STANFORD UNIVERSITY
HABITAT CONSERVATION PLAN

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Prepared by:
Stanford University Land Use and Environmental Planning Office

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1.0 INTRODUCTION

A Habitat Conservation Plan (HCP) is part of a process outlined by Section 10 of the federal Endangered Species Act (ESA) that involves cooperation between the federal government and a private landowner. The ESA prohibits landowners from taking a wildlife species that is listed as threatened or endangered. "Taking" includes directly killing an individual of a wildlife species or, in some circumstances, destroying its habitat. Under Section 10, the U.S. Fish and Wildlife Service (Service) and the National Oceanic and Atmospheric Administration (NOAA Fisheries) can authorize the taking of listed species that is incidental to an otherwise lawful activity, if the landowner first prepares and agrees to implement an acceptable HCP. This authority is discussed in more detail in Section 1.2, below. The purpose of this HCP is to describe Stanford's activities and identify measures that will minimize and mitigate the effects of these activities on species.

Stanford University owns more than 8,000 contiguous acres of land on the San Francisco Peninsula. Stanford's activities, such as construction of new facilities and certain activities performed to keep the University functioning, have been ongoing for more than 100 years, and could result in the incidental taking of species presently listed as threatened or endangered under the federal ESA, or species that could become listed in the future. As a result, Stanford desires to obtain incidental take authorization. Stanford also desires to conduct long-term land use and academic planning, and implement conservation actions on its land. All of these desires will be served by this HCP, which will result in a long-term (50-year) incidental take permit from the Service and NOAA Fisheries, and provide long-term certainty for Stanford's planning and land management efforts.

The particular species covered by this HCP are identified in Section 1.3 and described in Section 2.4, and the permitted activities are described in Section 3.0. Section 4.0 of this HCP describes the specific conservation commitments, which include take avoidance measures and specific habitat enhancement measures. The requirements for issuing an incidental take permit are discussed in more detail in Section 6.0. Other portions of this document provide additional information about the University and pertinent information about the various species and their habitat.

1.1 STANFORD UNIVERSITY - A UNIQUE LANDOWNER

1.1.1 History and the Founding Grant

In 1876, former California Governor Leland Stanford purchased 650 acres of Rancho San Francisquito for a country home and began the development of his famous Palo Alto Stock Farm for trotting horses. He later bought adjoining properties and the farm grew to 6,400 acres. This land eventually became the main Stanford campus.

Upon the death of Leland Stanford Junior in 1884, Governor and Mrs. Stanford decided that founding a university would be a fitting memorial to their son. In November 1885, the Stanfords created a "Founding Grant" for the University. This document provides the original endowment for the University and, to this day, governs the University's objectives, organization and responsibilities. Under the Founding Grant, the objectives of the University are:

> *"to qualify students for personal success and direct usefulness in life; and to promote the public welfare by exercising an influence on behalf of humanity and civilization, teaching the blessings of liberty regulated by law, and inculcating love and reverence for the great principles of government as derived from the inalienable rights of man to life, liberty, and the pursuit of happiness."*

The Founding Grant forbids the sale of any of the lands the Stanfords donated to the University, and ensures the University will be a permanent academic institution. The original endowment of 6,400 acres was intended to provide for the University's original and future academic objectives. In an address to the University's first Board of Trustees, then Senator Stanford explained the reasons for prohibiting the sale of any land donated by the Stanfords:

> *"The endowment of lands is made because they are, in themselves, of great value, and their proper management will insure to the University an income much greater than would be realized were their value to be invested in any reliable, interest-bearing security."*

The land endowment was intended to support the University by providing land for academic uses and for other uses that would produce a steady stream of income and subsidize the costs of higher education. During their lifetimes, the Stanfords leased portions of the University lands so they could focus their attention on building the University. In addition to income from these leases, the University was relieved of the substantial burdens of routine maintenance on the 5,000 acres of leased property. The need to generate income in support of the University's educational mission and to maintain the land reserve remains an important element of land use planning outside of the academic campus area.

The Stanfords consulted with many of the era's leading academics and architects, and hired Frederick Law Olmsted (the landscape architect who designed New York's Central Park) and Charles Allerton Coolidge to design the University. Olmsted originally suggested building the main campus in the foothills, but the Stanfords decided to construct the University on the relatively flat alluvial plain. On May 14, 1887 (Leland Jr.'s birthday), the cornerstone of the University was laid, and on October 1, 1891, Stanford University opened its doors to students.

1.1.2 Site Description

Stanford University owns 8,180 acres of land in northern Santa Clara County and southern San Mateo County along the southeastern base of the San Francisco Peninsula (Figure 1-1). The University is located in two counties (Santa Clara and San Mateo), two cities (Palo Alto and Menlo Park), and two towns (Woodside and Portola Valley) (Figure 1-2).

The University is located in two main watersheds: Matadero/ Deer Creek and San Francisquito Creek. The San Francisquito Creek watershed includes San Francisquito, Los Trancos, Corte Madera, Bear, Dennis Martin, Sausal, and Alambique creeks.

1.1.3 Land Use at Stanford University

The University is developed with various land uses (Figure 1-3), and all of the lands owned by Stanford are an integral part of the University's academic fabric. Most of the urban facilities, including academic buildings, student and faculty housing, roads, sidewalks, bicycle paths, and recreational facilities such as playing fields, equestrian facilities, a golf course, and a golf driving range, are located in the central part of the campus, roughly bounded by Junipero Serra Boulevard, El Camino Real, Stanford Avenue and Sand Hill Road. There is an Academic Reserve outside this core academic area that is generally undeveloped or vacant and used for low intensity academic uses, such as the radio astronomy program. Some of Stanford's lands are leased for interim non-academic purposes, which provide funds for University operations. Stanford also maintains three open-water reservoirs: Lagunita, Felt, and Searsville (Figure 1-3).

