump unwanted aquatic fish and snails into ponds, such as those at Agua Caliente Park, move creatures from one location to another in bait buckets or fishing equipment, and/or who host species such as bullfrogs in their backyard ponds from which the frogs may escape to other aquatic locations (bullfrogs can easily travel several miles overland in search of suitable habitat [Tangley 2003]).

Other problematic species include feral dogs and cats which can kill or wound native lizards, rodents, and birds. Feral dogs also serve to spread parasitic worms, giardia, tick fever, and rabies into wild mammal populations. Feral dogs are a well-documented problem in the Las Cienegas National Conservation Area, in the San Xavier District of the Tohono O'odham Nation, on ranchlands, and elsewhere. Feral cats are especially problematic at the urban/wildlife interface, in large part because there are no leash laws as there are for dogs, and nothing limits their hunting from extending into public preserves and natural areas.

3.4 Land Ownership and Use

This section discusses urban land uses in terms of existing distribution of population, future projections in growth and growth areas, and the regulatory framework for land use within the Town. Information here is based on the Town 2007 General Plan (Town 2007a).

3.4.1 Existing Distribution of Population and Land Use

3.4.1.1 Population

Since the Town incorporated in 1977, its population increased significantly (Table 3.6). Between 1980 and 1990, the Town's population grew to 2,187, an increase of 521 residents or 31 percent. From 1990 to 2000, population grew to 13,556 residents and nearly 5,000 households, a 520-percent increase. From 2000 to 2007, the population increased to an estimated 36,435 residents, a 169-percent increase. From 2000 to 2006,

the Town was the 8th fastest growing city in Arizona (out of 90 incorporated cities) with a 124.5-percent increase in population.

**TABLE 3.6
 REGIONAL POPULATION GROWTH 1977–2007**

	1977	1980	1990	2000	2007
Marana Incorporated Area (square miles)	10	29	59	74	120
Marana Population	1,512	1,674	2,187	13,556	36,435
Population per Square Mile	151	58	37	183	253
Percent Change (Population) From Previous Period	-----	+11	+31	+520	+169

Source: Year 2000 Census, Pima Association of Governments, Town 2007a

3.4.1.2 Land Use

The Town's population growth since 1977 is the result of both annexations and the development of master-planned communities. When incorporated in 1977, the Town limits included 10 square miles. By 1980, the Town grew to 75 square kilometers (sq km) [29 square miles (sq mi)], which was a 300-percent increase, and by 1990 it expanded to 153 sq km (59 sq mi), a 100-percent increase for the decade. A large area of State Trust Land to the northeast was added in early 2002, for a total of approximately 306 sq km (118 sq mi), or over 30,958 ha (76,500 ac).

Within the Town's current boundaries, over 60 percent of the land area (both public and private ownership) is currently vacant or undeveloped. In addition, 15 percent of the land area is devoted to active agricultural production and ranching. The ASLD is a major landowner in the Town, with ownership of approximately 60 percent of undeveloped lands within current Town boundaries (Town 2007a).

Existing land uses within the Town include natural undisturbed desert areas, farm and ranching lands, and residential, commercial, and industrial development (Figure 3.3, Table 3.7). Recent growth has been characterized by development of master planned communities such as Dove Mountain in the northeast, Continental Ranch and Continental Reserve in the south, and Gladden Farms and Rancho Marana in the northwest.

Existing development along Interstate 10 is characterized by major commercial and industrial uses with neighborhood commercial centers developed at major road intersections. These uses include hospitality, business and industrial parks, and recreational facilities in the south area of the corridor. Older, lower-density residential and commercial development is located in and near the traditional town area where many of the Town's pioneer families settled.

The lands west of Interstate 10 are dominated by traditional family farms and agricultural activities, while the Tortolita Fan east of the CAP retains large areas characterized by steep slopes, natural drainage ways, native vegetation, and floodplains which provide NUOS and wildlife habitat, as well as areas for livestock grazing.

The majority of State Trust Lands east of the CAP are leased for grazing (ASLD 2008). The Town does not hold any grazing leases. According to the U.S. Department of Agriculture's (USDA) agricultural census, the number of cattle in Pima County has steadily declined by approximately 50 percent between 1992 and 2002 (51,000 head in 1992; 26,000 head in 1997 and 2002), with current levels even lower (RECON 2006).

**TABLE 3.7
EXISTING LAND USE**

Type of Land Use	Town	Percent of Total
Airport	237 ha (585 ac)	0.8
Commercial	399 ha (985 ac)	1.3
Industrial	443 ha (1,095 ac)	1.4
Parks, Recreation, and Open Space	1,760 ha (4,350 ac)	5.7
Public/Institutional	992 ha (2,450 ac)	3.2
Residential Detached Single Family	1,570 ha (3,880 ac)	5.1
Residential Manufactured Home	93 ha (230 ac)	0.3
Residential Multi-Family	16 ha (40 ac)	0.1
Total Developed	5,510 ha (13,615 ac)	17.7
Agriculture	4,648 ha (11,485 ac)	15.0
Rivers, Major Washes and Drainage Channels	1,728 ha (4,270 ac)	5.6
Vacant/Undeveloped	19,172 ha (47,375 ac)	61.7
Total Undeveloped	25,528 ha (63,130 ac)	82.3
Grand Total	31,058 ha (76,745 ac)	100

Source: Town 2007a

Planned communities in the northeast, including Dove Mountain, Saguaro Ranch, and Sky Ranch, have evolved in response to those natural conditions with less intense development. In addition, the Tortolita Preserve with 971 ha (2,400 ac) within the Tortolita Fan was set aside for preservation in 2001 as part of the Dove Mountain development project. Additional land uses within the Town include the Marana Regional Airport, and sand and gravel mining operations within the Santa Cruz River.

The PCRFC is the primary landowner along the southern reach of the Santa Cruz River and Canada del Oro Wash. There are IGAs between the Town and the PCRFC for drainage maintenance in these areas.

3.4.2 Future Distribution of Populations and Land Use

3.4.2.1 Population

The estimated population growth of the Town indicates that the significant increases of the past will continue into the future, particularly through 2015. The Town's population can be expected to grow to over 60,000 by 2015 and over 96,000 by 2035 (Table 3.8) (Arizona Department of Commerce 2007).

TABLE 3.8
TOWN'S POPULATION PROJECTIONS 2010–2035

Year	Population Projection
2010	43,352
2015	60,809
2020	72,915
2025	82,252
2030	89,761
2035	96,190

Source: AZ Dept. of Commerce 2007

3.4.2.2 Land Use

Future development in the Town will include a variety of land development to meet increasing demands for housing; commerce; employment; schools and churches; parks, recreation, and open space; and other public services (Figure 3.4 and Table 3.9). Over the next 25 years, up to 19,430 ha (48,013 ac) of land development is planned in the Town. Much of the Town's land area is anticipated to be developed with residential uses over the next 20 years. Development of community retail and service uses for the growing population will keep pace with the residential growth. Additional land will be needed for industrial uses and employment. As development occurs, agricultural uses will be replaced until they are no longer occurring on private lands within the Town. Livestock grazing leases on State Trust Lands would likely continue until such a time that the parcels are sold at auction. The Town would not control or manage any grazing on State, Town-owned, or private lands under any of the alternatives evaluated.

The Town continues to promote expansion of commercial and industrial projects along the Interstate 10 corridor, around the Marana Regional Airport, and in selected areas dispersed throughout the community to better serve neighborhoods with jobs, goods, and services. The Interstate 10 corridor is important as the Town's main arterial roadway, the primary link between north and south areas of the Town, and a major gateway to the community. For residents, the interstate is an important connection to Tucson and Phoenix. Visitors and travelers derive their first impressions of the Town, and residents derive daily impressions from views along the corridor. Areas along

Interstate 10 are particularly appropriate for commerce parks, industry, tourist services, and warehousing.

**TABLE 3.9
 TOWN'S FUTURE LAND USE**

Type of Land Use	Town	Percent of Total
Airport	874 ha (2,160 ac)	3
Commercial	1,554 ha (3,840 ac)	5
Industrial	3,031 ha (7,490 ac)	10
Rural Density Residential	9,239 ha (22,830 ac)	30
Low Density Residential	4,055 ha (10,020 ac)	13
Medium Density Residential	2,058 ha (5,085 ac)	7
Mixed Rural	83 ha (205 ac)	<1
Park/Open Space	1,388 ha (3,430 ac)	4
Town Center Planning Area	644 ha (1,590 ac)	2
Master Planning Area	8,128 ha (20,085 ac)	26
Total	31,058 ha (76,745 ac)	100

Source: Town 2007a

The Town has identified in its 2007 General Plan three major growth areas within the HCP Permit Area that can expect significant development activity. Key features of the three areas—south, northeast, and northwest—are detailed below.

The south area contains several existing master-planned communities and residential subdivisions. Commercial facilities to serve these communities are located along major transportation corridors. Key features of this area include:

- Completion of existing master-planned communities such as Continental Ranch, Continental Reserve, Pima Farms, Pima Farms North, and Cortaro Ranch
- New master-planned communities such as Cascada, DeAnza, and Saguaro Springs
- Corridor commercial activities along Interstate 10, Ina Road, Thornydale Road, and Orange Grove Road
- Employment-based industry

The northeast area has significant, environmentally challenging areas that constrain development. This area will see future development that will include land preservation, limits on land disturbance, and projects that will be carefully integrated with the natural conditions. Master-planned communities will generally be low-density and/or clustered development which respond to the environmental constraints and are integrated with significant open space. A significant portion of the land may be preserved as NUOS to preserve habitat and resources. Significant population growth and new development will

be channeled away from this area into the more developable target growth areas. Key features will include:

- Master-planned communities incorporating clustered development
- Large lot custom homes
- Resort development
- Significant open space, trails, and recreational amenities

The northwest area has been targeted as the prime growth area in the next decade. Recommendations for land use, transportation, and other growth factors involve these key features:

- Town Center
- Master-planned communities
- Commercial and industrial uses along the Interstate 10 corridor
- Commercial and industrial development surrounding the Marana Regional Airport

Development of a viable Town Center in the northwest area will include 644 ha (1,590 ac) of land lying between Interstate 10, Sanders Road to the west, and Barnett Road to the south. The Town Center is intended to be a focal point of public and private commerce surrounded by medium- and high-density residential neighborhoods with strategically located community facilities. Existing land uses in this area include older commercial businesses along Sandario Road, several residential areas, the Marana Municipal Complex, Estes Elementary School and Marana Middle School, churches, and agricultural fields. Future development plans will bring high-density residential and major commercial development to the area.

The Town Center is included within an area designated as the Marana Single Central Business District (CBD). Extending along Interstate 10 from Marana Road to Tangerine Road, the CBD will include higher density mixed-use, transit-oriented development.

3.4.3 Recreation

3.4.3.1 Existing Recreation Facilities

The Town of Marana Park, Trail, and Open Space System Master Plan, adopted in 2000, provides the framework for park acquisition and development. Current park and recreation opportunities include four golf courses (one under construction); two district parks (one under construction); six neighborhood parks; several other parks under

construction; and various pedestrian, bicycle, and equestrian trails (Figure 3.5). Components of the existing system of parks and outdoor recreation facilities include Ora Mae Harn Park near the Marana Municipal Complex; 174 ha (430 ac) including Pima County-owned and operated parks, 193 ha (478 ac) of undeveloped Pima County park sites, 138 ha (340 ac) of public use facilities associated with school campuses and several private recreation facilities. The Town also began construction of the Silverbell–Cortaro Regional Park in 2007. The park is located along the Santa Cruz River adjacent to the Wheeler Taft Abbott, Sr. Library, completed in 2008. The park includes 19 ha (48 ac) of active uses, playfields, family recreation facilities, a dog park, an equestrian staging area, and archaeological interpretive areas (Town 2007a).

The existing trail system in the Town consists of trails that were identified by the 1996 *Eastern Pima County Regional Trail System Master Plan* (Pima County Ordinance 1996–75), adopted by the Marana Town Council in 1997. Two new trails have been developed along the Santa Cruz River corridor, with one from Coyote Trails Elementary School to El Rio Park and another from Sanders Road to Marana Heritage Park. The Juan Bautista de Anza National Historic Trail also parallels the Santa Cruz River.

To date, over 39 km (24 mi) of trails have been completed in the Tortolita Mountains, the Tortolita Preserve, and other areas for hiking, mountain biking, and equestrian recreation. Annexed in 2002, a portion of the Tortolita Fan was set aside with a 99-year lease of 971 ha (2,400 ac) to establish the Tortolita Preserve, an area to be managed by the Town for wildlife habitat preservation.

The Marana Arts Council establishes and maintains awareness and appreciation of the diverse traditional and cultural arts in the Town. The Council accomplishes these goals with a strong commitment to and participation in a variety of community-based arts events and educational programs for all age groups. They work with Town policy makers in determining public art needs and opportunities. This partnership, in cooperation with input from citizens, will drive the creation of a theme and implementation strategy for the Town's public art facilities.

The *Marana Regional Airport Master Plan Update*, adopted in 2007, provides policies for the continued support of the recreational aviation events at the airport. The skydiving center hosts a number of annual competitions and exhibitions as well as training sessions.

3.4.3.2 Planned Future Recreation Facilities

The *Trail and Open Space System Master Plan* is being updated as part of the *Parks and Recreation Master Plan* due in 2009. The 2009 update will specify park acreage needed for future population growth and include standards for a variety of recreational facilities. Specific facilities being developed or planned (Figure 3.5) include the Marana Cultural and Heritage Park, designed to tell the story of the Town's past and to

celebrate, honor, and interpret the community's history and culture. The park is located within the Marana Heritage River Park, an area of 101 ha (250 ac) along the Santa Cruz River north of the Town.

The Barnett Linear Park, planned along the existing Barnett Road alignment from Interstate 10 to the Santa Cruz River, will provide recreation as a major linear park. The Town is also actively working with Pima County and the BOR to develop 202 ha (500 ac) of Federal land for the Marana Regional Sports Complex east of the Marana Regional Airport. The plan includes soccer fields, baseball and softball fields, equestrian facilities, a skate park, and trailheads. The use of airport facilities for aviation-related recreation can also continue and expand as needed.

The Town envisions an interconnected trail system throughout the community that will link developed areas to river trails and extend to surrounding preserves. The proposed trail along the CAP canal will provide a continuous pathway through the Town, providing a connection from the Tortolita Mountains to the Tucson Mountains.

The spine of the Town's trail system will be the Santa Cruz Linear Park, with regional trails provided along the CAP canal, the Rillito River, Cañada del Oro Wash, and Wild Burro Wash. The Santa Cruz River Corridor Plan, which covers approximately 27 km (17 mil) of river corridor within the Town, calls for development of two primary trails to provide uninterrupted trail connections for the full length of the corridor. One trail will be for biking and pedestrian use, and another will be for equestrian use. Key trail elements include parking and staging areas with trail access points.

The Town also requires developers to integrate recreation facilities and open space into their developments and to contribute on-site recreation facilities as well as an impact fee for each residence toward off-site recreation facilities. Town staff will continue to require park donations in the future and create partnerships with developers to achieve park and recreation goals.

These new facilities are included as covered activities within the HCP since they will result in impacts from construction (permanent removal of native vegetation, construction noise) and long-term recreation use (lighting, organized sports, biking, hiking, bird watching, and pets). Impacts would likely be greatest at the sports complex and least along the linear parks and trails.

3.4.4 Prime and Unique Farmlands/Community Heritage

3.4.4.1 Prime and Unique Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, and other agricultural crops. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. Prime or unique farmlands are designated by the Natural Resource Conservation Service (NRCS) of the USDA and are subject to protection under the *Farmland Protection Policy Act* (P.L. 97-98, Sec. 1539-1549; 7 U.S.C. 4201 et seq.).

Active farmlands under irrigation in the Town are determined to be either prime or unique (pers. comm. Stephen Smarik, USDA NRCS, May 13, 2008). However, Federal permitting for activities on private or non-Federal lands is not considered a 'Federal Program' under the *Farmland Protection Policy Act* (49 FR 27724). Therefore the issuance of an ITP would not be subject to the requirements of the *Farmland Protection Policy Act*.

3.4.4.2 Community Heritage

Although a relatively young municipality, the community has a long and rich history with more than 4,200 years of continuous human occupation in the Town and the surrounding middle Santa Cruz Valley. Long before the arrival of the Spanish conquistadors and missionaries in the 17th Century, the area was inhabited by the Hohokam people who developed extensive canal systems and used waters from the Santa Cruz River to irrigate crops.

The first European to arrive in the Town area was a Jesuit priest, Father Eusebio Francisco Kino in 1694. In 1775, Juan Bautista de Anza, captain of the Presidio of Tubac led an expedition north along the Santa Cruz River to found the city of San Francisco. With the area under the jurisdiction of the United States in 1854, prospectors seeking mineral riches intensified their efforts in the region. Gold was not discovered in abundance, but by 1865, high-grade copper ore was being shipped from mines in the Silver Bell Mountains. With the early establishment of mining and ranching, it was not until the First World War that the Town became primarily an agricultural center, producing mainly cotton, but also wheat, barley, alfalfa and pecans.

The Town's rural heritage is reflected in traditional family farms and agricultural activities that continue on many hectares of land historically used for agriculture. The importance of this heritage is reflected in the Town's motto: "Committed to the future, inspired by our past."

3.4.5 Mineral Resources and Mining Activities

Excavation of sand, gravel, and other aggregates is one of the activities allowed within the floodway of the Santa Cruz River under Title 21 (Flood Plain and Erosion Hazard Management) of the Town's Land Development Code. Because of the high demand for readily available aggregates for paving, building, and landscape materials, numerous operations extracting the alluvial deposits of the Santa Cruz River basin have operated and continue to operate within the Town.

While Arizona mines are subject to relevant Federal laws which regulate claims processes, State law (specifically Title 11 [Mines] of the Arizona Administrative Code) regulates land lease agreements, access, and inspections. This Title requires a post-mining land use and site reclamation plan to include procedures to aid in the development of vegetation consistent with the proposed post-mining land use objective such as grazing, wildlife habitat, or forestry. The plan is also required to contain a timetable and financial assurances for accomplishing successful reclamation. Permitting and a reclamation plan are also required by Title 21.05.08 of the Town of Marana LDC and Chapter 9-10 of the Municipal Code.

3.5 Infrastructure

This section discusses the existing infrastructure in the Town, including transportation, utilities, and flood control, as outlined in the 2007 General Plan.

3.5.1 Transportation

3.5.1.1 Existing Transportation Network and Facilities

The Town's roadway network comprises approximately 29 freeway km (18 freeway mi), six interchanges maintained by the Arizona Department of Transportation (ADOT), and approximately 201 km (125 mi) of Town-maintained surface streets. The Town's existing arterial road network consists largely of roads along section lines that were originally built prior to creation of the Town. These roads are regionally significant and serve residents of both the Town and unincorporated areas of northwest Pima County and the Town of Oro Valley.