In addition to the need to maintain use of its land for future academic uses, the University's lands have always been used as outdoor laboratories for teaching and research in biology, archaeology, geology and engineering. Jasper Ridge Biological Preserve and the Archaeological Preserve along San Francisquito Creek are examples of the University's commitment to this type of academic land use.

The University's rich array of native biological communities, including redwood forest, riparian forest, chaparral, oak woodland-savanna, and serpentine grassland, has contributed to its academic success. These natural resources provide an essential link between laboratory activities, teaching, research, and field-based studies. In 1973, the Jasper Ridge Biological Preserve was formalized as a research facility. Jasper Ridge Biological Preserve is 1,200 acres, which is larger than the entire core academic campus. Scientists and students have used the Preserve for decades as an outdoor laboratory and classroom, and continue to do so.

Throughout Stanford's history, undergraduates, graduate students, and faculty have spent significant amounts of time conducting studies utilizing local natural resources. In recent years, 2,000 to 2,500 Stanford students from 15 to 20 courses visit Jasper Ridge annually. As of 2009, there were more than 60 on-going research projects using data collected at Jasper Ridge. These projects were conducted by faculty, senior scientists, and students from Stanford University and other institutions. In addition to Jasper Ridge Biological Preserve, Stanford faculty, students and researchers have long-term research and teaching interests in San Francisquito Creek, Corte Madera Creek, Los Trancos Creek, Matadero Creek, and the University's oak woodland-savannas.

1.1.4 Operating Stanford University

Stanford University supports a daily population of approximately 30,000 people on its academic campus. Therefore, operating the University is akin to operating a mid-sized city that has land uses ranging from cattle grazing to high tech research and development, and includes medical and other public service facilities. To accommodate the variety of land uses at Stanford, the University operates and maintains a number of utilities, roadways, flood control improvements, water diversion and delivery facilities, and other urban improvements.

Stanford has been operating many of its facilities since the University's inception nearly 120 years ago, and, as a permanent academic institution, it will continue to operate for the indefinite future. This includes permanent water diversion and delivery facilities, and flood control improvements. Some of Stanford's facilities and day-to-day operations, such as Searsville Dam which was built in 1892, have changed very little since Stanford open its doors. Other facilities and day-to-day activities have evolved or been expanded over time to reflect new technology, respond to environmental concerns, or accommodate an expanding population. As such, Stanford has more than 100 years of hindsight in operating the University, which provides a sound basis for identifying its future operations and need for new improvements.


NAPA COUNTY
SONOMA COUNTY
SOLANO COUNTY
MARIN COUNTY
Sausalito
BERKELEY
CONTRA COSTA COUNTY
OAKLAND
SAN FRANCISCO CO.
SAN FRANCISCO
Pacific Ocean
Hayward
Pleasanton
Pacifica
San Francisco Bay
ALAMEDA COUNTY
San Mateo
Newark
Half Moon Bay
STANFORD UNIVERSITY
Palo Alto
SAN JOSE
La Honda
Sunnyvale
San Gregorio
SAN MATEO COUNTY
SANTA CLARA COUNTY
NOT TO SCALE
Stanford University Planning Office
Data Printed: December 2011
(Aerial Photo Source: PG&E, USGS, 2004)

Figure 1-1

1.2 REGULATORY CONTEXT

1.2.1 Federal Endangered Species Act

The ESA creates a process for identifying species needing protection, provides a framework for determining the type of protective measures needed, and provides for enforcement measures. Two sections of the ESA are most relevant to Stanford:

- Section 9 (16 USC 1538) prohibits the taking of wildlife species listed as threatened or endangered; and
- Section 10 (16 USC 1539) provides for the issuance to non-federal entities of a permit authorizing the incidental take of listed wildlife species.

Section 9 of the ESA prohibits the take of wildlife species listed as endangered, and it prohibits the take of species listed as threatened unless otherwise specifically authorized by regulation. "Take" is broadly defined to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" has been defined to mean an act which actually kills or injures wildlife, including those activities that cause significant habitat modification or degradation resulting in the killing or injuring of wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. (50 CFR 17.3; 50 CFR 222).

Section 10 of the ESA allows for the incidental take of endangered and threatened species by non-federal entities. The ESA defines "incidental take" as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Parties that are responsible for incidental take of listed species must do so under the authorization of an incidental take permit issued by the Service or NOAA Fisheries.

To obtain an incidental take permit under Section 10 of the ESA, an applicant must prepare a Habitat Conservation Plan that provides the following information:

- Impacts likely to result from the proposed taking of the species for which permit coverage is requested;
- Measures the applicant will undertake to monitor, minimize, and mitigate such impacts;
- Funding the applicant or other known sources will make available to undertake these measures and the procedures that will be followed in dealing with changed and unforeseen circumstances;
- Alternative actions the applicant considered that would not result in take, and the reasons why it is not proposing these alternatives; and
- Additional measures that the Service or NOAA Fisheries may require as necessary or appropriate for purposes of the plan. [1]

1.2.2 National Environmental Policy Act (NEPA)

Congress enacted the National Environmental Policy Act (NEPA) in 1969 to ensure that federal agencies consider the environmental impacts of their actions and decisions. NEPA requires the federal government to use all practicable means and measures to protect environmental values and makes environmental protection a part of the mandate of every federal agency and department. NEPA requires analysis and a detailed statement of the environmental impact of any proposed federal action that significantly affects the quality of the human environment. With respect to this HCP, the Service and NOAA Fisheries will analyze the potential environmental effects related to the issuance of a Section 10 incidental take permit consistent with NEPA requirements. The NEPA analysis will address the direct, indirect, and cumulative effects.

1.2.3 Five-Point Policy Guidance

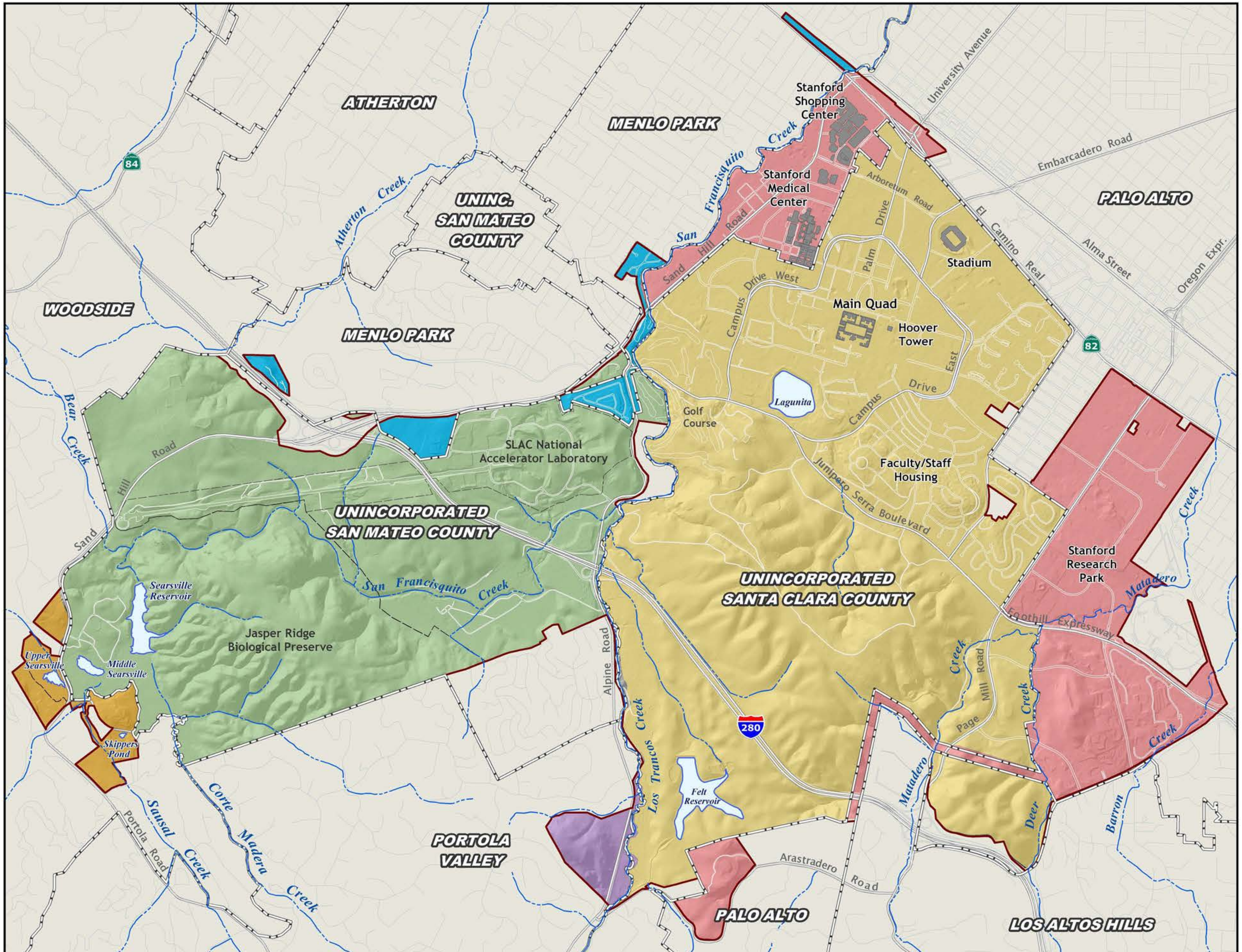
In 2000, the Service and NOAA Fisheries adopted a five-point policy initiative designed to clarify elements of the HCP program as they relate to measurable biological goals, adaptive management, monitoring, permit duration, and public participation. The following summarizes these five points.

Biological Goals and Objectives: HCPs must include biological goals and objectives that set out specific measurable targets that the plan is intended to meet. These targets are based on the best scientific information available and are used to guide conservation strategies for species covered by the plan.

Adaptive Management: The five-point policy encourages the development of adaptive management plans as part of the HCP process under certain circumstances. Adaptive management provides a means to address biological uncertainty and to devise alternative strategies for meeting biological goals and objectives.

Monitoring: Monitoring is a mandatory element of all HCPs under the five-point policy. As such, an HCP must provide for monitoring programs to gauge the effectiveness of the plan in meeting the biological goals and objectives and to verify that the terms and conditions of the plan are being properly implemented.

[1] *The Habitat Conservation Planning and Incidental Take Permit Processing Handbook*, published by the Service and NOAA Fisheries (formerly called the National Marine Fisheries Service or NMFS) in November 1996, provides additional guidance concerning the preparation and content of habitat conservation plans. The Service and NMFS published a final addendum to the *HCP Handbook* on June 1, 2000 (65 FR 35242). This addendum, also known as the Five-Point Policy guidance, provides clarifying guidance for the two agencies in conducting the incidental take permit program and for those applying for an incidental take permit under Section 10(a)(1)(B) of the ESA. The five components addressed in the policy are: (1) biological goals, (2) adaptive management, (3) monitoring, (4) permit duration, and (5) public participation. These components are discussed in Section 1.2.3.