The Union Pacific Railroad Sunset Route provides freight rail service and parallels Interstate 10 for its entire diagonal length through the Town. The route is planned to be double-tracked, with some sections already completed. There are limited possibilities for industry-serving spurs or sidings. The railroad operations significantly impact both the Town surface street system as well as Interstate 10. The only existing grade-separated crossing for the Union Pacific Railroad is located at Orange Grove Road.

Planned improvements to the existing interchanges at Ina Road, Tangerine Road, Marana Road, and future interchanges at Twin Peaks Road and the future Tortolita Boulevard will provide grade-separated railroad crossings.

The Marana Regional Airport, a general aviation facility, maintains two runways and terminal facilities, and serves as a designated reliever airport for Tucson International Airport.

Mass transit in the Town is limited due to historically low ridership and long route distances. Public transit in the Town is now provided through a contractual agreement between the Town and Pima County for Sun Tran service and the Marana Rural Route. Sun Tran services include three routes to serve riders from the Town to and from downtown Tucson.

3.5.1.2 Planned Transportation Network and Facilities

New freeway interchanges are proposed at Twin Peaks/Linda Vista Roads (scheduled to begin construction in early 2009), east of the existing Pinal Interchange at Tortolita Parkway, and at Moore Road alignment.

Modifications to existing interchanges will be necessary in coordination with road widening at key locations. Improvements for Tangerine Farms Road west of Interstate 10 were completed in 2008. Interchange improvements at Tangerine Road are planned for the future. Marana Road interchange improvements are also planned as part of the Town's long-range transportation network.

The 2001–2025 Transportation Plan Update for the Town identifies 229 km (142 mi) of public road projects planned for the next 20 years. These road improvements include the construction of approximately 351 lane km (218 lane mi) of new roads over the next 20 years, widening of approximately 266 lane km (165 lane mi) of existing roads, and resurfacing of existing roads. Improvements to arterials west of Interstate 10 include Silverbell Road, Sandario Road, Sanders Road, Tangerine Farms Road, and Lockett Road. Dove Mountain Boulevard, Camino de Mañana, and Thornydale Road will require improvements to provide adequate traffic capacity east of Interstate 10.

Four existing roads and two future roads will cross the Santa Cruz River; new bridges, associated grade control, bank protection along the Santa Cruz River, and channel modification are planned as a part of these projects. Table 3.10 lists all of the anticipated projects according to type.

Given the anticipated population increases in the Town and Tucson, air traffic as well as plane size and weight are expected to increase over the next 25 years. The airport intends to accommodate these increases through the improvement of existing runways

and taxiways and associated lighting, construction of a new runway, and construction of new hangars and parking facilities, among other projects.

**TABLE 3.10
 ANTICIPATED ROADWAY TRANSPORTATION PROJECTS IN THE TOWN**

Project Type	Total Extent of Projects
Road widening	266 lane km (165 lane mi)
New roads	351 lane km (218 lane mi)
Bridges	15,155 sq km (163,125 sq ft)
Grade control structures	44,069 sq km (474,350 sq ft)

3.5.2 Utilities

There are a number of utility infrastructure assets within the Town, including overhead electric transmission and distribution lines; underground water, sewer, and natural gas pipelines; cable television and telephone lines; and cellular telephone transmission towers. The most conspicuous utility assets in the Town are electric transmission and distribution lines owned by Tucson Electric Power (TEP) and by Trico Electric Cooperative. The largest of these are 27 m (90 ft) tall towers that support 138-kilovolt (kv) transmission lines owned by TEP. These towers are parallel to and approximately 46 m (150 ft) east of the Union Pacific Railroad (UPRR). Electrical distribution lines on standard wooden utility poles also parallel much of the road network within the Town. Additionally, three high-pressure petroleum pipelines and various fiber optic communication lines are within a utility right-of-way parallel to the UPRR tracks.

The Town is served by two public water providers; the Marana Water Department generally serves western areas of the Town and the City of Tucson Water Department serves eastern areas. The Town envisions that in the future potable water for all residents will be supplied by a single, comprehensive, municipal entity, such as the Town of Marana Municipal Water Department. The Town's Municipal Water System includes 16 potable water wells pumping from 34 to 73 m (110 to 240 ft) below the surface of the earth from the aquifer. The water from those wells is stored in reservoirs where it is minimally chlorinated and then pumped through pipelines to reach residences and businesses. The balance of the Town's water users are served by Tucson Water, franchised private water companies, or private wells. The CMID also operates various wells to supply irrigation water for agricultural uses (Town 2007a).

Determination from the ADWR concerning the quantity and quality of water available for any development confirms that water of sufficient quality will be physically, legally, and

continuously available for the next 100 years. The Marana Water Department meets those criteria and is a Designated Water Provider.

Additional water plant and pipeline construction is anticipated in order to meet the needs of continued growth within the Town.

Sewage generated from residential, commercial and industrial uses within the Town is collected and transported to Pima County's Ina Road and Marana WWTF for treatment and disposal. The Ina Road WWTF, managed by Pima County, also serves the City of Tucson and other County generators. The Marana WWTF serves the rest of the Town and is currently rated to treat up to 2.6 million L (700,000 gal) of wastewater per day. A portion of households in the Town rely on private septic systems. While wastewater management in the Town is currently provided by Pima County, it is being transitioned to the Town. Where possible, new developments will be served by public sewer, and stricter regulations will be applied to new septic systems and their use.

3.5.3 Flood Control

Flood control infrastructure consists primarily of stormwater detention basins to attenuate flood flows, modifications to stabilize or clear channels, and bank protection to mitigate against soil erosion and scour. Bank protection consists of, but is not limited to, soil stabilization by dynamic compaction and soil-cement stabilized earth. Bank protection can also be accomplished with the use of geotextiles, gabions, rip-rap lined banks, and shotcrete protection.

While some of the downstream reaches of the Santa Cruz River in the Town have a natural floodplain several hundred feet wide, much of the river is constricted in places by bank protection. The PCRFC is the primary landowner along the southern reach of the Santa Cruz River and Canada del Oro Wash. There are IGAs between the Town and the PCRFC for drainage maintenance in these areas.

Through Continental Ranch nearly to Avra Valley Road, both banks are protected with soil cement delineating both a low-flow channel and a larger overbank area designed to contain a 100-year flood event. From Avra Valley road to Sanders Road, a levee protects the north/east bank, while natural floodplain conditions are maintained on the south/west bank, except near the CAP canal and Sanders Road bridge. Downstream of Sanders Road, no structural flood control improvements have been made except near bridge crossings (Myers 2001).

In July 2007, the Town completed 2 km (1.3 mi) of soil cement bank protection on the south/west bank of the Santa Cruz River between the Yuma Mine Wash and Cortaro Road as part of the development of a regional park that was authorized in Pima County's 1997 General Obligation Bond election. This project will provide protection from 100-

year flood events for the development occurring in the northern half of the project limits and 10-year erosion protection for the southern half of the project limits.

Future development in the Town will likely require the bank protection along the remainder of the Santa Cruz River and creation of new drainage channels in what is now agricultural land in the northwest part of the Town. If bank protection is added to all remaining sections of the Santa Cruz River within the Town, it would include approximately 2,947,225 sq m (31,723,671 sq ft) of bank protection. Locations and number of channels are unknown, but the channels will be located in existing agriculture or other disturbed areas. One such channel is the Barnett Linear Channel. It will be a 61 m (200 ft) wide drainage structure 5.6 km (3.5 mi) long designed to carry flood water from the Tortolita Fan to the Santa Cruz River. The channel will be constructed to also serve as a recreational facility on the eastern end of the project near Interstate 10.

3.5.4 Operations and Maintenance

Maintenance of existing facilities is needed to protect the integrity of existing infrastructure. Examples of such routine activities include general operation, routine maintenance, and minor construction activities for existing roads, erosion control activities, vegetation management control activities, pest control activities, removal of sediment from water control structures, and flood control channel maintenance.

3.5.4.1 Road Maintenance

Road-maintenance activities are required to keep the roads and associated structures, such as ROWs, landscaping, signs, and bridges in good repair and working condition. Minor improvements undertaken during the normal process of performing these activities are also included. Maintenance activities relating to the road system and associated facilities include inspection activities, pavement rehabilitation, right-of-way maintenance, sign installation, landscaping maintenance, trash pick-up, grading of road shoulders, structure maintenance, culvert cleaning, street sweeping and striping, painting and graffiti removal, weed control, and storm and flood response.

3.5.4.2 Park and Trail Maintenance

Maintenance activities required for the parks system includes maintaining existing irrigation, drainage, and related facilities in good repair and working condition. Minor improvements undertaken during the normal process of performing these activities are also included.

Other maintenance activities include management of open space and trail maintenance. Open space within park areas is maintained through irrigation, routine mowing of grass, and trash collection. Weeds are controlled in grassy open spaces of parks with

herbicides. Maintenance of trails includes routine trash patrol along trail routes, sign mending, and repair of vandalized sites and wash-out areas. Trail maintenance will occur on regional park trails, trail connections to Saguaro National Park, and the Tortolita Mountain trail system within the Town.

3.5.4.3 Water Infrastructure Maintenance

Pipeline and Valve Maintenance

Maintenance activities associated with pipelines and valves include valve exercising, marking blue-stakes for main locations, routine hydrant and main flushing, chlorine residual and bacteriological testing, and routine inspections to ensure that the existing facilities are in good repair and in working condition. These activities are generally performed quarterly by one- to two-person crews with light trucks (1 ton or less).

Pipeline and Valve Repairs

Pipeline and valve repairs include repairing mainline breaks and the replacement of leaking and/or failing valves. The ground disturbance associated with these activities is usually limited by easement width or within public rights-of-way. These activities are not regularly scheduled and typically are performed on an emergency basis. Construction crews usually consist of 2 to 10 people. Project duration typically is less than one week, but can be much longer in extreme cases. Repair or replacement can include aboveground installation of temporary pipelines to maintain service.

3.5.4.4 Airport Maintenance

The maintenance of the runways, taxiways, and apron areas consist of daily inspections and sweeping of the paved areas. The shoulders of these areas also are maintained with fill dirt as needed to ensure proper drainage without having more than a 2.5 cm (1 in) drop off the edges of pavement. The airport lighting system is inspected daily and weekly, and fill dirt also is used as needed to ensure that there is not more than a 2.5 cm (1 in) rise to the lights in the shoulder areas. The lighting and shoulder areas of all pavements are sprayed to prohibit all plant growth for visibility around the low-level airport lights. All other areas of the airport property are mowed to ensure minimum plant growth around the airport.

3.6 Socioeconomics

The Town limits reflect the many changes and transitions that have occurred since its incorporation in 1977. Older, low-density residential and commercial development is located in and near the traditional town area where many of the Town's pioneer families

settled. West of Interstate 10, the Town's rural heritage is reflected in traditional family farms and agricultural activities that continue on many hectares of land historically used for agriculture (Town 2007a).

Recent growth has been characterized by development of master-planned communities such as Dove Mountain in the northeast, Continental Ranch and Continental Reserve in the south, and Gladden Farms and Rancho Marana in the northwest. There have also been several large planned communities entitled for future development, including the Villages at Tortolita and Cascada in the northeast and Sanders Grove in the northwest. Industrial and commercial uses have largely followed the Interstate 10 corridor with neighborhood commercial centers developed at major road intersections (Town 2007a).

This section presents information with respect to existing social and economic resources within the Town. The following discussion describes existing demographic and economic conditions, and the relative importance of its strongest employment sectors. The discussion includes the Town population characteristics, the local economy, housing trends, and future projections.

3.6.1 Demographics

3.6.1.1 Population

Since the rural farming community of 1,512 people was incorporated in 1977, the population in the Town has increased to an estimated 36,435 residents. A more detailed discussion of population levels and trends is presented in Section 3.4.1.1

3.6.1.2 Age and Ethnicity

The Town area was originally home to the Hohokam Culture (550 to 1450 A.D., ancestors of the present day Tohono O'odham). This culture was heavily influenced by the arrival of the Spaniards and Apaches in the 1600s. Mexico gained jurisdiction over the Town area until 1854, further mixing the population. The area became part of the United States with the Gadsden Purchase, leading to the opening of the transcontinental corridor for the Southern Pacific Railroad, which brought miners, soldiers, farmers, and ranchers to the area (Town 2008). Current ethnic diversity and age characteristics are presented in Table 3-11.

In 2000, the median age of the Town's 13,550 people was 34.5 years. The average household size was 2.66 persons and the average family size was 3 persons. The Town's population is diversified, with several neighborhoods of low- to moderate-income families, several large regions of middle class working families and some golf communities which are characterized by age-restricted and non-restricted middle- to upper-income families (Town 2008).

**TABLE 3.11
ETHNIC DIVERSITY AND AGE CHARACTERISTICS OF THE TOWN'S POPULATION**

General Population Characteristics	Percentage of Population
Age	
Under 5 years	8.6
18 years and over	73.3
65 years and over	9.5
Ethnicity	
White	81.8
Black/African America	2.9
Native American	2.1
Asian	2.5
Native Hawaiian and other Pacific Islander	0.1
Some other race	7.5
Two or more races	3.1
Hispanic or Latino	19.6

3.6.2 Employment and Economic Activity

3.6.2.1 Employment

The estimated average household income in 2006 for the Town was \$62,747 per year (Town 2008). The Town's employment base includes agriculture, construction, manufacturing, wholesale trade, retail trade, transportation, and information systems. Major employers in the Town area include Marana Unified School District, the Town, Evergreen Air, Arizona Portland Cement, and CTI Transportation. Major retailers within the Town include Wal-Mart, Costco, Home Depot, Lowes, Target, Kohl's, Basha's, Fry's Food and Drug, and Safeway. The current Town employment sector, by number of establishments and employees, is presented in Table 3.12.

The Town's total employment was approximately 212 per 1,000 residents, 50 to 56 percent less than the national and State averages, and in the lowest quartile of 83 incorporated cities and towns in Arizona. The low per capita figure resulted from the large number of Town residents who commuted into Tucson or other communities to work. The number of jobs located in the Town (in 2001) was only half of the 13,800 employed Town residents counted in the 2000 census (Arizona Department of Commerce 2008).

The Town exhibits a high degree of home ownership with nearly 83 percent of the population living in owner-occupied housing in 2000. Median household income in the Town in 2000 totaled \$52,870, while the average family income for the year was \$56,718 (US Census Bureau 2000).

**TABLE 3.12
TOWN EMPLOYMENT BY SECTOR**

Sector	Number of Establishments	Employment
Agriculture	40	217
Government	9	1,836
Mining	2	52
Utilities	4	193
Construction	68	501
Manufacturing	24	1,013
Wholesale Trade	17	327
Retail Trade	47	991
Transportation and Warehousing	23	701
Information	10	315
Finance and Insurance	17	69
Real Estate and Rental and Leasing	13	91
Professional, Scientific and Technical Services	47	177
Management of Companies and Enterprises	1	2
Administrative, Support, Waste Management, Remediation Services	31	379
Educational Services	4	23
Health Care and Social Assistance	21	213
Arts, Entertainment and Recreation	8	477
Accommodation and Food Services	45	980
Other Services (except public administration)	34	174
Unclassified Establishments	9	7
Total	474	8,736

Source: Arizona Department of Commerce 2008

3.6.2.2 Economic Activity

A variety of activities drive the Town’s economy, including the Evergreen Air Center, the Army National Guard, various manufacturing operations, and some tourism. Government provides the most employment of any sector in the Town (see Table 3-12). However, the Town is partially dependent on the economy of the broader region (Arizona Department of Commerce 2008).

Agriculture remains a major force in the Town’s economy, although a recent influx of residential and commercial development has occurred due to its location between Phoenix and Tucson along the Interstate 10 and UPRR corridors. These transportation corridors are important to the growth and economic development of the Town’s business community.

3.6.3 Public Health and Safety

Overall, residents of the Town have indicated that the area has a high standard of public safety due to the efforts of the Town’s police department and Northwest Fire

Department. The Town of Marana Police Department had 97 sworn and non-sworn members, and the department has a ratio of roughly 1 officer per 400 residents. The Town's property crime levels tend to be similar to Arizona's average level. The same data show that violent crime levels tend to be lower than Arizona's average (IDcide 2008).

Northwest Fire Department has eight fire stations that provide emergency and community services to 114,000 residents and 1,900 commercial occupancies over a 363 sq km (140 sq mi) area. The department has 192 firefighters that are paramedics or emergency medical technicians. The district's ratio of paramedics to residents is one of the best in the State at one paramedic per 9,000 residents. The department responds to 85 percent of its calls in 6.5 minutes or faster.

The Northwest Medical Center is a full-service healthcare facility approximately 8 km (5 mi) east of the Town. The key service areas of Northwest Medical Center include the Regional Heart Care Center, Women's Center, Center for Neuroscience, orthopedics, diagnostic imaging, intensive care surgery, 24-hour emergency department, and pediatric and adult urgent care. The Town also has the Marana Health Center. The Town has a variety of community amenities for public use including library, swimming pool, tennis courts, soccer field, recreation center, and numerous parks. The Town also has a Senior Center that features senior education classes, a meal program, legal assistance, and other amenities to assist senior health needs.

3.7 Environmental Justice

United States Executive Order 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 CFR 7629, 16 February 1994)—directs Federal agencies to “make . . . achieving environmental justice part of its mission” and to identify and address “disproportionately high and adverse human health or environmental effect of it programs, policies, and activities on minority and low-income populations.” To address this issue, this section identifies minority and low-income populations within the planning area that may be affected by implementation of any of the proposed actions. Demographic information on ethnicity, race, and economic status is provided in this section as the baseline against which potential effects can be identified and analyzed.

3.7.1 Distribution of Low-income and Minority Populations

Low income populations are defined by environmental justice guidance using the statistical poverty thresholds of the U.S. Census Bureau. In 1999, the poverty-weighted average threshold for a family of four was \$17,029 and \$8,501 for an unrelated individual

(U.S. Census Bureau 2003). In 1999, the national poverty level was 12.4 percent for individuals and 9.2 percent for families. In order to be classified as “meaningfully greater,” local poverty rates must exceed the national rate by 10 percent; this threshold is 22.4 percent. The Town’s 1999 census poverty rate for individuals was 6.2 percent and for families was 5.5 percent (U.S. Census Bureau 2000). Overall, the poverty rates for individuals and families within the Town were lower than the national average and below the meaningfully greater threshold for the nation.

The Town’s low-income areas are primarily concentrated within older neighborhoods and within the central portion of the Town. The U.S. Department of Housing and Urban Development identified five “colonias” within the Town. The term colonias is used to identify low-income communities within 241 km (150 mi) of the U.S.–Mexico border.

Minorities are persons of Hispanic or Latino origin of any race, Blacks or African Americans, American Indians, or Alaskan Natives, Asians, and Native Hawaiian and other Pacific Islanders.

The Council on Environmental Quality (CEQ) identifies these groups as minority populations when either:

- The minority population of the affected area exceeds 50 percent; or
- The minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis.

In order to be classified as meaningfully greater, a local population must exceed the State minority population by 10 percent; in the State of Arizona, this threshold is 36.2 percent.

In 1999, the Town’s minority population was 18.2 percent, with the largest minority groups consisting of Hispanic or Latino origin and Blacks or African Americans (see 3-11). Overall, the population of minorities within the Town was lower than the national average of 25 percent and well below the meaningfully greater threshold of 36.2 percent for the State of Arizona.

3.7.2 Protection of Children

United States Executive Order 13045—Protection of Children from Environmental Health Risks (April 21, 1997)—recognizes a growing body of scientific knowledge that demonstrates that children may suffer disproportionately from environmental health risks and safety risks. These risks arise, because (1) children’s bodily systems are not fully developed, (2) children eat, drink, and breathe more in proportion to their body weight, (3) their size and weight may diminish protection from standard safety features, and (4)

their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

3.8 Air Quality

This section discusses conditions based on summary air quality reports and data prepared by Pima County (Pima County Department of Environmental Quality [PDEQ] 2007a) and the Town (Town 2007a).

3.8.1 Ambient Air Quality

Throughout Pima County, and including the Town, PDEQ monitors ambient (outdoor) air pollutants. Monitoring is performed in accordance with the National Ambient Air Quality Standards (NAAQS) set by the EPA to comply with the Federal Clean Air Act.

Two air quality monitoring stations are located within the Town limits: one near Tangerine Road and Camino de Oeste and another near Coachline Boulevard and Silverbell Road. A third monitoring site, near Orange Grove Road and Camino de la Tierra, is just outside of the Town limits. Locations of the monitors are based on emission source distribution and population exposure (40 CFR, Part 58, App. D).

The five air pollutants, called “criteria” pollutants, monitored by PDEQ within the County are carbon monoxide, ozone (O₃), particulate matter (PM₁₀, PM_{2.5}), nitrogen dioxide, and sulfur dioxide. Lead monitoring in Pima County was discontinued in March of 1997.

Currently, only two air pollutants, O₃ and particulate matter, are monitored within the Town. Carbon monoxide monitoring at the Tangerine Road site was discontinued in 2004.

3.8.2 Pollutant Levels

3.8.2.1 Ozone

In March of 2008, the EPA set a new standard for O₃ of 0.075ppm. Compliance with this new standard will probably be determined in 2009 and be based on the 2006–2008 data. Ground-level O₃ concentrations have remained relatively steady, approaching but not exceeding the NAAQS.

3.8.2.2 Particulate Matter (PM₁₀ and PM_{2.5})

Two sizes of particulate matter are monitored in Pima County. PM₁₀ is particulate matter with an aerodynamic diameter of 10 microns or less, and PM_{2.5} is particulate matter with an aerodynamic diameter of 2.5 microns or less. Particulate matter is a health concern because when inhaled, the particles are able to pass through the body's protective filtration system and enter the lungs.

Pima County violated the PM₁₀ standard in 1999 with four recorded exceedances at the Orange Grove monitoring location. There were three exceedances of the PM₁₀ NAAQS in 2002, one at the Orange Grove location and two at the South Tucson location. There was one exceedance in 2003 at the Orange Grove location, which was considered a natural event due to forest fires in the nearby Catalina Mountain Range (Pima County 2007). See Section 3.8.4 below for additional information. There have been no exceedances of the NAAQS for PM_{2.5} since monitoring began in 1999.

3.8.3 Pollutant Sources

Pollutants come from a variety of sources, including vehicle emissions, dust from areas with no vegetation, and industrial areas. Higher levels of pollution can occur in the winter, when the air is calmest. Under these conditions, especially during winter mornings, pollutants become trapped by temperature inversions.

Ground-level O₃ concentrations are the highest in the summer months due to the intense sunlight and heat. Nitrogen oxide and volatile organic compounds are the "precursor" pollutants that react in the presence of sunlight to form O₃. The highest O₃ levels generally are not found near major intersections. Instead they are found when precursor pollutants are released and carried away, due to wind or simple dispersion, from the area of concentration before reacting with sunlight to form O₃.

The Town adopted ordinances in 2002 (Ordinances 2002.06 and 2002.30) to protect air quality and reduce air pollution. These ordinances made revised Title 10 of the Town Code (Health and Sanitation) to require that all hauling vehicles be covered with tarps during transport.

3.8.4 Attainment and Non-attainment Areas

A portion of the Town is located within the Rillito PM₁₀ area, a classification given to the unincorporated Rillito area because it has failed some measures of air quality. The pollution is caused primarily by industry, but also by nearby development, open fields, and unpaved roads. This management area supports intensive land uses and is Federally designated as a non-attainment area (Town 2007a).

3.9 Cultural and Historic Resources

3.9.1 Introduction and Background

The Town's cultural resources tend to be distributed in relation to its natural resources. The confluence of waterways, farmland, and dramatic range of elevation has made this area attractive for settlement for more than 4,000 years. The people who settled here have left behind a rich legacy of cultural resources, including Los Morteros, the Marana Mound Site, the Dairy Site, the Costello King Site, and a range of historical sites including a portion of the Anza Trail.

The waterways also formed trade routes dotted with camp sites, pictographs, and lost possessions. These routes were followed by Native American traders, by Spanish expeditions led by Father Francisco Kino and Juan Bautista de Anza, by the Forty-Niners on their way to find gold in California, by the Mormon Battalion, and by the Butterfield Stage. These same trails later became the routes for the Southern Pacific Railroad and our modern highway system. The Town was named for the Spanish word *maraña* (meaning "thicket") by 19th-century railroad workers who had to clear a line through the area. Many archaeological sites cluster along the Santa Cruz River and the area around the Tortolita Mountains, which are also areas critical for environmental preservation. The Hohokam culture thrived here from around 600–1400 A.D., using irrigation and flood water agriculture to grow corn, beans, squash, and cotton, and exploiting a wide variety of wild or "encouraged" plants such as agave and amaranth. Recent excavations in the Town area have found evidence of irrigation canals dating back more than 3,000 years.

3.9.2 Cultural Resources

There are numerous cultural resources located within the Town. Cultural resources in the Town fall under various laws and ordinances, including Title 20 of the Town of Marana Land Use Code, the State Historic Preservation Act (A.R.S. §41-861 *et seq.*), Arizona Antiquities Act (ARS §41-841 *et seq.*), as well as several Federal laws, including the National Historic Preservation Act of 1966, as amended (36 CFR Part 800), Native American Graves Protection and Repatriation Act (25 USC 3001 *et seq.*), and Archaeological Resources Protection Act of 1979 (16 USC 470aa-mm). Depending on the jurisdictions involved, the sources of funding, and/or the permits required, one or more of these laws and ordinances are triggered by projects within the Town. The Town complies with all applicable regulations, in consultation with the SHPO as well as other local, State, and Federal agencies as required.

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4.0 Environmental Consequences

This chapter discusses impacts to each resource or issue that is expected to result from the implementation of each of the three alternatives that were identified in Chapter 2. Those alternatives are briefly summarized as follows:

Alternative A: No Action Alternative (no regional Section 10 Permit, ESA compliance achieved on a project-by-project basis)

Alternative B: Incidental Take Permit for the Town's CIP Activities and Voluntary Inclusion of Non-Discretionary Actions

Alternative C: Incidental Take Permit for the Town's CIP and Discretionary Actions, and Voluntary Inclusion of Non-Discretionary Actions (proposed action)

According to NEPA, each of the alternatives must be analyzed in equal detail as the proposed action. The direct, indirect, and cumulative impacts of Alternatives B and C on the resources described in Chapter 3 are compared and discussed below relative to Alternative A, No Action. This chapter also includes an abbreviated impacts summary table, which uses a numeric scale for the purposes of comparison.

For the purposes of analyzing impacts, three different land development categories were employed: *CIP*, *HCP Discretionary Lands*, and *Private–Potential for Voluntary Inclusion*.

- *CIP*: These include all CIP activities as discussed in Section 2.2 of the HCP.
- *HCP Discretionary Lands*: These lands were categorized under the assumption that virtually all future development on these parcels would be subject to some discretionary action, and therefore subject to the conservation measures implemented as part of the HCP.
- *Private–Potential for Voluntary Inclusion*: These lands were categorized under the assumption that development on these parcels would not require further discretionary action by the Town and thus could proceed under existing land use entitlements and would not be subject to the conservation measures outlined in the HCP. However, some unknown number of these parcels' owners may voluntarily choose to be included in the HCP, especially if a species occurring on the property becomes listed before the land is developed.

The impacts discussed under each alternative are those that are anticipated to occur over the duration of the permit. Typically, those impacts listed under Alternatives B and C are not triggered by the proposed action (issuance of the ITP), but are in fact minimized or mitigated by it.

Impacts under Alternative A were analyzed using the land development projections in the Town's 2007 General Plan (Town 2007a) as applied to all land development categories. Impacts under Alternatives B and C were analyzed assuming the most likely future land development scenario with the application of the HCP and its associated conservation measures on various land development categories. Some impacts in this document lend themselves to quantitative analysis resulting in an expression of hectares impacted or preserved, while other impacts are difficult to quantify. In such cases, impacts are discussed on a qualitative scale in comparison to the significance criteria and to the other alternatives.

The term "significant" as used in NEPA requires considerations of both context (society as a whole, the affected region, the affected interests, and the locality) and intensity (severity of impact). Significance criteria serve as thresholds or benchmarks for determining if a project alternative will result in a significant environmental impact. Criteria will differ among issues.

Impacts are indicated below for each resource category or issue based on whether the impacts are beneficial or adverse, and the level of impact, using the following terminology:

- Significant beneficial impact
- Less than significant beneficial impact
- Potential or minor beneficial impact
- Neutral impact
- Potential or minor adverse impact
- Less than significant adverse impact
- Significant adverse impact

4.1 Physical Environment

This section compares impacts resulting from alternatives on the components of the Town's physical environment (i.e., geology and soils, elevation and drainage, and climate).

Criteria for Determining Significance

The following criteria were used to determine whether any of the alternatives would have significant impacts on the Town's physical environment. The impacts would be significant if implementation would:

- Substantially alter important geologic features, elevation profiles, soil conditions, or capacities or flow patterns of watercourses
- Conflict with any Federal regulations or policies relevant to soil erosion or floodplain protection
- Conflicts with Federal regulations regarding Traditional Navigable Waters

4.1.1 Impacts Common to All Alternatives

Impacts to all components of the Town's physical environment resulting from CIP activities and development and construction on Private–Potential for Voluntary Inclusion parcels would be comparable under all three alternatives.

Increased soil erosion may result from development and construction under all alternatives; however, the Town's existing stormwater management program would also be implemented under all alternatives.

4.1.2 Impacts of Alternative A (No Action)

Under the No Action Alternative, impacts to the Town's physical environment would result primarily from new development and construction as represented in the 2007 General Plan (Town 2007a). No changes to the geology, elevation, or climate are expected from such development. While the drainage patterns of major watercourses in the Town would not be changed on a regional level, alterations of minor washes may occur at a smaller scale. Because of widespread development and construction under Alternative A, likely significant adverse impacts would occur to soil productivity, permeability, and percolation.

4.1.3 Impacts of Alternative B

Impacts to the Town's physical environmental under Alternative B would be similar to Alternative A. Some of the conservation measures outlined in the HCP (e.g., ESRDG), would reduce soil impacts resulting from CIP construction as compared to Alternative A; however, because of the uncertain level of participation in the HCP through voluntary inclusion, we assume most of the impacts to soil productivity, permeability, and percolation from residential and commercial development and construction would also occur under this alternative.

4.1.4 Impacts of Alternative C

Less than significant adverse impacts to the Town's physical environmental, namely soil conditions, would occur under Alternative C, and the impacts would be considerably less than either Alternative A or B. The full complement of conservation measures outlined in the HCP would minimize soil impacts resulting from much of the development and construction on HCP Discretionary Lands. While extensive residential and commercial development would still occur under Alternative C, the primary difference in impacts would come from increased amounts of NUOS within the conservation zones and increased protections for riparian habitat. Because of this, Alternative C would result in the protection of existing soil structure and function on a larger amount of land than either Alternative A or B.

4.2 Water Resources

This section compares impacts resulting from alternatives on the Town's water sources (ground and surface water) and water quality.

Criteria for Determining Significance

The following criteria were used to determine whether any of the alternatives would have significant impacts on the Town's physical environment. The impacts would be significant if implementation would:

- Conflict with any regulations, policies or ordinances relevant to surface or drinking water quality standards
- Reduce water resources to the point the Town loses its assured water supply designation

4.2.1 Impacts Common to All Alternatives

Population growth and associated water use is expected to increase substantially during the duration of the ITP under all alternatives. Although groundwater will likely remain as the primary potable water source for some time, the Town currently recharges its CAP water allotment and anticipates maintaining its assured water supply designation through the use of recharge credits in the future as needed. Additionally, groundwater pumping for irrigation would be reduced under all alternatives as agriculture lands are converted to municipal and industrial uses.

Because the Town does not currently own or control any rights to the effluent in the river, and none of the proposed conservation measures deal with effluent release, any reduction of in-stream flow of effluent would be similar under all alternatives.

Because livestock grazing on State Trust Lands would continue at similar levels under all alternatives, its impacts such as increased sediment production (Platts 1990; Johnson 1992; Wetz and Wood 1986) and increased nutrient transport into riparian systems (Kaufman and Krueger 1984) would also be similar under all alternatives.

While new development and construction could lead to deterioration of water quality due to an increase in erosion from construction sites, non-point pollution sources, and runoff from impermeable surface areas, the Town's Stormwater Management Plan and Stormwater Ordinance (Title 25) would be enforced under all alternatives. These policies would cover implementation of Stormwater Pollution Prevention Plans and best management practices (BMP) to minimize impacts to water quality. Because BMPs are not fail-proof, there is some potential for differences in water quality impacts under each alternative as discussed below.

4.2.2 Impacts of Alternative A (No Action)

While impacts to water quality would be managed through the Town's Stormwater Management Plan and Title 25 under all alternatives, the amount of surface disturbance, and therefore potential for BMP failures, would be greatest under Alternative A.

4.2.3 Impacts of Alternative B

The amount of surface disturbance, and therefore potential for BMP failures under this alternative, would be slightly less under this alternative compared to Alternative A, primarily due to increases in NUOS on those parcels opting for voluntary inclusion.

4.2.4 Impacts of Alternative C

The least amount of surface disturbance, and therefore potential for BMP failures, would occur under this alternative compared to either Alternative A or B. The sizeable increase in NUOS would occur mostly on HCP Discretionary Lands within Conservation Zones 1, 2, and 3.

4.3 Biological Resources

This section compares impacts resulting from each alternative on the Town's vegetation and wildlife, covered species, special status species, and migratory birds. To assess potential future impacts, GIS software was used to overlay the footprints of anticipated activities for each alternative onto the existing vegetation communities and modeled habitat for the thirteen species proposed for coverage in the HCP. The number of property owners selecting voluntary inclusion is difficult to anticipate or quantify, and therefore these impacts were analyzed qualitatively.

Criteria for Determining Significance

The following criteria were used to determine whether any of the alternatives would have significant impacts on biological resources. The impacts would be significant if implementation would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any covered species, Federal or State species, or migratory bird
- Interfere substantially with the movement of any native wildlife species or impede the use of wildlife linkages
- Promote the introduction or spread of invasive or non-native species
- Conflict with any local policies or ordinances protecting biological resources

4.3.1 Vegetation

Locations of CIP activities and land development categories in relation to vegetation communities are displayed in Figures 4.1 and 4.2 respectively. Amounts of each vegetation community within each land development category are listed in Table 4.1.

**TABLE 4.1
 LAND DEVELOPMENT CATEGORIES IN RELATION TO VEGETATION COMMUNITIES**

Vegetation Community	Land Development Category	Hectares (Acres)
Palo verde–cacti–mixed scrub	CIP	630 (1,556)
	HCP Discretionary Lands	10,710 (26,466)
	Private-Potential for Voluntary Inclusion	2,003 (4,950)
	Subtotal	13,343 (32,972)
Cottonwood–willow	CIP	7 (17)
	HCP Discretionary Lands	5 (12)
	Private-Potential for Voluntary Inclusion	0 (0)
	Subtotal	37 (91)
Creosote–bursage	CIP	129 (318)
	HCP Discretionary Lands	777 (1,920)
	Private-Potential for Voluntary Inclusion	266 (657)
	Subtotal	1,172 (2,895)
Mesquite	CIP	23 (56)
	HCP Discretionary Lands	33 (81)
	Private-Potential for Voluntary Inclusion	17 (36)
	Subtotal	70 (173)
Xeroriparian	CIP	759 (1,876)
	HCP Discretionary Lands	1,328 (3,281)
	Private-Potential for Voluntary Inclusion	203 (502)
	Subtotal	2,290 (5,659)
Total		16,854 (41,646)

4.3.1.1 Impacts Common to All Alternatives

While direct impacts to vegetation communities resulting from CIP activities would be comparable under all alternatives, the ESRDG would be implemented as part of the HCP under Alternatives B and C, resulting in differences in the level of mitigation as discussed below.

Direct Impacts to vegetation communities resulting from development and construction on parcels with existing land use entitlements would also likely be very similar under all alternatives. Impacts from livestock grazing on State Trust Lands, such as removal and trampling of plants, alteration of plant species composition (Fleischner 1994), and disruption of fire regimes (Service 2002a) , would also be similar under all alternatives.

4.3.1.2 Impacts of Alternative A (No Action)

Table 4.1 indicates potential impacts to various vegetation communities resulting from future land development under Alternative A. Likely significant adverse impacts to vegetation communities would result from direct removal during development and construction in accordance with the Town's 2007 General Plan (2007a) on HCP Discretionary Lands. Most of these impacts would occur in the palo verde-cacti-mixed scrub vegetation community (see Table 4.1). Under Alternative A, these impacts would be partially mitigated through the Town's existing Title 17, Environmental Resources Preservation and Native Plant Protection Ordinance. Other impacts to vegetation would be expected from CIP operations and maintenance activities such as mowing and tree trimming in flood conveyance channels that provide riparian habitat.

Potential indirect impacts to vegetation communities could occur from the introduction of invasive species, which are often associated with new roads as a first point of entry into a new landscape (Lonsdale and Lane 1994; Greenberg et al. 1997). Invasion by these plants may have significant biological and ecological effects if the species are able to disrupt the structure or function of the native ecosystem. While the Town currently conducts some invasive species control, it does not currently have a formal invasive species management plan.

The No Action Alternative also provides no assurances that native plant and riparian habitat protections will remain in place under Title 17.