Stanford University Habitat Conservation Plan

Governmental Jurisdictions

- Government Jurisdiction
- Stanford Lands
- City of Menlo Park
- City of Palo Alto
- Town of Portola Valley
- Town of Woodside
- San Mateo County
- Santa Clara County

hectare

100

25

4

acres

Sources:
Jurisdictions: Stanford University Planning Office, 2004
Creeks: US Geological Survey, 1991

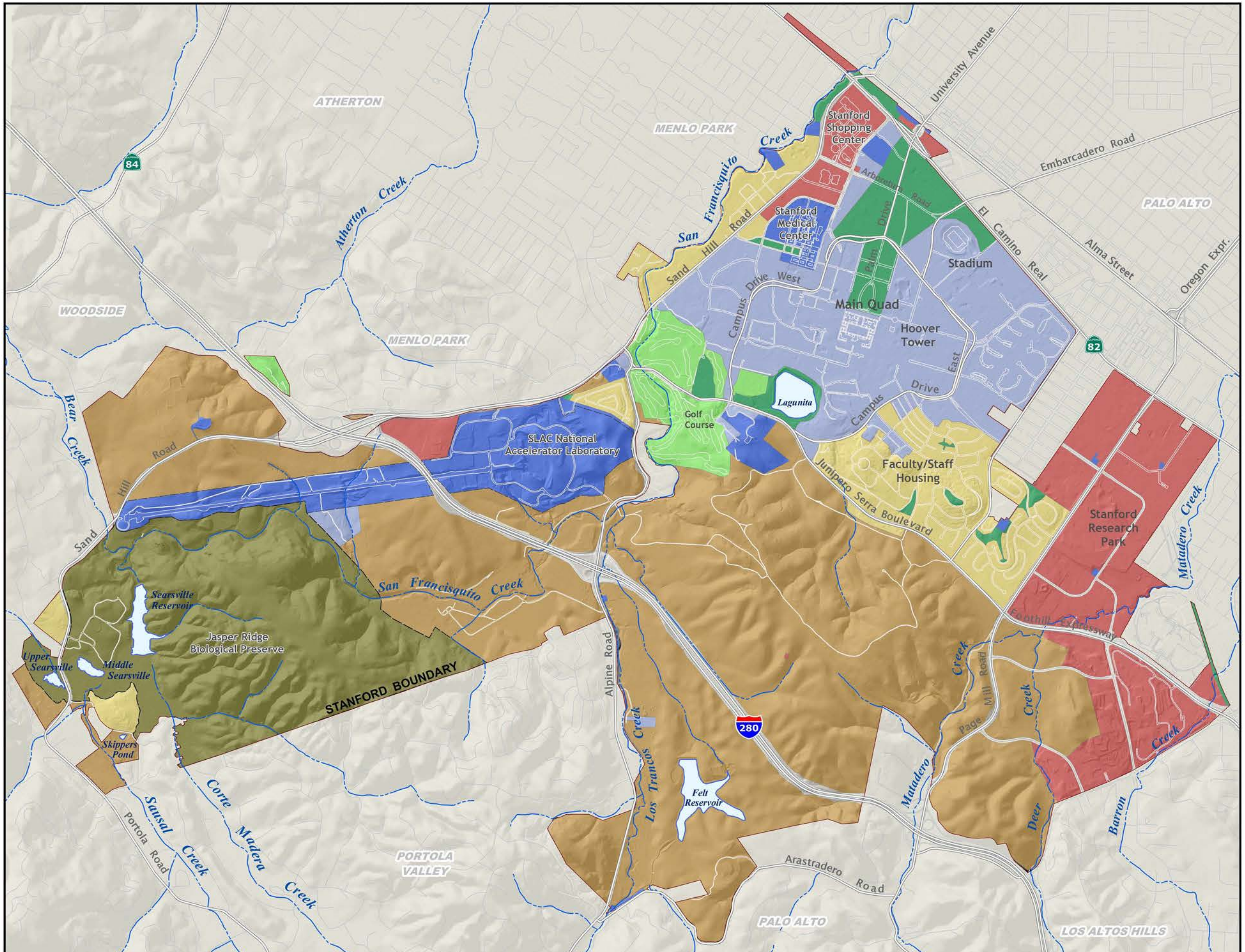
Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 1-2



Stanford University Habitat Conservation Plan

Land Use

- Academic
- Academic Reserve
- Biological Preserve
- Commercial
- Institutional
- Open Space
- Recreation
- Residential

hectare

100

25

4

acres

Sources:
Land Use: Stanford University Planning Office, 2006
Creeks: US Geological Survey, 1991

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Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 1-3

Permit Duration: Under the five-point policy, several factors are used to determine the duration of an incidental take permit, including the duration of the applicant's proposed activities and the expected positive and negative effects on covered species associated with the proposed duration. The agencies also consider the level of scientific and commercial data underlying the proposed operating conservation program, the length of time necessary to implement and achieve the benefits of the operating conservation program, and the extent to which the program incorporates adaptive management strategies.

Public Participation: Under the five-point policy guidance, the agencies announced their intent to expand public participation in the HCP process to provide greater opportunity for the public to assess, review, and analyze HCPs and associated documentation (e.g., NEPA review). As part of this effort, the public review process for most HCPs was expanded from a 30-day comment period to a 60-day period.