4.3.1.3 Impacts of Alternative B

Because only CIP activities and voluntary inclusion are covered under this alternative, development and construction under Alternative B would result in impacts similar to Alternative A. However, under this alternative, total adverse impacts to vegetation may be slightly less than Alternative A, because of increased NUOS and mitigation on parcels opting for voluntary inclusion in the HCP, but would still likely be significant. The

least impacts would occur on voluntary inclusion parcels within the Conservation Zones. Similarly, revisions to Title 17, or policy guidance documents, would result in more extensive pre-development review and planning, as well as more consistent mitigation on these parcels.

For CIP activities, the primary difference between Alternatives A and B would be mitigation. Under Alternative B, designated Environmentally Sensitive Roadways would be designed, constructed, and mitigated according to the Town's ESRDG, which would consider both impacts to native vegetation and threats from non-native invasive plant species. Non-linear CIP activities (e.g., parks, pump stations) would also be designed, constructed, and mitigated in accordance with the HCP conservation measures, including NUOS requirements. Additionally, operations and maintenance activities would consider impacts to sensitive vegetation communities. Under Alternative B, invasive species issues associated with CIP activities would be addressed in the Town's Invasive Species Management Program as outlined in the HCP.

4.3.1.4 Impacts of Alternative C

The total impacts to vegetation communities would be least under Alternative C, primarily because of the application of the conservation measures to all HCP Discretionary Lands. Impacts from CIP activities and voluntary inclusion lands would be the same as under Alternative B.

Under this alternative, 12,826 ha (31,693 ac) of the various vegetation communities would fall within HCP Discretionary Lands and would be subject to the conservation measures in the HCP. HCP conservation measures would not be applied to any of these lands under Alternatives A or B. The vegetation community with the highest percentage of HCP Discretionary Lands is the palo verde-cacti-mixed scrub. Based on the amount of lands included in the HCP, the amount of NUOS would be the highest under this alternative and native plant protection and mitigation through the revised Title 17, or policy guidance documents, would be applied to the largest area under this alternative. Additionally, the adoption of the riparian habitat map and the restoration of selected watercourses, as outlined in the HCP, would result in the greatest level of protection and mitigation for riparian plants among the alternatives. A comprehensive Invasive Species Management Program would also be implemented under Alternative C.

Alternative C would result in less than significant adverse impacts.

4.3.2 Wildlife

4.3.2.1 Impacts Common to All Alternatives

Direct impacts resulting from development and construction on parcels with existing land use entitlements would be similar under all alternatives, although some unknown number of parcels may seek voluntary inclusion in the HCP.

4.3.2.2 Impacts of Alternative A (No Action)

Significant adverse impacts to wildlife would likely be expected under this alternative as a result of both CIP infrastructure construction and anticipated residential, municipal, and industrial development as represented in the Town's 2007 General Plan (Town 2007a). Direct impacts would include mortality of individual wildlife, especially less mobile taxa such as rodents, reptiles, and amphibians. Other direct impacts would include interference with breeding, fragmentation of habitat, and loss of forage plants, although some of these impacts would be partially mitigated through the Town's existing Title 17.

Indirect impacts to wildlife would include mortality from collision with vehicles along new roads and increased light disturbances in and adjacent to developed areas. Other indirect impacts to wildlife habitat would be expected from operations and maintenance activities such as vegetation control. Without a comprehensive Invasive Species Management Plan under this alternative, impacts to wildlife would also include habitat changes from encroachment of invasive plant species and continued predation by and competition with non-native vertebrate species.

4.3.2.3 Impacts of Alternative B

Development and construction on both Private–Potential for Voluntary Inclusion and HCP Discretionary Lands under Alternative B would result in impacts similar to Alternative A. While these adverse impacts would still be significant under this alternative, total impacts to wildlife may be slightly less than Alternative A because of mitigation associated with parcels opting for voluntary inclusion in the HCP. Similarly, revisions to Title 17, or policy guidance documents, would result in more extensive pre-development review and planning, as well as more consistent mitigation on these voluntary inclusion parcels. Additionally, the adoption of the riparian habitat map and the restoration of selected watercourses, as outlined in the HCP, would result in protection and mitigation for riparian habitat and potential wildlife linkages.

For CIP activities, the primary difference between Alternatives A and B would be mitigation. Under Alternative B, designated Environmentally Sensitive Roadways would be designed, constructed, and mitigated according to the Town's ESRDG, which would require consideration of wildlife linkages, wildlife fencing, and road-crossing features.

These would reduce road mortality and habitat fragmentation. Non-linear CIP activities (e.g., parks, pump stations) would also be designed, constructed, and mitigated in accordance with the HCP conservation measures, including NUOS requirements. Additionally, operations and maintenance activities would consider impacts to wildlife. Under Alternative B, invasive species issues associated with CIP activities would be addressed in the Town's Invasive Species Management Program as outlined in the HCP.

4.3.2.4 Impacts of Alternative C

Adverse impacts to wildlife would be less than significant under Alternative C, primarily because of the application of the conservation measures to all HCP Discretionary Lands, primarily east of Interstate 10 and on the Tortolita Fan. The Conservation Zones would result in the highest levels of NUOS of all the alternatives, and mitigation through the revised Title 17, or policy guidance documents, would be applied to the largest area under this alternative. Likewise, implementation of a comprehensive Invasive Species Management Program would likely benefit the largest area under this alternative.

Impacts and mitigation associated with CIP and operations and maintenance activities would be the same as in Alternative B.

4.3.3 Species Proposed for Coverage by the HCP

Within the Permit Area, a combined total of 17,406 ha (43,010 ac) of habitat was modeled for all 13 covered species. The HCP identifies 1,031 ha (2,547 ac) of impacts to the combined modeled habitat from the Town's CIP activities and 8,329 ha (20,582 ac) of impacts from development. A minimum of 9,054 ha (22,373 ac) of combined modeled habitat would be protected as NUOS. However, because the HCP assumes that all currently entitled lands would be developed, the total amount of NUOS may ultimately be higher, depending on the level of voluntary participation by private landowners in the HCP (voluntary inclusion).

An analysis of impacts to each covered species and their habitat is presented below.

4.3.3.1 Western Burrowing Owl

A total of 4,235 ha (10,466 ac) of habitat for the burrowing owl was modeled within the Town. Locations of land development categories in relation to burrowing owl modeled habitat are displayed in Figures 4.3 and 4.4.

Impacts Common to All Alternatives

Direct impacts to 490 ha (1,211 ac) of burrowing owl modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below.

Impacts of Alternative A (No Action)

Under Alternative A, 4,235 ha (10,466 ac) of burrowing owl modeled habitat would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to burrowing owls resulting from CIP activities would potentially include destruction of burrows or removal of potential habitat for parks, bank protection, and airport projects, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, burrowing owls would also be impacted by development and construction. These impacts would include destruction of burrows and permanent removal of habitat during land clearing activities, modification of vegetation composition and structure (such as the planting of trees) at the edges of developed areas that would reduce suitability of adjacent habitat areas, and harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to burrowing owls would likely occur.

Impacts of Alternative B

Under Alternative B, 4,235 ha (10,466 ac) burrowing owl modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would require pre-construction surveys and standards for eviction of owls from occupied burrows if necessary, and the protection of modeled habitat in Conservation Zone 1 along the Santa Cruz River. Other conservation measures would include the application of the ESRDG to linear CIP projects, the establishment of 43 ha (106 ac) of burrowing owl management areas (BOMAs), implementation of an Invasive Species Management Program, coordination with other jurisdictions on burrowing owl conservation, and an education program to inform Town staff and residents how to avoid or minimize impacts to burrowing owls.

The Town has also proposed to collaborate with the City of Tucson by contributing to research or management of Tucson Water parcels near the Brawley/Los Robles washes and the Santa Cruz River. These parcels were identified in planning meetings between the City of Tucson, Town of Marana, Pima County, the Service, and Phil Rosen

(University of Arizona) as being important regional habitat linkages for conservation of the various species, including burrowing owls.

Similar impact minimization and mitigation would occur on an unknown portion of the 594 ha (1,468 ac) of lands with existing entitlements through voluntary inclusion in the HCP.

Under Alternative B, adverse impacts to burrowing owls would be less than significant.

Impacts of Alternative C

Under Alternative C, 3,731 ha (9,220 ac) of burrowing owl modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures of the HCP.

Primarily the HCP conservation measures would require pre-construction surveys and standards for eviction of owls from occupied burrows if necessary, and the protection of modeled habitat in Conservation Zone 1 along the Santa Cruz River. A total of 504 ha (1,246 ac) of modeled habitat would be protected as NUOS. Other conservation measures would include the application of the ESRDG to linear CIP projects, the establishment of 43 ha (106 ac) of BOMAs, implementation of an Invasive Species Management Program, coordination with other jurisdictions on burrowing owl conservation, and an education program to inform Town staff and residents how to avoid or minimize impacts to burrowing owls. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.2 below. For the burrowing owl, the Service believes a less than 1:1 mitigation based on hectares of impacts is appropriate because the Town chose to apply a more regional conservation approach. This regional approach recognizes that modeled habitat for this species includes large areas that are not likely currently occupied or may be of varying quality. Because habitat characteristics, such as the presence of suitable soil types and burrowing mammals, are difficult to determine at the scale of the habitat model, the actual acreage of suitable and occupied habitat is likely less than the total extent of the modeled habitat. Currently, fewer than 10 occupied burrowing owl sites exist within the Permit Area. The objective of the regional approach to burrowing owl conservation is to increase the number of occupied sites within the region. The development of BOMAs and additional burrow sites proposed within the HCP will help to achieve this objective. Protection of the existing occupied sites and expansion of potential sites will adequately mitigate the potential effects to modeled habitat. The NUOS areas along the Santa Cruz River and the BOMAs would provide additional sites for potential occupancy beyond what currently exist within the permit area. In addition to impacts to modeled habitat, the incidental lethal take of up to five individual burrowing owls would be anticipated; however, the

likelihood of lethal take will be substantially reduced due to the conservation measures outlined in the HCP. Under Alternative C, adverse impacts to burrowing owls would be less than significant.

**TABLE 4.2
 BURROWING OWL MODELED HABITAT AND PROJECTED FUTURE IMPACTS
 IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	4,235 ha (10,466 ac)
Total habitat impacted by Town’s CIP	490 ha (1,211 ac)
Total habitat impacted by development within HCP Conservation Zones	78 ha (191 ac)
Total habitat impacted by development outside of HCP Conservation Zones	3,164 ha (7,818 ac)
Total impacts	3,731 ha (9,220 ac)
Total NUOS	504 ha (1,246 ac)

4.3.3.2 Cactus Ferruginous Pygmy-owl

Locations of land development categories in relation to pygmy-owl modeled habitat are displayed in Figures 4.5 and 4.6.

Impacts Common to All Alternatives

Direct impacts to 185 ha (457 ac) of pygmy-owl modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below. The Town would also continue to manage the 971 ha (2,400 ac) Tortolita Preserve, support pygmy-owl augmentation efforts, and support efforts to purchase, preserve, and enhance parcels needed for a regional movement linkage across Interstate 10.

Impacts of Alternative A (No Action)

Under Alternative A, 10,398 ha (25,693 ac) of pygmy-owl modeled habitat (with the exception of the existing Tortolita Preserve and other areas under conservation easement) would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to pygmy-owls resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for parks and roadways, potential increases in vehicle mortality, and possible introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, pygmy-owls would also be impacted by development and construction. These impacts would include destruction and

fragmentation of habitat during land clearing activities, disturbance from construction and traffic noise, the possible introduction or spread of invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to pygmy-owls would likely occur.

Impacts of Alternative B

Under Alternative B, 10,398 ha (25,693 ac) of pygmy-owl modeled habitat would still be subject to impacts as described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include Permit Area pygmy-owl surveys by the Town and the implementation of the ESRDG, which would require pre-construction surveys, enhanced native plant preservation and mitigation, and consideration of wildlife crossings. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to pygmy-owls.

Impact minimization and mitigation on an unknown portion of the 1,919 ha (4,741 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include enhanced native plant protections under a revised Title 17, or policy guidance documents, NUOS requirements, and protections in various Conservation Zones, ranging from 80 percent NUOS on the Tortolita Fan (Zone 2) to between 40 and 70 percent NUOS south of the Tortolita Preserve and extending across and south of Tangerine Road (Zone 3). These NUOS areas would prioritize the protection of riparian habitat and wildlife linkages. Pre-construction surveys for pygmy-owls would also be required on parcels of more than 200 ha (500 ac).

Under Alternative B, significant adverse impacts to pygmy-owls would likely occur.

Impacts of Alternative C

Under Alternative C, 3,357 ha (8,295 ac) of pygmy-owl modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 7,041 ha (17,398 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of pygmy-owl modeled habitat than the other alternatives, because most of the HCP Discretionary Lands are within modeled habitat on the Tortolita Fan and within Conservation Zone 2, which would require 80-percent NUOS. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.3 below. No lethal take of individual pygmy-owls would be anticipated. Under Alternative C, adverse impacts to pygmy-owls would be less than significant.

**TABLE 4.3
PYGMY-OWL MODELED HABITAT AND PROJECTED FUTURE IMPACTS
IN THE TOWN**

Type of Habitat or Impact	Area
Modeled Habitat	10,398 ha (25,693 ac)
Total habitat impacted by Town's CIP	185 ha (457 ac)
Total habitat impacted by development within HCP Conservation Zones	3,071 ha (7,588 ac)
Total habitat impacted by development outside of HCP Conservation Zones	101 ha (250 ac)
Total Impact	3,357 ha (8,295 ac)
Total NUOS	7,041 ha (17,398 ac)

4.3.3.3 Southwestern Willow Flycatcher

Locations of land development categories in relation to willow flycatcher modeled habitat are displayed in Figures 4.7 and 4.8.

Impacts Common to All Alternatives

Direct impacts to 45 ha (110 ac) of willow flycatcher modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below. Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 462 ha (1,141 ac), of willow flycatcher modeled habitat would be subject to impacts from future development and CIP activities.

Impacts to willow flycatchers resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for bridges and bank protection, disturbance from construction and traffic noise, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, willow flycatchers would also be impacted by various levels of development and construction. These impacts would include destruction and fragmentation of habitat during land clearing activities, disturbance from construction and traffic noise, introduction or spread of invasive plant species associated

with land disturbance, and potential harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to willow flycatchers would likely occur.

Impacts of Alternative B

Under Alternative B, 462 ha (1,141 ac) of willow flycatcher modeled habitat would be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhanced native plant preservation and mitigation through the revised Title 17, or policy guidance documents, and consideration of wildlife crossings. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to willow flycatchers.

Impact minimization and mitigation on an unknown number of hectares on parcels opting for voluntary inclusion in the HCP would include pre-construction surveys, enhanced native plant protections under the revised Title 17, or policy guidance documents, and the 95 percent NUOS requirement for Conservation Zone 1 along the Santa Cruz River.

Similar impact minimization and mitigation would occur on an unknown portion of the 3 ha (7 ac) of lands with existing entitlements through voluntary inclusion in the HCP.

Under Alternative B, adverse impacts to willow flycatchers would be less than significant.

Impacts of Alternative C

Under Alternative C, 107 ha (264 ac) of willow flycatcher modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. This alternative would result in 355 ha (877 ac) of preserved willow flycatcher modeled habitat as NUOS. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.4 below. No lethal take of willow flycatchers would be anticipated. Under Alternative C, potential or minor adverse impacts to willow flycatchers would be anticipated.

**TABLE 4.4
SOUTHWESTERN WILLOW FLYCATCHER MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled Habitat	462 ha (1,141 ac)
Total habitat impacted by Town's CIP	45 ha (110 ac)
Total habitat impacted by development within HCP Conservation Zones	25 ha (62 ac)
Total habitat impacted by development outside of HCP Conservation Zones	37 ha (92 ac)
Total Impact	107 ha (264 ac)
Total NUOS	355 ha (877 ac)

4.3.3.4 Western Yellow-billed Cuckoo

Locations of land development categories in relation to cuckoo modeled habitat are displayed in Figures 4.9 and 4.10.

Impacts Common to All Alternatives

Direct impacts to 45 ha (110 ac) of cuckoo modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below. Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 462 ha (1,141 ac), of cuckoo modeled habitat would be subject to impacts from future development and CIP activities.

Impacts to cuckoo resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for bridges and bank protection, disturbance from construction and traffic noise, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, cuckoos would also be impacted by development and construction. These impacts would include destruction and fragmentation of habitat during land clearing activities, disturbance from construction and traffic noise, introduction or spread of invasive plant species associated with land disturbance, and potential harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to cuckoos would likely occur.

Impacts of Alternative B

Under Alternative B, 462 ha (1,141 ac) of cuckoo modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhanced native plant preservation and mitigation through the revised Title 17, or policy guidance documents, and consideration of wildlife crossings. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to cuckoos.

Impact minimization and mitigation on an unknown number of hectares on parcels opting for voluntary inclusion in the HCP would include pre-construction surveys, enhanced native plant protections under the revised Title 17, or policy guidance documents, and the 95 percent NUOS requirement for Conservation Zone 1 along the Santa Cruz River.

Similar impact minimization and mitigation would occur on an unknown portion of the 2 ha (4 ac) of lands with existing entitlements through voluntary inclusion in the HCP.

Under Alternative B, adverse impacts to cuckoos would be less than significant.

Impacts of Alternative C

Under Alternative C, 107 ha (264 ac) of cuckoo modeled habitat would still be subject to impacts as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. This alternative would result in 355 ha (877 ac) of preserved cuckoo modeled habitat as NUOS. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.5 below. No lethal take of cuckoos would be anticipated. Under Alternative C, potential or minor adverse impacts to cuckoos would be anticipated.

**TABLE 4.5
WESTERN YELLOW-BILLED CUCKOO MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled Habitat	462 ha (1,141 ac)
Total habitat impacted by Town's CIP	45 ha (110 ac)
Total habitat impacted by development within HCP Conservation Zones	25 ha (62 ac)
Total habitat impacted by development outside of HCP Conservation Zones	37 ha (92 ac)
Total Impact	107 ha (264 ac)
Total NUOS	355 ha (877 ac)

4.3.3.5 Lesser Long-nosed Bat

Locations of land development categories in relation to lesser long-nosed bat modeled habitat are displayed in Figures 4.11 and 4.12.

Impacts Common to All Alternatives

Direct impacts to 148 ha (1,108 ac) of lesser long-nosed bat modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below. The Town would also continue to manage the 971 ha (2,400 ac) Tortolita Preserve and support efforts to purchase, preserve, and enhance parcels needed for a regional movement linkage across Interstate 10.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 12,988 ha (32,094 ac) of lesser long-nosed bat modeled habitat (with the exception of the existing Tortolita Preserve and other areas under conservation easement) would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to lesser long-nosed bats resulting from CIP activities would primarily be the result of destruction and fragmentation of foraging habitat for parks and roadways, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, lesser long-nosed bats would also be impacted by development and construction. These impacts would include destruction and fragmentation of foraging habitat during land clearing activities, alteration of foraging or travel patterns due to development-associated light sources, introduction or spread of

invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to lesser long-nosed bats would likely occur.