1.3 COVERED SPECIES

Covered Species are the species addressed by this HCP and covered by the resulting incidental take permits. Stanford's intent is to provide conservation and acquire incidental take permit coverage for several species listed under the ESA, and for an additional species that could be listed during the term of the incidental take permits. Stanford has requested an incidental take permit from both NOAA Fisheries and the Service to cover incidental take of the following species, which are each discussed in detail in Section 2.4:

- California red-legged frog (Rana aurora draytonii)
- Central California Coast Evolutionary Significant Unit steelhead (Oncorhynchus mykiss)
- California tiger salamander (Ambystoma californiense)
- Western pond turtle (Clemmys marmorata)
- San Francisco garter snake (Thamnophis sirtalis tetrataenia)

Several of the Covered Species have the same general habitat requirements. However, the precise habitat needs for each of the species vary. For example, all five of the Covered Species use aquatic habitats. Steelhead require relatively cool and clean flowing water, and creeks that permit barrier-free passage. Red-legged frogs, pond turtles, and tiger salamanders both need pools or slow-moving water for breeding and adjacent upland areas for foraging and dispersal. Garter snakes are found in a wide range of environments, but are typically associated with pond or creeks with surrounding vegetation. The general habitat needs of each of the Covered Species are summarized in Table 1-1, and they are described in detail in Section 2.4.

1.4 COVERED ACTIVITIES

Covered Activities are those activities for which incidental take is permitted under an incidental take permit. Stanford is an academic institution that engages in a variety of activities, some of which could present a risk to one or more of the Covered Species. The following categories of activities are addressed by this HCP and will be covered by the resulting incidental take permit:

- Ongoing operations of the University, including maintaining, renewing and necessary development of the campus (e.g., landscape; facility maintenance; civil, energy, and communications infrastructure; fire suppression),
- Academic activities as mandated by the Founding Grant of the University,
- Operation and maintenance of water supplies and water supply facilities,
- Recreational activities, and
- Future development associated with the Santa Clara County 2000 General Use Permit and other development which may occur under future permits from Santa Clara and San Mateo counties and the cities and towns of Palo Alto, Menlo Park, Woodside, and Portola Valley.

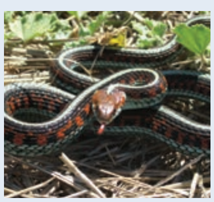
In addition, the incidental take permit will cover activities carried out by Stanford lessees under Certificates of Inclusion. These activities include:

- Equestrian facilities
- Agricultural activities
- Commercial and institutional activities
- Operation of civil, energy, and communications infrastructure

As discussed in Section 3.1, the HCP does not cover Searsville facilities or operations, or any modifications to Searsville. Any modifications are currently speculative and any future changes could be covered by an amendment to the HCP or through a separate permit under Section 7 of the Endangered Species Act.

The HCP also does not cover biocide use, although it does provide minimization measures for biocide use.

Table 1-1 General Habitat Needs of the Covered Species

SPECIES		SUMMARY OF HABITAT NEEDS
California red-legged frog (CRLF)		Permanent bodies of slow-moving or standing water, with sufficient vegetation to provide cover and support ample prey, and with areas that are at least 3 feet in depth; adjacent upland areas of suitable vegetation to allow for dispersal and to seasonally support non-breeding individuals.
Steelhead (SH)		Streams and creeks with relatively cool and clean water, low sediment gravel beds for spawning sites, pools, riffles, and runs for rearing habitat, riparian vegetation to help cool the water and to support high levels of prey, unimpeded upstream and downstream dispersal routes.
California tiger salamander (CTS)		Seasonal ponds that fill in December or January and hold water until June, with sufficient levels of aquatic prey and cover to allow for larval development and metamorphosis; adjacent upland areas that provide sufficient densities of rodent burrows or debris for California tiger salamander to inhabit during the non-reproductive period, and vegetation appropriate for California tiger salamander residency and migration.
Western pond turtle (WPT)		Permanent bodies of slow-moving or standing water, with sufficient vegetation to provide cover and support ample quantities of food; adjacent upland areas of suitable substrate and vegetation as to provide nesting locations and wet season refugia.
San Francisco garter snake (SFGS)		Permanent or nearly permanent bodies of water, usually with areas of shallow water and heavily vegetated shores; however, they are known to occur, at least temporarily, in grassland, riparian woodland, oak woodland, and coniferous forest.

1.5 HCP GOALS

1.5.1 Stanford's Institutional Goals

Stanford's primary mission is teaching and research. Proper stewardship of Stanford's lands has been, and will continue to be, essential to the success of the University. Since opening in 1891, Stanford has endeavored to provide a top-ranked academic experience for all eligible students, regardless of their financial resources. The academic curriculum, depth and kinds of research, and how students are taught have all progressed remarkably since the University opened. This continuous progress makes it difficult to predict the needs of future students and faculty members. For these reasons, and because of legal restrictions associated with the Founding Grant that established the University, retaining future land use flexibility is vital to the University's long-term academic success.

During the academic year, thousands of people live on campus, and hundreds more visit the University each day. The University's size and infrastructure, which includes laboratories, offices, hospitals, student centers, athletic facilities, housing, roads, landscape and other urban facilities, are similar to a city of 30,000 people. Currently, Stanford provides housing for 95 percent of the 6,500 undergraduate students that attend the University and approximately 60 percent of its 6,500 graduate students. The University also houses nearly 900 faculty members.

Stanford has developed a set of Institutional Goals that reflect the University's core academic mission and the realities of day-to-day operation of the University. These goals, in concert with Stanford's Biological Goals, will be used to evaluate future activities that are governed by this HCP.