Impacts of Alternative B

Under Alternative B, 12,988 ha (32,094 ac) of lesser long-nosed bat modeled habitat would still be subject to impacts as described under Alternative A; however impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would enhance native plant preservation and mitigation and consider wildlife movement linkages. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to lesser long-nosed bat. Impact minimization and mitigation on an unknown portion of the 1,743 ha (4,308 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include enhanced native plant protections under a revised Title 17, or policy guidance documents, and NUOS requirements and protections in various Conservation Zones, ranging from 80 percent NUOS on the Tortolita Fan (Zone 2), and between 40 and 70 percent NUOS south of Tangerine Road (Zone 3). These NUOS areas would prioritize important lesser long-nosed bat foraging areas and movement linkages.

Under Alternative B, significant adverse impacts to lesser long-nosed bats would likely occur.

Impacts of Alternative C

Under Alternative C, 4,826 ha (11,925 ac) of lesser long-nosed bat modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 8,162 ha (20,169 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of lesser long-nosed bat modeled habitat than the other alternatives because most of the HCP Discretionary Lands are within modeled habitat in Conservation Zone 2, which would require 80 percent NUOS. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.6 below. No lethal take of individual lesser long-nosed bats would be anticipated. Under Alternative C, adverse impacts to lesser long-nosed bats would be less than significant.

**TABLE 4.6
LESSER LONG-NOSED BAT MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	12,988 ha (32,094 ac)
Total habitat impacted by Town's CIP	448 ha (1,108 ac)
Total habitat impacted by development within HCP Conservation Zones	3,299 ha (8,152 ac)
Total habitat impacted by development outside of HCP Conservation Zones	1,079 ha (2,665 ac)
Total impacts	4,826 ha (11,925 ac)
Total NUOS	8,126 ha (20,169 ac)

4.3.3.6 Merriam's Mesquite Mouse

Locations of land development categories in relation to mesquite mouse modeled habitat are displayed in Figures 4.13 and 4.14.

Impacts Common to All Alternatives

Direct impacts to 170 ha (420 ac) of mesquite mouse modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 4,610 ha (11,392 ac) of mesquite mouse modeled habitat (with the exception of habitat within the existing Tortolita Preserve and other areas under conservation easement) would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to mesquite mice resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for bridges and roadways, increased mortality from land clearing and vehicle strikes, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, mesquite mice would also be impacted by development and construction. These impacts would include increased mortality and destruction and fragmentation of habitat during land clearing activities, introduction or spread of invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Under Alternative A, adverse impacts to the mesquite mouse would be less than significant.

Impacts of Alternative B

Under Alternative B, 4,610 ha (11,392 ac) of mesquite mouse modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would enhance native plant preservation and mitigation and consider wildlife movement linkages. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to mesquite mice. The Town would also conduct riparian habitat restoration efforts on selected degraded watercourses identified in consultation with the Service.

Impact minimization and mitigation on an unknown portion of the 909 ha (2,245 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include enhanced riparian habitat protections and mapping under a revised Title 17, or policy guidance documents, and NUOS requirements and protections in various Conservation Zones, specifically 95 percent NUOS along the Santa Cruz River (Zone 1), 80 percent NUOS on the Tortolita Fan (Zone 2), and between 40 and 70 percent NUOS south of the Tortolita Preserve and extending across and south of Tangerine Road (Zone 3). These NUOS areas would prioritize important xeroriparian and mesquite bosque areas.

Under Alternative B, adverse impacts to the mesquite mouse would be less than significant.

Impacts of Alternative C

Under Alternative C, 1,502 ha (3,712 ac) of mesquite mouse modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 3,108 ha (7,679 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of mesquite mouse modeled habitat than the other alternatives, because many of the HCP Discretionary Lands are within modeled habitat in the Conservation Zones, which would require the preservation of relatively large amounts of NUOS.

Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.7 below. Additionally, the incidental lethal take of up to 10 individual Merriam's mesquite mice would be

anticipated. Under Alternative C, minor adverse impacts to the mesquite mouse would be anticipated.

**TABLE 4.7
MERRIAM'S MESQUITE MOUSE MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	4,610 ha (11,392 ac)
Total habitat impacted by Town's CIP	170 ha (420 ac)
Total habitat impacted by development within HCP Conservation Zones	1,083 ha (2,677 ac)
Total habitat impacted by development outside of HCP Conservation Zones	249 ha (616 ac)
Total impacts	1,502 ha (3,712 ac)
Total NUOS	3,108 ha (7,679 ac)

4.3.3.7 Pale Townsend's Big-eared Bat

Locations of land development categories in relation to pale Townsend's big-eared bat modeled habitat are displayed in Figures 4.15 and 4.16.

Impacts Common to All Alternatives

Direct impacts to 480 ha (1,186 ac) of pale Townsend's big-eared bat modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 18,020 ha (44,528 ac) of pale Townsend's big-eared bat modeled habitat (with the exception of habitat within the existing Tortolita Preserve and other areas under conservation easement) would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to pale Townsend's big-eared bats resulting from CIP activities would primarily be the result of destruction and fragmentation of foraging habitat for roadways, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, pale Townsend's big-eared bats would also be impacted by development and construction. These impacts would include destruction and fragmentation of foraging habitat during land clearing activities, alteration of foraging or travel patterns due to development-associated light sources, introduction or spread of invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to pale Townsend's big-eared bats would likely occur.

Impacts of Alternative B

Under Alternative B, 18,020 ha (44,528 ac) of pale Townsend's big-eared bat modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would enhance native plant and riparian habitat preservation and mitigation and consider wildlife movement linkages. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to pale Townsend's big-eared bat. The Town would also continue to manage the 971 ha (2,400 ac) Tortolita Preserve and support efforts to purchase, preserve, and enhance parcels needed for a regional movement linkage across Interstate 10. The Town would also conduct riparian habitat restoration efforts on selected degraded watercourses identified in consultation with the Service.

Impact minimization and mitigation on an unknown portion of the 1,616 ha (3,994 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include enhanced native plant and riparian habitat protections under a revised Title 17, or policy guidance documents, and NUOS requirements and protections in various Conservation Zones, ranging from 80 percent NUOS on the Tortolita Fan (Zone 2), and between 40 and 70 percent NUOS south of the Tortolita Preserve and extending across and south of Tangerine Road (Zone 3). These NUOS areas would prioritize important pale Townsend's big-eared bat foraging areas and movement linkages.

Under Alternative B, significant adverse impacts to pale Townsend's big-eared bats would likely occur.

Impacts of Alternative C

Under Alternative C, 9,823 ha (24,273 ac) of pale Townsend's big-eared bat modeled habitat would still be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 8,197 ha (20,255 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of pale Townsend's big-eared bat modeled habitat than the other alternatives because many of the HCP Discretionary Lands are within modeled habitat in Conservation Zones 2 and 3, which would require the preservation of relatively large amounts NUOS. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.8 below. For the pale Townsend's big-eared bat, the Service believes a less than 1:1 mitigation based on hectares of impacts is appropriate because the modeled habitat likely includes areas of varying quality and the areas with the highest quality for this species, the riparian areas, would be protected by the conservation measures outlined in the HCP. Additionally, those areas of modeled habitat impacted by development, especially low-density residential development adjacent to blocks of NUOS, would likely retain some of their value as foraging habitat of movement linkages. Therefore, the areas of NUOS will adequately mitigate the anticipated impacts. No lethal take of individual pale Townsend's big-eared bats would be anticipated. Under Alternative C, adverse impacts to this species would be less than significant.

**TABLE 4.8
PALE TOWNSEND'S BIG-EARED BAT MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	18,020 ha (44,528 ac)
Total habitat impacted by Town's CIP	480 ha (1,186 ac)
Total habitat impacted by development within HCP Conservation Zones	3,293 ha (8,136 ac)
Total habitat impacted by development outside of HCP Conservation Zones	6,051 ha (14,951 ac)
Total impacts	9,823 ha (24,273 ac)
Total NUOS	8,197 ha (20,255 ac)

4.3.3.8 Ground Snake

Locations of land development categories in relation to ground snake modeled habitat are displayed in Figures 4.17 and 4.18.

Impacts Common to All Alternatives

Direct impacts to 78 ha (192 ac) of ground snake modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 3,027 ha (7,480 ac) of ground snake modeled habitat would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to ground snakes resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for roadways and airport expansion, increased mortality from land clearing and vehicle strikes, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, ground snakes would also be impacted by development and construction. These impacts would include increased mortality and destruction and fragmentation of habitat during land clearing activities, introduction or spread of invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to the ground snake would likely occur.

Impacts of Alternative B

Under Alternative B, 78 ha (192 ac) of ground snake modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhance native plant preservation and mitigation, and consider wildlife movement linkages. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to ground snakes.

The Town has also proposed to collaborate with the City of Tucson by contributing to research or management of Tucson Water parcels in the Brawley/Robles washes and the Santa Cruz River. These parcels were identified in planning meetings between the City of Tucson, Town of Marana, Pima County, the Service, and Phil Rosen (University of Arizona) as being important regional habitat linkages for conservation of various species, including the ground snake.

Impact minimization and mitigation on an unknown portion of the 312 ha (771 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include pre-construction surveys, enhanced native plant protections under a revised Title 17, or policy guidance documents, and NUOS requirements and protections in various Conservation Zones. Of most importance to ground snake habitat would be requirements for 80 percent NUOS on the Tortolita Fan in Zone 2.

Under Alternative B, significant adverse impacts to the ground snake would likely occur.

Impacts of Alternative C

Under Alternative C, 892 ha (2,205 ac) of ground snake modeled habitat would still be impacted as described under Alternative A; however, impacts from CIP activities and

various levels of development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 2,135 ha (5,275 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of ground snake modeled habitat than the other alternatives because many of the HCP Discretionary Lands are within modeled habitat in Conservation Zone 2, and modeled habitat on City of Tucson lands would be managed in a manner consistent with ground snake survival and recovery. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.9 below. Additionally, the incidental lethal take of up to five individual ground snakes would be anticipated. Under Alternative C, adverse impacts to the ground snake would be less than significant.

**TABLE 4.9
GROUND SNAKE MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	3,027 ha (7,480 ac)
Total habitat impacted by Town's CIP	78 ha (192 ac)
Total habitat impacted by development within HCP Conservation Zones	570 ha (1,409 ac)
Total habitat impacted by development outside of HCP Conservation Zones	244 ha (604 ac)
Total impacts	892 ha (2,205 ac)
Total NUOS	2,135 ha (5,275 ac)

4.3.3.9 Mexican Garter Snake

Locations of land development categories in relation to Mexican garter snake modeled habitat are displayed in Figures 4.19 and 4.20.

Impacts Common to All Alternatives

Direct impacts to 32 ha (79 ac) of Mexican garter snake modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below. Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 453 ha (1,120 ac) of Mexican garter snake modeled habitat would be subject to impacts from future development and CIP activities.

Impacts to Mexican garter snake resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for bridges and bank protection, increased mortality from land clearing and vehicle strikes, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, Mexican garter snakes would also be impacted by development and construction. These impacts would include increased mortality and destruction and fragmentation of habitat during land clearing activities, continued predation by and competition with non-native vertebrate species, and harassment and predation by humans and domestic pets.

Under Alternative A, adverse impacts to the Mexican garter snake would be less than significant.

Impacts of Alternative B

Under Alternative B, 453 ha (1,120 ac) of Mexican garter snake modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhanced riparian habitat preservation and mitigation through the revised Title 17, or policy guidance documents, and consideration of wildlife crossings. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to Mexican garter snakes.

There are no lands with existing entitlements within modeled habitat for this species, so no voluntary inclusion would be possible under this alternative.

Under Alternative B, adverse impacts to the Mexican garter snake would be less than significant.

Impacts of Alternative C

Under Alternative C, 89 ha (221 ac) of Mexican garter snake modeled habitat would be impacted as described under Alternative A; however, all impacts would be minimized and mitigated through the conservation measures listed under Alternative B. Avoidance and mitigation on HCP Discretionary Lands would include pre-construction surveys, enhanced riparian habitat protection and mitigation under the revised Title 17, or policy

guidance documents, and the 95 percent NUOS requirement for Conservation Zone 1 along the Santa Cruz River. Alternative C would result in 364 ha (899 ac) of preserved Mexican garter snake modeled habitat as NUOS.

Habitat impacts under Alternative C are detailed in Table 4.10 below. Additionally, the incidental lethal take of up to two individual Mexican garter snakes would be anticipated. Under Alternative C, potential or minor adverse impacts to the Mexican garter snake would be anticipated.

**TABLE 4.10
MEXICAN GARTER SNAKE MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	453 ha (1,120 ac)
Total habitat impacted by Town's CIP	32 ha (79 ac)
Total habitat impacted by development within HCP Conservation Zones	44 ha (108 ac)
Total habitat impacted by development outside of HCP Conservation Zones	14 ha (34 ac)
Total impacts	89 ha (221 ac)
Total NUOS	364 ha (899 ac)

4.3.3.10 Sonoran Desert Tortoise

Locations of land development categories in relation to Sonoran desert tortoise modeled habitat are displayed in Figures 4.21 and 4.22.

Impacts Common to All Alternatives

Direct impacts to 4 ha (4 ac) of Sonoran desert tortoise modeled habitat resulting from CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below. The Town would also continue to support efforts to purchase, preserve, and enhance parcels needed for a regional movement linkage across Interstate 10.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 3,000 ha (7,413 ac) of Sonoran desert tortoise modeled habitat would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to Sonoran desert tortoises resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for roadways, increased mortality from

land clearing and vehicle strikes, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, Sonoran desert tortoises would also be impacted by development and construction. These impacts would include increased mortality and destruction as well as fragmentation of habitat during land clearing activities, introduction or spread of invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Under Alternative A, significant adverse impacts to the Sonoran desert tortoise would likely occur.

Impacts of Alternative B

Under Alternative B, 3,000 ha (7,413 ac) of Sonoran desert tortoise modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhance native plant preservation and mitigation, and consider wildlife movement linkages. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to Sonoran desert tortoises.

Impact minimization and mitigation on an unknown portion of the 552 ha (1,365 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include enhanced native plant protections under a revised Title 17, or policy guidance documents, and NUOS requirements and protections in various Conservation Zones. Of most importance to Sonoran desert tortoise habitat would be requirements for 80 percent NUOS on the Tortolita Fan and the northern end of the Tucson Mountains, both in Zone 2. Additionally, the revised Title 19 would protect areas of modeled habitat with slopes of 15 percent or greater.

Under Alternative B, adverse impacts to the Sonoran desert tortoise would be less than significant.

Impacts of Alternative C

Under Alternative C, 611 ha (1,510 ac) of Sonoran desert tortoise modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 2,389 ha (5,903 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in significantly more preservation of Sonoran desert tortoise modeled habitat than the other alternatives because many of the HCP Discretionary Lands are within modeled habitat in Conservation Zone 2, which would require the preservation of 80 percent NUOS, and are on slopes of 15 percent or greater, which would be protected by Title 19. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.11 below. Additionally, the incidental lethal take of up to 10 individual Sonoran desert tortoises would be anticipated. Under Alternative C, potential or minor adverse impacts to this species would be anticipated.

**TABLE 4.11
SONORAN DESERT TORTOISE MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	3,000 ha (7,413 ac)
Total habitat impacted by Town's CIP	2 ha (4 ac)
Total habitat impacted by development within HCP Conservation Zones	598 ha (1,477 ac)
Total habitat impacted by development outside of HCP Conservation Zones	12 ha (29 ac)
Total impacts	611 ha (1,510 ac)
Total NUOS	2,389 ha (5,903 ac)

4.3.3.11 Tucson Shovel-nosed Snake

Locations of land development categories in relation to Tucson shovel-nosed snake modeled habitat are displayed in Figures 4.23 and 4.24.

Impacts Common to All Alternatives

Direct impacts to 157 ha (1,130 ac) of Tucson shovel-nosed snake modeled habitat resulting CIP activities would be the same under all alternatives. However, mitigation for these impacts would differ under the alternatives as discussed below.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 5,208 ha (12,870 ac) of Tucson shovel-nosed snake modeled habitat would be subject to impacts from either ongoing agriculture or future development and CIP activities.

Impacts to Tucson shovel-nosed snakes resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for roadways and airport expansion, increased mortality from land clearing and vehicle strikes, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, Tucson shovel-nosed snakes would also be impacted by development and construction. These impacts would include increased mortality and destruction and fragmentation of habitat during land clearing activities, introduction or spread of invasive plant species associated with land disturbance, and harassment and predation by humans and domestic pets.

Adverse impacts to the Tucson shovel-nosed snake under Alternative A would be less than significant.

Impacts of Alternative B

Under Alternative B, 5,208 ha (12,870 ac) of Tucson shovel-nosed snake modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhance native plant preservation and mitigation, and consider wildlife movement linkages. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to Tucson shovel-nosed snakes.

The Town has also proposed to collaborate with the City of Tucson by contributing to research or management of Tucson Water parcels in the Brawley/Los Robles and Blanco Washes and the Santa Cruz River. These parcels were identified in planning meetings between the City of Tucson, Town of Marana, Pima County, the Service, and Phil Rosen (University of Arizona) as being important regional habitat linkages for conservation of various species, including the Tucson shovel-nosed snake.

Impact minimization and mitigation on an unknown number or portion of the 296 ha (732 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include pre-construction surveys and enhanced native plant protections under a revised Title 17, or policy guidance documents. Some areas of modeled habitat would also benefit from NUOS requirements and protections in Conservation Zones 2 and 3.

Adverse impacts to the Tucson shovel-nosed snake under Alternative B would be less than significant.

Impacts of Alternative C

Under Alternative C, 3,867 ha (9,556 ac) of Tucson shovel-nosed snake modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. A total of 1,341 ha (3,314 ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of Tucson shovel-nosed snake modeled habitat than the other alternatives because many of the HCP Discretionary Lands are within modeled habitat in Conservation Zone 2, and modeled habitat on City of Tucson lands would be managed in a manner consistent with Tucson shovel-nosed snake survival and recovery. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.12 below. For the Tucson shovel-nosed snake, the Service believes a less than 1:1 mitigation based on hectares of impacts is appropriate because the Town chose to apply a more regional conservation approach. This regional approach recognizes that modeled habitat for this species includes large areas that are not likely currently occupied or may be of varying quality. Currently, this species has not been documented within the Permit Area for more than 26 years. The objective of the regional approach to conservation for the shovel-nosed snake is to protect and restore potential habitat within the region, and to conduct research to better understand the ecological status and habitat requirements for the species. The collaborative management and research on Tucson Water Lands proposed within the HCP will help to achieve this objective. In addition to impacts to modeled habitat, the incidental lethal take of up to two individual Tucson shovel-nosed snakes would be anticipated; however, the likelihood of lethal take will be substantially reduced by the conservation measures outlined in the HCP. Under Alternative C, potential or minor adverse impacts to the Tucson shovel-nosed snake would be anticipated.