In the context of this HCP, Stanford's Institutional Goals are as follows:

Institutional Goal #1: Maintain land use flexibility.

Institutional Goal #2: Maintain and enhance biological resources (i.e., native biodiversity) on University lands so that these resources can be utilized by future generations of students and faculty researchers.

Institutional Goal #3: Prepare a conservation program that incorporates sustainable land use planning policies and practices.

Institutional Goal #4: Implement cost effective conservation measures that efficiently invest the University's assets.

Institutional Goal #5: Define the University's legal responsibilities toward biological resources so that the University can develop its lands and operate in an environmentally and fiscally responsible manner during the next 50 years.

Institutional Goal #6: Utilize Stanford's water resources for the benefit of the University's research, educational, and operational activities, to the full extent of its water rights.

1.5.2 Stanford's Biological Goals and Objectives

Stanford University, like most of the San Francisco Peninsula, has urbanized over the past several decades. This regional urbanization likely will continue and has placed considerable stress on the area's natural resources. Stanford's Institutional Goals recognize the need to utilize the University's land and water resources, and the Biological Goals seek to protect and enhance Stanford's natural resources.

The Biological Goals described below implement the Five Points Policy, which states, "the best HCPs clearly define the desired outcome for the covered species and their habitats in terms of biological goals and objectives." In this HCP, Stanford has developed broad Biological Goals, as well as more specific "Biological Objectives" that provide measurable ways of determining whether a goal is being met. These goals and objectives provided the framework for developing an integrated conservation program that identifies specific management and minimization actions. These actions are intended to meet the Biological Goals and Objectives during the life of the HCP. The Biological Goals and Objectives also provide the Service and NOAA Fisheries with a benchmark for evaluating the likelihood the conservation program will be successful.

The Biological Goals of this HCP are:

Biological Goal #1: Maintain and enhance natural communities so that they benefit the Covered Species.

Biological Goal #2: Stabilize the local California tiger salamander population and increase its chance of long-term persistence at Stanford.

Biological Goal #3: Maintain ponds to promote California tiger salamander reproduction in the Foothills.

Biological Goal #4: Increase the local California red-legged frog population and increase its chance of long-term persistence at Stanford.

Biological Goal #5: Maintain or improve hydrologic and terrestrial conditions that presently support steelhead and increase the chance of long-term persistence for the local steelhead population.

Biological Goal #6: Maintain and improve habitat for western pond turtle to increase its chance of long-term persistence at Stanford.

Biological Goal #7: Maintain or improve habitat that could support the San Francisco garter snake and continue to contribute to the body of information about garter snakes at Stanford.

The goals and objectives are provided in Table 1-2.

1.6 SUMMARY OF STANFORD HCP APPROACH

Stanford's land use policies recognize the University's responsibility and commitment to respect the University's lands. A key focus of the HCP will be on species protected by the federal Endangered Species Act, including those species projected to receive protection during the life of the HCP, and their habitats that exist on Stanford lands. The incidental take of California red-legged frog, California tiger salamander, steelhead, western pond turtle, and San Francisco garter snake by ongoing and future Stanford University activities is projected to be small.

Stanford seeks a 50-year incidental take permit from the Service and NOAA Fisheries. The strategy employed by the HCP will begin benefiting the Covered Species as soon as the HCP is approved, and will continue to benefit the Covered Species throughout the life of the HCP. Stanford will over-mitigate projected impacts to Covered Species in the early years to maintain land use flexibility throughout the permit term. This will be achieved by establishing a pay-up-front conservation program. Many HCPs, such as one designed for a single development project, authorize incidental take early in the project period while spreading out mitigation throughout the project. In the Stanford HCP, Stanford has the opportunity to immediately contribute to the Covered Species through early preservation of existing habitat and creating new habitat. The pay-up-front approach means that early habitat conservation measures will compensate for or exceed any take associated with the HCP and ensure adequate species conservation throughout the life of the incidental take permit.

Table 1-2 Biological Goals and Objectives

Goal #1. Maintain and enhance natural communities so that they benefit the Covered Species.
Objective 1.1. Protect 13 contiguous miles of riparian vegetation and creek along San Francisquito Creek (7 miles), Los Trancos Creek (2.5 miles), Matadero Creek (2 miles), and Deer Creek (1.5 miles).
Objective 1.2. Protect no less than 350 acres along San Francisquito and Los Trancos creeks, and Matadero and Deer creeks within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries. Width of easement should range between 75 feet and 600 feet, averaging approximately 225 feet. Dedication of conservation easements that permanently protect high-quality habitat from urban encroachment should allow the populations to increase naturally, and prevent mortalities associated with urban land uses.
Objective 1.3. Implement site-specific management and monitoring plans for each permanent riparian conservation easement area that would prohibit new structures, monitor water quality, support revegetation and restoration activities, survey for Covered and non-native species, and control non-native species.
Objective 1.4. Protect 300 acres of grassland and seasonal ponds by establishing a no-build zone south of Junipero Serra Boulevard.
Objective 1.5. Implement a site-specific management and monitoring plan for the protected land to survey for Covered and non-native species, limit recreational activities, and provide vegetation management.
Objective 1.6. Move temporary structures and roads to areas more than 150 feet from the top of the creek bank, and revegetate vacated areas. Relocate 5,000 feet of road further from the creek within 3 years of issuance of an incidental take permit by the Service and NOAA Fisheries.
Objective 1.7. Restore 50 acres of riparian habitat and adjacent upland habitat.
Goal #2: California tiger salamander: Stabilize the local California tiger salamander population and increase its chance of long-term persistence at Stanford.
Objective 2.1. Protect, enhance, and expand prime habitat for the California tiger salamander, including both upland and aquatic habitat, in areas relatively distant from existing population sinks, by setting aside and prohibiting development for 50 years on no less than 300 acres in the foothills south of Junipero Serra Boulevard within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.
Objective 2.2. When California tiger salamander habitat in less desirable areas is permanently impacted, permanently protect habitat for California tiger salamander through the dedication of permanent conservation easements within the 300 acres.

Goal #2 (continued)

Objective 2.3. Eliminate or reduce non-native plant and animal species that are impairing California tiger salamander reproduction or survival.

Objective 2.4. Facilitate California tiger salamander movement between developed areas that provide at least some marginal habitat and protected high-quality California tiger salamander habitat by maintaining at least three amphibian tunnels across Junipero Serra Boulevard.

Objective 2.5. Continue to supply water to Lagunita to allow metamorphosis of larval CTS.

Goal #3: California tiger salamander ponds: Maintain ponds to promote California tiger salamander reproduction in the Foothills.

Objective 3.1. Reduce the California tiger salamanders' reliance on Lagunita by constructing and maintaining a complex of a minimum of 10 seasonal ponds in the foothills to provide additional breeding location opportunities, and achieve California tiger salamander reproductive success in no less than 75% of the ponds.

Objective 3.2. Provide an appropriate environment for CTS, including an appropriate pH, a minimum depth of 12 inches, and an adequate invertebrate food source while CTS and larvae are present.

Objective 3.3. Within the first 3 years, construct five additional cover piles within 150 feet of the existing ponds to promote occupancy of the area by ground squirrels.

Objective 3.4. Any new ponds will have a minimum of three cover piles associated with them.

Objective 3.5. Manage grass height appropriate for ground squirrels and CTS around CTS ponds to an approximate distance of 500 feet from the ponds.

Objective 3.6. Modify or eliminate constructed ponds that the annual monitoring shows are not ponding during years of average or above average rainfall for a sufficient period of time to support California tiger salamander reproduction, or that are otherwise not adequately supporting tiger salamander reproduction.

Goal #4: California red-legged frog: Increase the local California red-legged frog population and increase its chance of long-term persistence at Stanford.

Objective 4.1. Protect riparian and adjacent upland areas for the benefit of California red-legged frog by dedicating conservation easements along San Francisquito and Los Trancos creeks and Matadero and Deer creeks that permanently protect no less than 350 acres of high-quality California red-legged frog habitat within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.

Objective 4.2. Eliminate or reduce non-native species that are impairing California red-legged frog reproduction or survival.

Objective 4.3. Create additional areas suitable for California red-legged frog reproduction, including off-channel ponds and side channels, by designing and building a minimum of three breeding sites located off any of the main creek channels.

Goal #5: Steelhead: Maintain or improve hydrologic and terrestrial conditions that presently support steelhead and increase the chance of long-term persistence for the local steelhead population.

Objective 5.1. Protect riparian areas for the benefit of steelhead by dedicating a conservation easement over habitat along San Francisquito and Los Trancos creeks that permanently protects no less than 270 acres of high quality steelhead habitat within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.

Goal #5 (continued)

Objective 5.2. Eliminate or reduce non-native species that are impairing steelhead spawning, rearing, or migration.

Objective 5.3. Repair and stabilize creek banks to remediate erosion and bank stabilization problems in order to prevent potentially intrusive emergency measures.

Objective 5.4. Remove undesirable items (trash, debris, etc.) from the creek channels.

Objective 5.5. Retain woody debris that does not pose a safety hazard in the creek channels.

Objective 5.6. Remove structures such as rip-rap, gabions, and in-stream structures that are adversely affecting steelhead migration, when feasible.

Objective 5.7. Restore more natural fish passage by removing the Lagunita Diversion facility.

Objective 5.8. Implement the Steelhead Habitat Enhancement Project by-pass flows.

Goal #6: Western pond turtle: Maintain and improve habitat for western pond turtle to increase its chance of long-term persistence at Stanford.

Objective 6.1. Protect riparian areas for the benefit of western pond turtles by dedicating a permanent conservation easement over habitat along San Francisquito and Los Trancos creeks that permanently protects no less than 270 acres of high-quality western pond turtle habitat within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.

Objective 6.2. Eliminate or reduce non-native species that are impairing western pond turtle reproduction or survival.

Objective 6.3. Provide at least three basking platforms (natural or artificial) at Searsville and Felt reservoirs and Skippers Pond.

Objective 6.4. Provide or ensure the presence of at least three natural basking platforms in reaches of San Francisquito Creek that are occupied by turtles.

Goal #7: San Francisco garter snake: Maintain or improve habitat that could support the San Francisco garter snake and continue to contribute to the body of information about garter snakes at Stanford.

Objective 7.1. Protect riparian and adjacent upland areas for the benefit of San Francisco garter snake by dedicating conservation easements along San Francisquito and Los Trancos creeks and Matadero and Deer creeks that permanently protect no less than 350 acres of potential high quality San Francisco garter snake habitat within 1 year of issuance of an incidental take permit by the Service.

Objective 7.2. Continue to supply water to Lagunita to promote a prey base for San Francisco garter snake.

Objective 7.3. Eliminate or reduce non-native species that could impair San Francisco garter snake reproduction or survival.