**TABLE 4.12
TUCSON SHOVEL-NOSED SNAKE MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	5,208 ha (12,870 ac)
Total habitat impacted by Town's CIP	157 ha (1,130 ac)
Total habitat impacted by development within HCP Conservation Zones	1,069 ha (2,642 ac)
Total habitat impacted by development outside of HCP Conservation Zones	2,341 ha (5,784 ac)
Total impacts	3,867 ha (9,556 ac)
Total NUOS	1,341 ha (3,314 ac)

4.3.3.12 Lowland Leopard Frog

Locations of land development categories in relation to lowland leopard frog modeled habitat are displayed in Figures 4.25 and 4.26.

Impacts Common to All Alternatives

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 680 ha (1,680 ac) of lowland leopard frog modeled habitat would be subject to impacts from future development and CIP activities.

Impacts to lowland leopard frog resulting from CIP activities would primarily be the result of destruction and fragmentation of habitat for bridges and bank protection, increased mortality from land clearing and vehicle strikes, and introduction or spread of invasive plant species associated with linear projects.

Without the implementation of the HCP, lowland leopard frogs would also be impacted by development and construction. These impacts would include increased mortality and destruction and fragmentation of habitat during land clearing activities, continued predation by and competition with non-native vertebrate species, and harassment and predation by humans and domestic pets.

Adverse impacts to the lowland leopard frog under Alternative A would be less than significant.

Impacts of Alternative B

Under Alternative B, 680 ha (1,680 ac) of lowland leopard frog modeled habitat would still be subject to impacts described under Alternative A; however, impacts from CIP activities would be minimized and mitigated through the conservation measures of the HCP. Primarily these conservation measures would include the implementation of the ESRDG, which would require pre-construction surveys, enhanced riparian habitat preservation and mitigation through the revised Title 17, or policy guidance documents, and consideration of wildlife crossings. Other conservation measures would include the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to lowland leopard frogs.

There are no lands with existing entitlements within modeled habitat for this species, so no voluntary inclusion would be possible under this alternative.

Adverse impacts to the lowland leopard frog under Alternative B would be less than significant.

Impacts of Alternative C

Under Alternative C, 141 ha (348 ac) of lowland leopard frog modeled habitat would be impacted as described under Alternative A; however, impacts from CIP activities and development on HCP Discretionary Lands would be minimized and mitigated through the conservation measures listed under Alternative B. Avoidance and mitigation on HCP Discretionary Lands would include pre-construction surveys, enhanced riparian habitat protection and mitigation under the revised Title 17, or policy guidance documents, and the 95 percent NUOS requirement for Conservation Zone 1 along the Santa Cruz River. Alternative C would result in 539 ha (1,332 ac) of preserved lowland leopard frog modeled habitat as NUOS.

Habitat impacts under Alternative C are detailed in Table 4.13 below. Additionally, the incidental lethal take of up to two individual lowland leopard frogs would be anticipated. Under Alternative C, potential or minor adverse impacts to this would be anticipated.

**TABLE 4.13
LOWLAND LEOPARD FROG MODELED HABITAT AND
PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	680 ha (1,680 ac)
Total habitat impacted by Town's CIP	42 ha (103 ac)
Total habitat impacted by development within HCP Conservation Zones	34 ha (83 ac)
Total habitat impacted by development outside of HCP Conservation Zones	66 ha (162 ac)
Total impacts	141 ha (348 ac)
Total NUOS	539 ha (1,332 ac)

4.3.3.13 Talus Snail

Locations of land development categories in relation to talus snail modeled habitat are displayed in Figures 4.27 and 4.28.

Impacts Common to All Alternatives

No impacts to talus snail modeled habitat are anticipated as a result of CIP activities under any of the alternatives.

Impacts of Alternative A (No Action)

Under Alternative A, a total of 2,582 ha (6,380 ac) of talus snail modeled habitat would be subject to impacts from future development activities.

Without the implementation of the HCP, talus snails would also be impacted by development and construction. These impacts would include increased mortality and destruction of habitat during land clearing activities, increased erosion and sedimentation of crevices and alteration of site hydrology due to land disturbance, and introduction or spread of invasive plant species associated with land disturbance, which may alter frequency and intensity of wildfires.

Under Alternative A, significant adverse impacts to the talus snail would likely occur.

Impacts of Alternative B

Under Alternative B, 2,582 ha (6,380 ac) of talus snail modeled habitat would still be subject to impacts described under Alternative A; however, impact minimization and mitigation on an unknown portion of the 419 ha (1,036 ac) of lands with existing entitlements through voluntary inclusion in the HCP would include enhanced project native plant protections and pre-development review and planning under a revised Title 17, or policy guidance documents, increased talus slope protections under a revised Title 19 (Hillside Development), and the 80 percent NUOS requirements and protections in Conservation Zone 2. Impacts to talus snails would also be mitigated through the implementation of an Invasive Species Management Program and an education program to inform Town staff and residents how to avoid or minimize impacts to talus snails.

Under Alternative B, significant adverse impacts to the talus snail would likely occur.

Impacts of Alternative C

Under Alternative C, 580 ha (1,432 ac) of talus snail modeled habitat would still be subject to impacts described under Alternative A; however, because Title 19 would protect areas of modeled habitat with slopes of 15 percent or greater, the actual number of hectares of impacted modeled habitat would likely be considerably less. Impacts from development on HCP Discretionary Lands would also be minimized and mitigated through enhanced project native plant protections and pre-development review and planning under a revised Title 17, or policy guidance documents, the 80 percent NUOS requirements and protections in Conservation Zone 2, the implementation of an Invasive Species Management Program, and an education program to inform Town staff and residents how to avoid or minimize impacts to talus snails. A total of 2,002 ha (4,948ac) of modeled habitat would be protected as NUOS.

Alternative C would result in considerably more preservation of talus snail modeled habitat than the other alternatives because many of the HCP Discretionary Lands are

within modeled habitat in Conservation Zone 2, which would require the preservation of 80 percent NUOS. Impacts on parcels opting for voluntary inclusion in the HCP would be the same as under Alternative B.

Habitat impacts under Alternative C are detailed in Table 4.14 below. No lethal take of individual talus snails would be anticipated. Under Alternative C, potential or minor adverse impacts to the talus snail would be anticipated.

**TABLE 4.14
 TALUS SNAIL MODELED HABITAT AND
 PROJECTED FUTURE IMPACTS IN THE TOWN**

Type of Habitat or Impact	Area
Modeled habitat	2,582 ha (6,380 ac)
Total habitat impacted by Town's CIP	0 ha
Total habitat impacted by development within HCP Conservation Zones	501 ha (1,237 ac)
Total habitat impacted by development outside of HCP Conservation Zones	79 ha (195 ac)
Total impacts	580 ha (1,432 ac)
Total NUOS	2,002 ha (4,948ac)

4.3.4 Federal Species Not Covered by the HCP

4.3.4.1 Gila Chub

Although Gila chub are not known to occur within the Town, potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town and because of habitat restoration projects such as TRDN, this species may occur within the Town during the duration of the ITP.

Impacts Common to All Alternatives

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code, thereby minimizing potential impacts to Gila chub.

Impacts of Alternative A (No Action)

Impacts to Gila chub would not be anticipated unless restoration of the riparian habitat along the Santa Cruz River resulted in improved habitat conditions so as to allow Gila chub to reoccupy the reaches within the Town. Due to this possibility, the Town has considered, as part of its TRDN coordination with PCRFC and the Corps, the possibility of entering into a Safe Harbor Agreement with the Service. This agreement

would benefit Gila chub while giving the Town assurances that no additional future regulatory restrictions would be imposed.

Impacts of Alternative B

Under Alternative B, no impacts would be anticipated because Gila chub are not known to occur in the Town. If Gila chub are discovered in the Town, or reoccupy the Santa Cruz River within the Town, any impacts would not be attributable to the implementation of the HCP. Conversely, under Alternative B, impacts to Gila chub habitat would be minimized and mitigated through many of the conservation measures of the HCP applied to CIP activities and on parcels opting for voluntary inclusion. These measures would include enhanced riparian habitat preservation and mitigation through the revised Title 17, or policy guidance documents, implementation of an Invasive Species Management Program, and the 95 percent NUOS requirement for Conservation Zone 1.

Impacts of Alternative C

Under Alternative C, no impacts would be anticipated because Gila chub are not known to occur in the Town. If Gila chub are discovered in the Town, or reoccupy the Santa Cruz River within the Town, any impacts would not be attributable to the implementation of the HCP. As under Alternative B, conservation measures in the HCP would minimize and mitigate any impacts to Gila chub and would also apply to HCP Discretionary Lands under Alternative C.

4.3.4.2 Gila Topminnow

Although Gila topminnow are not known to occur within the Town, potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town and because of habitat restoration projects such as TRDN, this species may occur within the Town during the duration of the ITP.

Impacts Common to All Alternatives

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code, thereby minimizing potential impacts to Gila topminnow.

Impacts of Alternative A (No Action)

Impacts to Gila topminnow would not be anticipated unless restoration of the riparian habitat along the Santa Cruz River resulted in improved habitat conditions so as to allow Gila topminnow to reoccupy the reaches within the Town. Due to this possibility, the Town has considered, as part of its TRDN coordination with PCRFC and the Corps, the possibility of entering into a Safe Harbor Agreement with the Service. This

agreement would benefit Gila topminnow while giving the Town assurances that no additional future regulatory restrictions would be imposed.

Impacts of Alternative B

Under Alternative B, no impacts would be anticipated because Gila topminnows are not known to occur in the Town. If Gila topminnow are discovered in the Town, or reoccupy the Santa Cruz River within the Town, any impacts would not be attributable to the implementation of the HCP. Conversely, under Alternative B, impacts to Gila topminnow habitat would be minimized and mitigated through many of the conservation measures of the HCP applied to CIP activities and on parcels opting for voluntary inclusion. These measures would include enhanced riparian habitat preservation and mitigation through the revised Title 17, or policy guidance documents, implementation of an Invasive Species Management Program, and the 95 percent NUOS requirement for Conservation Zone 1.

Impacts of Alternative C

Under Alternative C, no impacts would be anticipated because Gila topminnows are not known to occur in the Town. If Gila topminnow are discovered in the Town, or reoccupy the Santa Cruz River within the Town, any impacts would not be attributable to the implementation of the HCP. As under Alternative B, conservation measures in the HCP would minimize and mitigate any impacts to Gila topminnow and would also apply to HCP Discretionary Lands under Alternative C.

4.3.4.3 Huachuca Water Umbel

Although populations of Huachuca water umbel are not known to occur within the Town, potential habitat for this species exists along the perennial stretches of the Santa Cruz River within the Town and because of habitat restoration projects such as TRDN, this species may occur within the Town during the duration of the ITP.

Impacts Common to All Alternatives

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code, thereby minimizing potential impacts to Huachuca water umbel populations.

Impacts of Alternative A (No Action)

Impacts to Huachuca water umbel would not be anticipated unless restoration of the riparian habitat along the Santa Cruz River resulted in improved habitat conditions so as to allow Huachuca water umbel to reoccupy the reaches within the Town. Due to this possibility, the Town has considered, as part of its TRDN coordination with PCRFCO

and the Corps, the possibility of entering into a Safe Harbor Agreement with the Service. This agreement would benefit Huachuca water umbel populations while giving the Town assurances that no additional future regulatory restrictions would be imposed.

Impacts of Alternative B

Under Alternative B, no impacts would be anticipated because Huachuca water umbel populations are not known to occur in the Town. If Huachuca water umbel are discovered in the Town, or reoccupy the Santa Cruz River within the Town, any impacts would not be attributable to the implementation of the HCP. Conversely, under Alternative B, impacts to Huachuca water umbel habitat would be minimized and mitigated through many of the conservation measures of the HCP applied to CIP activities and on parcels opting for voluntary inclusion. These measures would include enhanced riparian habitat preservation and mitigation through the revised Title 17, or policy guidance documents, implementation of an Invasive Species Management Program, and the 95 percent NUOS requirement for Conservation Zone 1.

Impacts of Alternative C

Under Alternative C, no impacts would be anticipated because Huachuca water umbel populations are not known to occur in the Town. If Huachuca water umbel are discovered in the Town, or reoccupy the Santa Cruz River within the Town, any impacts would not be attributable to the implementation of the HCP. As under Alternative B, conservation measures in the HCP would minimize and mitigate any impacts to Huachuca water umbel and would also apply to HCP Discretionary Lands under Alternative C.

4.3.5 Migratory Birds

The ITP will also constitute a Special Purpose Permit under 50 Code of Federal Regulations (CFR) 21.27 for the take of Federally listed birds in the amount and/or number and subject to the terms and conditions specified herein. Any such take will not be in violation of the MBTA of 1918, as amended (16 U.S.C. 703-712). Unlisted birds that are covered by the HCP are not covered by the Special Purpose Permit and may be taken only if such take is not in violation of the MBTA. The Special Purpose Permit will be renewed automatically, provided that the Town continues to fulfill its obligations under the HCP and its Implementing Agreement. Each automatic renewal will be valid for the maximum time period allowed by 50 CFR 21.27 or its successor at the time of renewal.

Impacts of Alternative A (No Action)

Under Alternative A, any take of migratory birds would constitute a violation of MBTA. However, because the level of development would be greatest under this alternative, unknown take of migratory birds would likely occur.

Impacts of Alternative B

Under this alternative, the implementation of conservation measures on CIP activities and voluntary inclusion/non-discretionary actions would likely offer some ancillary protection to migratory birds in the Town through increased awareness of wildlife from the education program and increased documentation of migratory bird nesting from site resource inventories.

Impacts of Alternative C

Under Alternative C, impacts to and take of migratory birds would be minor. As under Alternative B, conservation measures in the HCP would provide additional protections for migratory birds but would also apply to HCP Discretionary Lands under this alternative.

4.3.6 State Species

4.3.6.1 Black-bellied Whistling Duck

Because black-bellied whistling ducks are most likely to use the perennial reaches of the Santa Cruz River, impacts to this species would be similar to those described for southwestern willow flycatcher and yellow-billed cuckoo.

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code, thereby minimizing potential impacts to this species.

Because many of the conservation measures in the HCP would also minimize and mitigate impacts to the black-bellied whistling duck, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.2 California Leaf-nosed Bat

Because California leaf-nosed bats are insectivorous and forage over Sonoran Desertscrub vegetation, impacts to this species would be similar to those described for the Pale Townsend's big-eared bat.

Because many of the conservation measures in the HCP, particularly the NUOS requirements in the Conservation Zones, would also minimize and mitigate impacts to the California leaf-nosed bat, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.3 Great Plains Narrow-mouthed Toad

Because Great Plains narrow-mouthed toads are most likely to use the riparian areas such as the Santa Cruz River, impacts to this species would be similar to those described for the Mexican garter snake and lowland leopard frog.

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code, thereby minimizing potential impacts to this species.

Because many of the conservation measures in the HCP would also minimize and mitigate impacts to the Great Plains narrow-mouthed toad, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.4 Tropical Kingbird

Because tropical kingbirds are most likely to use the perennial reaches of the Santa Cruz River, impacts to this species would be similar to those described for southwestern willow flycatcher and yellow-billed cuckoo.

Under all alternatives, the Town would continue to limit development within the Santa Cruz River floodway to those uses permissible under Title 21 of the Town's Land Use Code, thereby minimizing potential impacts to this species.

Because many of the conservation measures in the HCP would also minimize and mitigate impacts to the tropical kingbird, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.5 Desert Night-blooming Cereus

This species is known to occur throughout the desert areas, especially in creosote-bursage vegetation communities, in and around the Town. While this species is listed in the Town's existing Title 17 list of protected native plants, many of the conservation measures in the HCP, particularly those related to invasive species management and NUOS requirements in the Conservation Zones, would also minimize and mitigate impacts to the desert night-blooming cereus.

Therefore, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.6 Kelvin Cholla

This species is known to be present in areas of Avra Valley as well as in the Tucson Mountains. Many of the conservation measures in the HCP, particularly those related to native plant protections and NUOS requirements in the Conservation Zones, would also minimize and mitigate impacts to the Kelvin cholla.

Therefore, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.7 Pima Indian Mallow

Within the Town, this species can be expected to potentially occur on the southwestern flank of the Tortolita Mountains at elevations between 914 to 1,006 m (3,000 and 3,300 ft). Many of the conservation measures in the HCP, particularly those related to native plant protections and NUOS requirements in the Conservation Zones, would also minimize and mitigate impacts to the Pima Indian mallow.

Therefore, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.8 Staghorn Cholla

This species is relatively common in desert scrub, desert flats, washes to rocky hillsides, and canyons, and is known to be present in areas of Avra Valley as well as in the Tucson Mountains. Many of the conservation measures in the HCP, particularly those related to native plant protections and NUOS requirements in the Conservation Zones, would also minimize and mitigate impacts to the staghorn cholla.

Therefore, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.9 Thornber Fishhook Cactus

Within the Town, this species could be expected in the western lowlands. Many of the conservation measures in the HCP, particularly those related to native plant protections, would also minimize and mitigate impacts to the Thornber fishhook cactus.

Therefore, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.3.6.10 Tumamoc Globeberry

Tumamoc globeberry can be expected to occur in the Town in areas of natural Sonoran Desert vegetation, especially along washes. Many of the conservation measures in the HCP, particularly those related to native plant protections, riparian habitat protection, and NUOS requirements in the Conservation Zones, would also minimize and mitigate impacts to this species.

Therefore, total impacts to this species would be the least under Alternative C and the most under Alternative A. Impacts under Alternative B would likely be at some level between the other alternatives.

4.4 Land Ownership and Use

This section compares impacts resulting from alternatives on the Town's distribution of population and land use, recreation, Prime and Unique Farmlands/community heritage, and mineral resources and mining activities.

Criteria for Determining Significance

The following criteria were used to determine whether any of the alternatives would have significant impacts on the Town's land ownership and use. The impacts would be significant if implementation would:

- Substantially restrict or alter population trends or distribution within the Town
- Substantially restrict or alter land use patterns
- Reduce recreational opportunities for a substantial segment of the population
- Substantially alter Prime or Unique Farmland or community heritage
- Substantially restrict current or future mineral resource extraction operations

4.4.1 Distribution of Population and Land Use

4.4.1.1 Impacts Common to All Alternatives

Population distribution and growth trends within the Town would likely be the same under all alternatives.

4.4.1.2 Impacts of Alternative A (No Action)

Under this alternative, future land use would continue to unfold in a manner consistent with the Town's General Plan (Town 2007a). This would result in commercial development, the Town's Central Business District, and medium-density residential development clustered along the interstate, industrial development clustered around the airport, and rural and low-density residential development located on the Tortolita Fan and near the western boundary of the Town.

4.4.1.3 Impacts of Alternative B

Because CIP activities would be the same under all alternatives, impacts under Alternative B would be dependent upon the level of participation in voluntary inclusion in the HCP. Any changes to land use under voluntary inclusion would increase NUOS and natural resource amenities. These minor beneficial impacts would be at an individual parcel scale and would not substantially alter the future land use patterns when compared to Alternative A.

4.4.1.4 Impacts of Alternative C

The primary beneficial impacts to land use under Alternative C would occur on parcels in the Tortolita Fan, much of which is currently State Trust land. Under this alternative, HCP Discretionary Lands within Conservation Zone 2 would be required to preserve 80 percent of their land as NUOS. Because the Tortolita Fan is planned for rural density development in the Town's General Plan (Town 2007a), this NUOS requirement would not substantially alter the land use for this area, however NUOS restrictions would result in more consistent protections for the natural landscape. A similar impact to land use would occur on HCP Discretionary Lands south of Tortolita Preserve, and extending across and south of Tangerine Road (HCP Conservation Zone 3), with NUOS requirements ranging from 40 to 70 percent. Again, these impacts would not be substantial as this area is planned as low-density residential development in the General Plan. Under this alternative, commercial development, the Town's Central Business District, and medium-density residential development would occur in the same general locations as under Alternative A.

4.4.2 Recreation

4.4.2.1 Impacts Common to All Alternatives

Because planned recreation projects are part of the CIP activities proposed for coverage under the HCP, future parks and trails facilities would be the same under all alternatives. Marana Arts Council programs and recreational aviation opportunities would also be similar under all alternatives.

4.4.2.2 Impacts of Alternative A (No Action)

Under this alternative, the Town would continue to manage, operate, and expand the main parks and trail networks within the Town. Most of these facilities would provide traditional recreation opportunities such as soccer and baseball fields, linear parks for pedestrian and bicycle use, hiking and equestrian trails, picnic areas, and children's playgrounds.

4.4.2.3 Impacts of Alternative B

Under this alternative, recreation opportunities and impacts to recreation would be identical to Alternative A.

4.4.2.4 Impacts of Alternative C

Under Alternative C, traditional recreation opportunities would be provided the same as under Alternative A, but these facilities and experiences would likely be significantly enhanced with the addition of wildlife habitat features (e.g., artificial burrows for burrowing owls), wildlife viewing areas (e.g., BOMA viewing platforms) and the increased protection of riparian habitats. The experience along hiking and equestrian trails along the Santa Cruz River and on the Tortolita Fan would also benefit due to increased NUOS in Conservation Zones.

4.4.3 Prime and Unique Farmlands/Community Heritage

4.4.3.1 Impacts Common to All Alternatives

The Town's identity is founded on its history of farming and agriculture. Because virtually all farmland within the Town will be developed to some degree under all alternatives, the community heritage will likely be significantly impacted under all alternatives.

4.4.3.2 Impacts of Alternative A (No Action)

Under this alternative, likely significant adverse impacts to Prime and Unique Farmlands would be anticipated; however these would not be a result of the proposed action (issuance of an ITP) and would be evaluated by the NRCS on a project-by-project basis for activities with a Federal nexus.

4.4.3.3 Impacts of Alternative B

Impacts under Alternative B would be to the same as Alternative A; again these impacts would not be triggered by the implementation of the HCP for covered activities under this alternative.

4.4.3.4 Impacts of Alternative C

Impacts to Prime and Unique Farmlands under Alternative C would be the same as in Alternative A; however some of the rural heritage of the area would be preserved in the NUOS of the Conservation Zones, particularly on the Tortolita Fan.

4.4.4 Mineral Resources and Mining Activity

4.4.4.1 Impacts Common to All Alternatives

Impacts to mineral resources and current mining activities would be similar under all alternatives. Impact differences would be most related to future discovery and extraction, as discussed below. Mineral resource exploration and extraction would continue to be subject to current and future regulations regarding mitigation and reclamation. Sand and gravel mining operation within the floodplain of the Santa Cruz River would continue to be an allowed use under the Town's Title 21, and the Town would have permit review authority. The State Mine Inspector would continue to be the authorizing entity for mining leases, access, and inspections.

4.4.4.2 Impacts of Alternative A (No Action)

Under Alternative A, regulatory control would be the same as currently exists, with the requirement for a reclamation and mitigation plan for excavated areas. If additional species are Federally listed for protection under the ESA, incidental take of species would have to be dealt with on a project-by-project basis through small-scale HCPs or Section 7 consultations where a Federal nexus is involved. This approach would not provide long-term certainty or legal assurances, resulting in less than significant impacts to mining activity.

4.4.4.3 Impacts of Alternative B

Some potential benefit to future mining activity is possible through voluntary inclusion in the HCP, especially if additional riparian species are Federally listed. By opting for voluntary inclusion, mining operations could receive increased certainty for long-term resource extraction and legal assurances.

4.4.4.4 Impacts of Alternative C

Because much of the available mineral resources are adjacent to the Santa Cruz River, and most of the lands in this area have existing land use entitlement. Alternative C would only provide minor benefits to the further discovery and development of mineral resources through voluntary inclusion outside of Conservation Zone 1.

4.5 Infrastructure

This section compares impacts resulting from alternatives on the Town's transportation, utility, and flood control infrastructure and facilities.

Criteria for Determining Significance

The following criteria were used to determine whether any of the alternatives would have significant impacts on the Town's infrastructure. The impacts would be significant if implementation would:

- Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections)
- Substantially increase flood hazards
- Result in inadequate emergency access
- Conflict with adopted policies, plans, or programs supporting alternative transportation

4.5.1 Impacts Common to All Alternatives

None of the alternatives would conflict with infrastructure as described in the Town's 2007 General Plan (Town 2007a). No impacts to roadway levels of service, restrictions on emergency access, or increase in design or flood hazards are anticipated under any of the alternatives.

The primary differences between alternatives, discussed below, would be with the level of environmental review, mitigation, and permitting associated with infrastructure projects.

4.5.2 Impacts of Alternative A (No Action)

Under this alternative, impacts resulting from the operations, maintenance, design, and construction of infrastructure within the Town would be subject to a variety of local, State, and Federal regulatory processes. The level of environmental review required for new projects would depend mostly on funding source and permitting requirements. For the most part, operations and maintenance activities would proceed as currently conducted; however, any activities involving take of Federally listed species would require individual permitting on a project-by-project basis. This piecemeal process would result in uncertainty and delays, a minor adverse impact.

4.5.3 Impacts of Alternative B

The Town's foreseeable infrastructure projects would be covered as CIP activities included in the ITP under this alternative. As such, new infrastructure development would be subject to conservation measures, including preconstruction surveys, consideration of vegetation communities and wildlife linkages, and set aside of NUOS. Many operations and maintenance actions would proceed as currently conducted with only the addition of education programs, but some activities would also require pre-constructions surveys and minor modifications to procedures in consideration of vegetation and wildlife. While these measures may require additional time for project development and completion, their inclusion in the ITP would provide ESA compliance, which would limit uncertainty and overall project delays, and provide legal assurances. The additional conservation measures and their resulting assurances would likely result in neutral impacts to infrastructure.

4.5.4 Impacts of Alternative C

Impacts under Alternative C would be the same as under Alternative B.

4.6 Socioeconomics

Socioeconomic impacts were evaluated in terms of demographics, economy and economic activity, public health and safety, and community services. These and other socioeconomic factors would not be adversely affected by any of the alternatives analyzed.

4.6.1 Impacts Common to All Alternatives

Under all alternatives, the Town's pace of residential development will continue to grow at a rapid rate, although it may fluctuate due to local and regional housing market conditions (Town 2007a). The socioeconomic climate would likely continue to grow as

well, and demographic trends and population increases would likely be similar to current levels. The Town would continue to provide community services to an increasing population, possibly more distributed in outlying areas.

4.6.2 Impacts of Alternative A (No Action)

Under Alternative A, the Town would continue to evaluate individual projects or actions for permit needs on a project-by-project basis. This alternative would not include a legally binding long-term commitment to landscape level conservation through an ITP. The Town's General Plan (2007a) identifies an economic development goal of identifying connections between the natural resources in the community and tourism, with particular attention to the development of eco-tourism opportunities. This alternative would be least able to support the local economic sector of environmentally based tourism. In addition, this alternative would be least able to support environmental, recreation, and open space goals outlined in the Town's General Plan (2007a). Alternative A would lack overall certainty and predictability in land development as projects would continue to be addressed on a project-by-project basis, without clearly defined natural resource conservation goals.

4.6.3 Impacts of Alternative B

Under Alternative B, ITP participation would be limited to the Town, covering CIP activities and voluntary inclusion parcels. Through the ITP and associated HCP, the Town aims to promote conservation of natural resources while providing for continued growth. The permit and HCP objectives include: facilitate compliance with the ESA for planned urban development and CIPs; promote biodiversity and species conservation and recovery within the Town's boundary; and, promote achievement of regional economic objectives including the orderly and efficient development of certain lands, while recognizing property rights and legal and physical land use constraints.

Analysis of other ITP socioeconomic impacts in the area, such as Pima County's MSCP (ESI 2003) indicate that there would be positive impacts on employment and new housing demand. These impacts were associated with two key factors: a greater certainty and predictability in the land development process and the greater likelihood of attracting an educated workforce for who open space and natural amenities are of value. Regulated development is facilitated by making the development process more straightforward and clearly defining the developable lands, these in turn help keep costs of development more tightly contained.

Open space and natural amenities produce amenities, such as recreational opportunities, scenic vistas, and healthy environments, that contribute directly to the well-being of people who have access to them; these are considered consumption amenities. Their contribution to consumers' well-being makes consumption amenities

economically important in their own right, but they also influence the location decisions of households and firms. The quantity and quality of natural resource amenities can affect the levels and types of jobs, incomes, profits, and economic activities in general throughout the local and regional economy, including sectors with no direct link to the use of ecosystem resources. Studies have documented that western counties with higher acreage of wilderness or roadless areas experience faster growth in jobs and income (ECO Northwest 2002).

Alternative B would help promote a more environmentally based economy by supporting the local economic sector of environmentally based tourism. In addition, this alternative would support environmental, recreation, and open space goals outlined in the Town's General Plan (2007a). In general, this alternative would result in a positive socioeconomic impact by enhancing consumption amenities of the Town and provide for long-term population growth and development in a more predictable, regulated context.

4.6.4 Impacts of Alternative C

Under Alternative C, HCP implementation would extend to private landowners whose land development activities are subject to the discretionary decisions of the Town (e.g., rezoning approvals), in addition to CIP activities and parcels opting for voluntary inclusion. This alternative would have the same positive benefits discussed for Alternative B with a greater ability to promote conservation of natural resources while providing for continued growth. Additional benefits of preserving open space include decreased costs for construction and maintenance of infrastructure associated with development.

This alternative would also have greater overall certainty and predictability in land development. Overall, this alternative would have a more beneficial socioeconomic impact of enhancing quality of life, enhancing consumptive amenities of the Town, and providing for long-term population growth and development in a more predictable, regulated context than Alternatives A or B.

4.7 Environmental Justice

4.7.1 Impacts of Alternative A (No Action)

Under Alternative A, low income and minority neighborhoods within the Town may experience negative impacts. Project-by-project permitting without more clearly defined developable land may lead to more dispersed and unregulated growth. Dispersed growth patterns lead to higher community expenditures for infrastructure and services. Overall, dispersed growth tends to discourage public transportation and encourage economic segregation which typically has an adverse impact on low-income and minority

populations. This alternative would be least able to preserve open space and unique sense of place, and wildlife habitats that have a particular value and meaning to Native American and other minority populations.

4.7.2 Impacts of Alternative B

Under Alternative B, no adverse impacts to low-income and minority populations would result. This alternative is more able to promote environmental justice issues than Alternative A by providing a greater certainty and predictability in the land development process and enhancing consumption amenities of the Town, such as open space, visual qualities, the unique sense of place, and wildlife habitats. More regulated growth also promotes the conservation rather than the development of areas outside of the transportation network.

4.7.3 Impacts of Alternative C

Alternative C would have the same positive benefits discussed for Alternative B with a greater ability to promote conservation of natural and cultural resources while providing for continued growth. This alternative would also have greater overall certainty and predictability in land development. Overall, this alternative would have a more beneficial impact than Alternatives A or B on low-income and minority populations by enhancing consumptive amenities of the Town, providing a landscape scale conservation framework, and promoting the conservation rather than the development of areas outside of the transportation network.

4.8 Air Quality

This section compares impacts resulting from alternatives on the Town's air quality, which will continue to be a concern as population growth, land development, and increased vehicular travel will occur under all alternatives.

Criteria for Determining Significance

The following criterion was used to determine whether any of the alternatives would have significant impacts on the Town's air quality. The impacts would be significant if implementation would result in noncompliance with Federal air quality standards.

4.8.1 Impacts Common to All Alternatives

Regional air quality would likely decline some because of population growth anticipated under all alternatives. The greatest impacts to air quality would likely result from increases in vehicular travel. Although sources of air pollution would likely increase

under all alternatives, this would not be attributable to the implementation of the HCP under either Alternative B or C. It is expected that air quality monitoring would be continued and mitigation measures as stipulated by PDEQ or EPA would be implemented, if necessary, to maintain compliance with the NAAQS under all alternatives.

4.8.2 Impacts of Alternative A (No Action)

Under this alternative some short-term increases in PM₁₀ concentrations would likely occur as development occurs, however these levels may then decrease in the long-term as more and more agricultural lands and other open spaces are covered with structures and pavement. While impacts to air quality would occur under this alternative, they would be minor and would not result in noncompliance with Federal air quality standards.

4.8.3 Impacts of Alternative B

Impacts under Alternative B would be similar to Alternative A. Because of their small footprint, conservation measures as applied to CIP activities and voluntary inclusion parcels would result in negligible or non-detectable impacts to air quality. Implementation of this alternative also would not result in noncompliance with Federal air quality standards.

4.8.4 Impacts of Alternative C

Because of an expected decrease in the amount of land that would be disturbed for construction or development, short-term impacts to air quality under this alternative would potentially be less than under Alternatives A or B. This difference in air quality would most likely be seen in PM₁₀ concentrations. Long-term PM₁₀ concentrations would also probably be less compared to the other alternatives because most of the open space would be in areas covered with native vegetation, minimizing wind-born particulate matter as compared to agricultural or disturbed open space. Implementation of this alternative would likely provide a minor beneficial impact.

4.9 Cultural and Historic Resources

This section compares impacts resulting from alternatives on the Town's cultural and historic resources.

Criteria for Determining Significance

The following criterion was used to determine whether any of the alternatives would have significant impacts on the Town's cultural and historic resources. The impacts would be significant if implementation would:

- Result in a violation of the National Historic Preservation Act (NHPA) or equivalent State regulations.
- If a proposed project would alter or impact the characteristics for which a cultural resource was eligible for inclusion in the National Register of Historic Places.

4.9.1 Impacts Common to All Alternatives

None of the alternatives would change existing Federal or State management of cultural resources within the Town. Take authorizations related to the HCP in Alternatives B or C would only be granted to otherwise lawful activities, which would still be subject to Section 106 of NHPA. The Service will meet its obligations under Section 106 of the NHPA through the Town's existing Cultural Resource Ordinance. Thus, there would be no difference in impacts whether any of the HCP alternatives were implemented or not. Conservation measures included in the HCP, in some cases, may actually provide ancillary protection for cultural resources, as discussed below.

4.9.2 Impacts of Alternative A (No Action)

Protection and management of cultural resources within the Town would continue to be administered as they are currently. Legal protection of cultural resources would still be regulated by NHPA, the Arizona Historic Preservation Act, Arizona Antiquities Act, and other associated provisions depending on land ownership. The Town would continue to implement Title 20 for actions on private land.

4.9.3 Impacts of Alternative B

The Service will meet its obligations under Section 106 of NHPA through the Town's existing Cultural Resource Ordinance as detailed in Section 1.10.1.4. Because of the small footprint of conservation measures applied to CIP activities and voluntary inclusion parcels, impacts under Alternative B would be virtually the same as under Alternative A.

4.9.4 Impacts of Alternative C

The Service will meet its obligations under Section 106 of NHPA through the Town's existing Cultural Resource Ordinance as detailed in Section 1.10.1.4. The regulatory protections of cultural resources under Alternative C would be identical to the other

alternatives. However, the NUOS provisions of the Conservation Zones as applied to HCP Discretionary Lands would likely provide important additional protections to cultural resources, particularly along the Santa Cruz River and on the Tortolita Fan.

4.10 Cumulative Effects

Implementing the procedural provisions of NEPA of 1969, as amended, CEQ regulations define “cumulative effects” as follows:

Cumulative impact is the impact on the environment which 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. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

As required by NEPA, cumulative effects must be evaluated along with the direct effects and indirect effects (those that occur later in time or are farther removed in distance) of each alternative. The range of alternatives must consider the No Action Alternative as a baseline against which to evaluate cumulative effects. The range of actions that must be considered under the cumulative effects includes not only the project but all connected and similar actions that could contribute to cumulative effects. Cumulative effects may arise from single or multiple actions and may result in additive or interactive effects (CEQ 1997).

To determine major cumulative effects of a project involves the following:

- The direct and indirect effects of the proposed action
- Which resources, ecosystems, and human communities, are affected
- Which effects on these resources are important from a cumulative effect perspective

In a general sense, all impacts on affected resources are cumulative; however, it is the goal of this analysis to narrow the important issues to those of regional or local significance.

The Town has developed a General Plan (Town 2007a) to set forth the policies and implementation measures needed to express community goals of accommodating anticipated growth while maintaining natural environments, as well as the identification of transportation corridors to meet the Town’s anticipated future transportation needs. Other related planning documents considered in the cumulative analysis include the

following general plans, land use plans, HCPs, and proposed actions related to the project area, which have guidance for development within cities and their spheres of influence, or within Pima and Pinal counties, as appropriate.

- City of Tucson General Plan (City of Tucson 2001)
- City of Tucson Habitat Conservation Plan, draft (City of Tucson 2007)
- Town of Oro Valley General Plan (Town of Oro Valley 2005)
- Pima County Multi Species Conservation Plan, Draft (Pima County 2006)
- Pima County Comprehensive Plan Update (Pima County 2007b)
- Pinal County Comprehensive Plan Proposal (Pinal County 2008)
- Ironwood Forest National Monument Draft Resource Management Plan/Draft EIS (BLM 2007)
- Saguaro National Park Fire Management Plan (National Park Service 2007)
- Tres Rios Del Norte Ecosystem Restoration EIS, preliminary draft (Corps 2006)

4.10.1 Cumulative Impact Analysis by Resource

This discussion evaluates the potential cumulative effects of the proposed HCP and alternatives on: the physical environment; water resources; biological resources; land ownership and use; recreation; prime and unique farmlands/community heritage; mineral resources and mining activity; infrastructure; socioeconomics and environmental justice; air quality; and cultural and historic resources.

4.10.1.1 Physical Environment

Riparian habitat restoration or construction that may be conducted under the proposed HCP and/or as implemented by future phases of TRDN could result in temporary increases in soil erosion at restoration sites. The Town's existing stormwater management program and implementation of conservation measures to limit erosion would result in a less-than-significant impact to soils. The proposed HCP, along with other regional conservation efforts, would result in increased amounts of NUOS and protections of riparian and other wildlife habitat. The proposed HCP would not contribute to a substantial cumulative impact to soils and erosion.

4.10.1.2 Water Resources

Measures enforced by State NPDES Permits establish a consistent program for mitigation of stormwater impacts and is designed to minimize cumulative, nonpoint source impacts from development activities. Further, the proposed HCP contains conservation measures that provide for additional water quality protection by the restoration of selected watercourses. The restoration of watercourses would result in improved channel morphology, water quality, vegetative habitat, and wildlife habitat in the long-term. Compliance with statewide standards for nonpoint source pollution reduction and restoration of selected watercourses will benefit water quality over time. In addition, implementation of the proposed HCP, in combination with other regional conservation efforts, including the Sonoran Desert Conservation Plan and City of Tucson Habitat Conservation Plan, may provide large, regional benefits to water quality. Therefore, implementation of the proposed HCP would result in less-than-significant cumulative effects to water resources.

4.10.1.3 Biological Resources

The proposed HCP must provide assurance that species and habitat will be conserved and recovered. The proposed HCP therefore evaluates impacts to covered species not only in terms of the impact of covered activities but also in terms of cumulative impact of other actions in the area. The cumulative impacts to covered species and habitats are inherently mitigated by the conservation program of the proposed HCP and therefore would not contribute to a cumulative significant impact.

Continued growth and urban expansion in adjacent communities such as the Town of Oro Valley, Oracle, and areas of southern Pinal County, may result in impacts to non-covered special-status species that would be cumulatively significant. Implementation of mitigation measures (e.g., requiring certain percentages of open space within a development area to be set aside and protected) would reduce potential impact to a less-than-significant level such that the effect of the overall conservation program, combined with other conservation projects in the region would be a beneficial cumulative impact to non-covered special-status species.

4.10.1.4 Land Ownership and Use

Establishment of conservation lands under the proposed HCP or alternatives in areas designated for agriculture or open space would not conflict with any existing or planned land uses, and would not contribute to a cumulative impact. Additional measures in the proposed HCP would reduce potential land use incompatibilities, such as providing limited incidental take coverage for adjacent land owners, and establishment of measures to buffer the interface between urban and wildland areas. Overall, implementation of the proposed HCP would encourage compatible land use

development patterns by ensuring that urban development is consistent with local general planning guidance, and that conservation occurs in a comprehensive coordinated manner consistent with existing and planned land uses.

Long-term regional growth may result in annexation of unincorporated lands. The extent and location of future conservation and development conflicts cannot be accurately predicted, although unincorporated areas where town and city general plans currently provide conceptual planning guidance are the most probable locations. Most areas where conservation lands and potential annexation would coincide are of a lower priority for land acquisition. Future development would be required to consider potential impacts to conserved lands and to the overall proposed HCP, and to mitigate for any impacts as part of the annexation and development. As a result, at such time as specific future land use changes are proposed, any potential cumulative land use impacts would be expected to be mitigated to a less-than-significant level through project modifications and/or implementation of project-specific mitigation measures.

Future changes in ownership of large land holdings currently owned by the State Land Department, such as in the Tortolita Fan area, would also be expected to result in private land development. Most development proposals of such lands would be subject to rezoning approvals by the Town, and would be required to conform to open-space set-aside areas that are intended to mitigate for the development impacts. A citizen's initiative that is now being proposed would designate many hectares of State Trust Land as conservation lands to be held by the Trust and managed by the ASLD for landscape conservation purposes. The proposed measure would also allow the Town to apply for and purchase additional conservation lands under the Arizona Preserve Initiative. Such future legislative changes related to State Trust Land could have a positive cumulative effect.

4.10.1.5 Recreation

Under all alternatives, recreational opportunities for area residents would continue to be provided and planned within the region. The proposed HCP, TRDN, and other large-scale conservation efforts would create new and enhanced recreation experiences through wildlife viewing areas, increased protection of riparian habitats, and increased outdoor recreational opportunities in open space lands.

4.10.1.6 Prime and Unique Farmlands/Community Heritage

The overall amount of agricultural lands is expected to continue to decline in the Town due to cumulative loss of productive lands, primarily by conversion of agricultural lands to residential and commercial land uses. Opportunities exist for the Town to conserve and/or restore some of the agricultural lands to benefit certain HCP covered species. Such efforts could also have a net positive effect on community character and heritage.

Because the proposed HCP does not identify specific parcels for acquisition, it is not feasible to assess the extent to which land acquisition under the proposed HCP would contribute to a cumulative impact to agricultural resources. Overall, the proposed HCP would not result in any significant impacts to agricultural resources and would not contribute to any substantial cumulative effect.

4.10.1.7 Mineral Resources and Mining Activity

Mineral and mining activity within the Town is primarily limited to sand and gravel extraction from the Santa Cruz River. The proposed HCP would provide mining and mineral resource extraction activities with increased legal assurances for long-term use. Overall, the proposed HCP would contribute less-than-significant cumulative impacts to mineral resources and mining activity.

4.10.1.8 Infrastructure

The proposed HCP or alternatives would not generate a substantial number of vehicle trips, or affect transportation, utility, or flood control systems. Neither the proposed HCP nor alternatives would contribute to a substantial cumulative impact to infrastructure and facilities.

4.10.1.9 Socioeconomics and Environmental Justice

Local development decisions are driven by many factors and, although implementation of the proposed HCP may affect a number of these, it is unlikely that the proposed HCP would result in substantial adverse effects on the area's economy, land values, or tax base, nor would it result in a disproportionate impact on low-income or minority populations. Overall, the proposed HCP would facilitate logical and orderly development pursuant to the Town's General Plan and long-term assurances for land developers. Systematic development in accordance with the General Plan would enable the Town to balance economic and social needs in development. Habitat conservation, in the context of orderly growth, and in conjunction with other large-scale planning and conservation efforts, would allow for economic and social issues to be appropriately balanced with other needs in a manner that would not have substantial adverse impacts.

4.10.1.10 Air Quality

The proposed HCP would not create new stationary sources of emissions or new land uses that would generate operational air emissions. Open space land use would not result in a substantial number of motor-vehicle trips that would increase emissions.

Construction projects that temporarily emit precursors of O₃ (i.e., reactive organic gases or nitrogen oxide) are accommodated in the emission inventories of State and Federally

required air plans and thus cumulative development would not have a significant impact on the attainment and maintenance of O₃ NAAQS.

4.10.1.11 Cultural and Historic Resources

Any cumulative loss of cultural resources from development activities would be partially offset by the proposed HCP and other large-scale conservation efforts that place lands in open space and remove the development potential, thereby avoiding substantial disturbance and loss of archaeological or historic resources.

4.11 Comparison of Impacts by Alternative

Tables 4.15, 4.16, and 4.17 summarize and compare the anticipated impacts under each alternative as discussed in Chapter 4. The summary tables utilize a numeric scoring system to facilitate the overall comparison of alternatives. The numeric values indicate whether the impacts are beneficial or adverse, and the level of impact, according to the following scale:

Impact Scale

+3 = Significant beneficial impact

+2 = Less than significant beneficial impact

+1 = Potential or minor beneficial impact

0 = Neutral impact

-1 = Potential or minor adverse impact

-2 = Less than significant adverse impact

-3 = Significant adverse impact

**TABLE 4.15
SUMMARY COMPARISON OF IMPACTS UNDER EACH ALTERNATIVE**

Resource/Issue	Alternative A (No Action)	Alternative B	Alternative C (Proposed HCP)
Physical Environment			
• Geology and Soils	-3 (soils)	-3 (soils)	-2 (soils)
• Elevation and Drainage	0	0	0
• Climate	0	0	0
Water Resources			
• Water sources	0	0	0
• Water Quality	-2	-1	0
Biological Resources			
• Vegetation	-3	-3	-2
• Wildlife	-3	-3	-2
• Species Proposed for HCP Coverage		See Table 4.16	
• Other Federal Species	0	0	0
• Migratory Birds	0	0	0
• State Species		See Table 4.17	
Land Ownership and Use			
• Population and Land Use	0	+1	+2
• Recreation	+2	+2	+3
• Prime and Unique Farmland	-3	-3	-3
• Community Heritage	-3	-3	-2
• Mineral Resources and Mining Activity	-2	+1	+1
Infrastructure	-1	0	0
Socioeconomics	-1	+1	+1
Environmental Justice	-1	+1	+1
Air Quality	-1	-1	+1
Cultural and Historic Resources	0	0	+2

TABLE 4.16
SUMMARY COMPARISON OF IMPACTS TO SPECIES PROPOSED FOR HCP COVERAGE
UNDER EACH ALTERNATIVE

Species	Alternative A	Alternative B	Alternative C
	(No Action)		(Proposed HCP)
Western Burrowing Owl	-3	-2	-2
Cactus Ferruginous Pygmy-owl	-3	-3	-2
Southwestern Willow Flycatcher	-3	-2	-1
Western Yellow-billed Cuckoo	-3	-2	-1
Lesser Long-nosed Bat	-3	-3	-2
Merriam's Mesquite Mouse	-2	-2	-1
Pale Townsend's Big-eared Bat	-3	-3	-2
Ground Snake	-3	-3	-2
Mexican Garter Snake	-3	-2	-1
Sonoran Desert Tortoise	-3	-2	-1
Tucson Shovel-nosed Snake	-2	-2	-1
Lowland Leopard Frog	-2	-2	-1
Talus Snail	-3	-3	-1

TABLE 4.17
SUMMARY COMPARISON OF IMPACTS TO STATE SPECIES UNDER EACH ALTERNATIVE

Species	Alternative A	Alternative B	Alternative C
	(No Action)		(Proposed HCP)
Black-bellied Whistling Duck	-3	-2	-1
California Leaf-nosed Bat	-3	-3	-2
Great Plains Narrow-mouthed Toad	-2	-2	-1
Tropical Kingbird	-3	-2	-1
Desert Night-blooming Cereus	-1	-1	-1
Kelvin Cholla	-3	-2	-1
Pima Indian Mallow	-3	-2	-1
Staghorn Cholla	-3	-2	-1
Thornber Fishhook Cactus	-3	-2	-1
Tumamoc Globeberry	-3	-2	-1

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7.0 Glossary of Terms and Acronyms

7.1 Glossary of Terms

alluvial. Related to sediment deposit transported by water in flood plains and deltas.

aquifer. Water-bearing stratum of permeable rock, sand, or gravel.

biology. The study of plant and animal life.

cienea. A permanently or seasonally saturated “seep wetland,” dominated by sedges and other herbaceous and woody wetland plants.

conservation. The use of methods and procedures necessary to bring any endangered or threatened species to the point at which the measures provided under the Endangered Species Act are no longer necessary; includes research, census, law enforcement, habitat acquisition, and maintenance, propagation, live trapping, and transportation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

development. The process of developing a tract of land without structures or infrastructure into land with residences, commercial buildings, and other uses, structures, and supporting infrastructure.

discretionary actions - Discretionary actions apply to projects that require the exercise of judgment or deliberation when the approving authority decides to approve or disapprove a particular activity, as distinguished from situations where the Town Council merely has to determine whether there has been conformity with applicable statutes, ordinances or regulations. Discretionary actions in the Town of Marana include, but are not limited to, annexations, General Plan amendments, specific plans, significant land use changes, rezonings, and variances.

discretionary lands – Lands which are anticipated to be subject to discretionary actions, and thus where the majority of the HCP Conservation Measures will be implemented.

diurnal. Primarily active during daylight hours.

ecology. The study of totality or pattern or relations between organisms and their environment.

ecosystem. A dynamic and interrelating complex of plant and animal communities and their associated nonliving (such as physical and chemical) environment.

endangered species. An animal or plant species in danger of extinction throughout all or a significant portion of its range.

entitled lands – Properties that currently have entitlements for some level of development and that will not likely be submitting an application to the Town of Marana for a discretionary action. The application of HCP Conservation Measures on these lands would occur only through voluntary inclusion.

ephemeral. Lasting only for a short time; related to watercourses that flow only in response to precipitation events.

Federally listed species. A species, subspecies, or distinct population segment that has been added to the Federal list of endangered and threatened wildlife and plants under the Endangered Species Act.

feral. Animals having escaped from domestication and become wild.

geographic information system (GIS). A type of software for digital mapping and data analysis on computers.

habitat. The place or environment where a plant or animal naturally lives and grows (a group of particular environmental conditions).

Habitat Conservation Plan (HCP). A plan that outlines ways of maintaining, enhancing, and protecting a given habitat type needed to protect species; usually includes measures to minimize impacts, and may include provisions for permanently protecting land, restoring habitat, and relocating plants or animals to another area. Required before an incidental take permit may be issued.

hydric. Pertaining to water; wet.

hydrology. The study of the properties, distribution, and circulation of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

incidental take. Take that results from, but is not the purpose of, carrying out an otherwise lawful activity.

infrastructure. The underlying foundation or basic framework of a system or organization.

insectivorous. Feeding primarily or exclusively on insects.

mesic. Area that is supported by perennial or intermittent streams, or areas of shallow groundwater.

mitigate. To cause to become less harsh or hostile; to make less severe or adverse.

natural undisturbed open space (NUOS). An area of land that is unimproved and not occupied by structures or man-made impervious surfaces that is set aside, dedicated or reserved in perpetuity as a conservation area. Trimming plants or raking is prohibited. Rights-of-way (including alleys) are also prohibited.

nocturnal. Primarily active during the nighttime.

non-native. Refers to plant or wildlife species outside of their historic range that are introduced to one ecosystem from another ecosystem in which they occur naturally and are indigenous. Some non-native species are invasive and effectively displace native species. Their invasion threatens native ecosystems or commercial, agricultural, or recreational activities dependent on these ecosystems.

omnivorous. Feeding on both animal and vegetable substances.

perennial. Present at all seasons of the year.

Permit Area - Area where the Section 10 Incidental Take Permit will apply.

refugium (pl. refugia). Globally, an area of relatively unaltered climate that is inhabited by plants and animals during a period of continental climatic change and remains as a center of relict forms from which a new dispersion and speciation may take place after climatic readjustment. Locally: Isolated habitats that enable formerly abundant species to persist in reduced numbers. Example: Native aquatic fauna that were once abundant in the perennial waterways of the Tucson basin now persist in small conservation refugia such as isolated mountain canyons, which are subject to random extinction processes.

relict. A persistent remnant of an otherwise extinct flora or fauna or kind of organism.

riffles. Wave pattern in sand or gravel caused by water movement.

riparian. Related to, living in, or located on the bank of a natural watercourse.

riparian area. Area influenced by surface or subsurface water flows that are expressed (visually) by facultative wetland or obligate wetland plant species and hydric soils.

Section 7 (ESA) - The section of the Endangered Species Act that requires all Federal agencies, in consultation, with the U.S. Fish and Wildlife Service, to ensure that their

actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

Section 9 (ESA) - Prohibits take of a threatened or endangered species. Take is defined to include harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3).

Section 10 (ESA) - The Section of the Endangered Species Act that lays out the guidelines under which a permit may be issued to authorize activities prohibited by Section 9, such as take of endangered or threatened species. Section 10 of the ESA is invoked for an area in which several projects will occur, for activities connected to a single project, or for takings as small as a single specimen. Under Section 10, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service will evaluate potential effects of the project and require specific protection measures.

species. For the purposes of the Endangered Species Act, this term includes any species or subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.

subspecies. The taxonomic category that ranks immediately below a species.

take. To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct; may include significant habitat modification or degradation if such actions kill or injure wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.

Taxon (pl. taxa). A taxonomic group or entity.

threatened species. An animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

topography. The configuration of a surface including its relief and the position of its natural and man-made features.

vertebrate. A subphylum of chordates comprising animals (mammals, birds, reptiles, amphibians, and fishes) with a segmented spinal column.

watershed. A region or area bounded peripherally by topographic high points and draining ultimately to a particular watercourse or body of water.

wildlife linkage - An area that links with another or between other similar areas of habitat, allowing for connectivity of wildlife habitat.

wetland. Land where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of the year.

xeroriparian. Areas associated with intermittent water supplies and that may include species from adjoining upland areas.

7.2 Acronyms

ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Traffic
ADWR	Arizona Department of Water Resources
af	acre-feet
AMA	Active Management Area
ARS	Arizona Revised Statute
ASDM	Arizona–Sonora Desert Museum
ASLD	Arizona State Lands Department
AZGFD	Arizona Game and Fish Department
AZPDES	Arizona Pollution Discharge Elimination System
BMP	Best Management Practice
BOMA	Burrowing Owl Management Area
BOR	Bureau of Reclamation
CAP	Central Arizona Project
CASA	Water Conservation Alliance of Southern Arizona
CBD	Central Business District
CFR	Code of Federal Regulations
cfs	cubic feet per second
C	Celsius
CIP	capital improvement project
CEQ	Center for Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter
CMID	Cortaro–Marana Irrigation District
Corps	U. S. Army Corps of Engineers
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency

ESA	Endangered Species Act
ESRDG	Environmentally Sensitive Roadway Design Guidelines
F	Fahrenheit
FR	Federal Register
ft	feet
FEIS	Final Environmental Impact Statement
gal	gallon
ha	hectare
HCP	Habitat Conservation Plan
IGA	Intergovernmental Agreement
in	inch
ITP	Incidental Take Permit
km	kilometer
L	liter
LDC	Land Development Code
m	meter
mi	mile
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NAAQS	National Ambient Air Quality Standards
NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
O ₃	ozone
PAG	Pima Association of Governments
PCDMSCP	Pima County Draft Multi-species Conservation Plan
PCRFCDD	Pima County Regional Flood Control District
PCRWRD	Pima County Regional Wastewater Reclamation Department
PDEQ	Pima County Department of Environmental Quality
PM	particulate matter
PPRPA	Private Property Rights Protection Act
ROD	record of decision

Service	United States Fish and Wildlife Service
SHPO	State Historic Preservation Officer
sq ft	square feet
sq km	square kilometers
sq m	square meters
sq mi	square miles
SR	Salvage Restricted
SWG	Stakeholder Working Group
TAS	Tucson Audubon Society
TBT	Technical Biology Team
TEP	Tucson Electric Power
Town	Town of Marana
TRDN	Tres Rios del Norte Feasibility Study
WSC	Wildlife of Special Concern
UPRR	Union Pacific Railroad
USDA	United States Department of Agriculture
WWTF	Wastewater Treatment Facility