SECTION 2
PHYSICAL/BIOLOGICAL SETTING, INCLUDING COVERED SPECIES

2.0 PHYSICAL / BIOLOGICAL SETTING, INCLUDING COVERED SPECIES

2.1 SIGNIFICANT HYDROLOGIC FEATURES

2.1.1 San Francisquito Creek Watershed

The San Francisquito Creek watershed encompasses an area of approximately 45 square miles and is located on the eastern flank of the Santa Cruz Mountains, at the base of the San Francisco Peninsula (Figure 2-1). This watershed is located in two counties, San Mateo and Santa Clara, and two of its constituent creeks (Los Trancos and San Francisquito) form part of the boundary between the two counties. The San Francisquito Creek watershed has four major sub-watersheds located at least partially on Stanford lands: Bear Creek (Bear Gulch Creek), Los Trancos Creek, San Francisquito Creek, and streams that flow into Searsville Reservoir (including Corte Madera, Dennis Martin, Sausal, and Alambique creeks).

A USGS gauging station (11164500) is located on San Francisquito Creek near the Stanford golf course, approximately 500 meters south (upstream) of the Junipero Serra Boulevard/Alpine Road intersection. This station has been in operation since the early 1930s.

The Stanford-owned mid-section of this watershed, including San Francisquito Creek between Searsville Reservoir and Junipero Serra Boulevard, Los Trancos Creek from Arastradero Road to its confluence with San Francisquito Creek at Piers Lane, and Bear Creek from Sand Hill Road to its confluence with San Francisquito Creek, are characterized by a mix of open space and development. This portion of the watershed includes low-density residential, commercial, recreational (e.g., Stanford golf course and equestrian facilities), scientific (e.g., SLAC National Accelerator Laboratory and Jasper Ridge Biological Reserve), and agricultural (e.g., Webb Ranch and Boething Treeland) land uses. Downstream from Junipero Serra Boulevard, the watershed is dominated by high-density residential and commercial land uses. Upstream from the Stanford-owned reaches, the watershed is mainly low-density residential and open space. Most of the creeks in the Stanford portion of the watershed support riparian vegetation, generally a 75- to 200-foot-wide band of dense willows, bay laurels, redwoods, alders, cottonwoods, dogwoods, valley oaks, and coast live oaks. This riparian zone is currently limited in extent by land use and topography.

The San Francisquito Creek watershed is a major source of water for Stanford. Flows within the creek are highly variable. In 1931, the USGS started recording flows within San Francisquito Creek. The mean annual flows have ranged from less that 0.05 cfs (recorded in 1961) to 89.1 cfs (recorded in 1933). During all but the wettest years, significant portions of San Francisquito Creek and its tributaries dry up by mid-summer.

When this HCP was prepared, Stanford had the following functioning water diversion facilities in the San Francisquito Creek system: Searsville Dam and Reservoir, located downstream from the confluence of Corte Madera Creek and Sausal Creek; Los Trancos diversion on Los Trancos Creek, near the intersection of Arastradero and Alpine roads; and an in-channel pumping station, located in San Francisquito Creek near the Stanford golf course, south of the Junipero Serra Boulevard/Alpine Road intersection. Another diversion facility called the Lagunita diversion dam facility, located on San Francisquito Creek approximately 4,300 feet south of Junipero Serra Boulevard, is currently not in service but has historically also served as a diversion facility to the campus. The diverted water is stored in Searsville Reservoir, Felt Reservoir, and Lagunita, or sometimes it is directly diverted for agricultural, University landscaping, and other uses.

Skippers Pond is the largest natural pond located on Stanford lands. It is situated in the riparian thicket adjacent to Family Farm Road, upstream from Jasper Ridge Biological Preserve, in San Mateo County. This pond fills naturally with groundwater and runoff, with comparatively little surface flow connection to the nearby creeks (Sausal and Corte Madera). Skippers Pond holds water year-round in some years, but generally dries up by the end of summer in years of average or below average rainfall.

A portion of the San Francisquito Creek watershed was listed in 1998 by the U.S. Environmental Protection Agency (EPA) as sediment and pesticide (diazinon) impaired. The EPA also listed Corte Madera Creek and the main stem of San Francisquito Creek as impaired. However, the water quality data from the Long Term Monitoring Program (a cooperative program sponsored by the San Francisquito Creek Watershed Council) in the San Francisquito Watershed consistently indicate absence of diazinon.

Hydrogeologic investigations of the groundwater in this area show the presence of thick coarse- and fine-grained alluvial deposits on the San Francisquito Creek alluvial fan where four of Stanford's groundwater wells are located (Sokol 1963, Geomatrix 1992). Geologic cross sections, based on the correlation of electrical resistivity logs, show that sand and gravel layers range between 50 and 200 feet in thickness, defining the most important groundwater zones. Several clay layers, interpreted to be mostly laterally continuous, range between 20 and 80 feet thick and form aquitards above and between the coarse water-bearing units. Stanford's wells are screened below the upper clays, starting at 100 feet below the surface.

2.1.2 Matadero Creek Watershed

The Matadero Creek watershed is entirely within Santa Clara County (Figure 2-1). Matadero Creek begins in Palo Alto's hills. The creek flows under Highway 280, through Stanford agricultural lands south of Foothill Expressway, and through the developed commercial and residential areas of the Stanford Research Park and Palo Alto. One major tributary, Deer Creek, joins Matadero Creek just upstream from Foothill Expressway.

Upstream from Foothill Expressway, Matadero and Deer creeks are generally low gradient, with broad riffle-run zones and pebble- to cobble-sized substrate. Both of the creeks in this area have reaches that dry out during drought conditions, but Deer Creek is much more ephemeral and susceptible to drying than the generally perennial Matadero Creek. The riparian zone is similar to that of San Francisquito Creek, consisting primarily of willow, bay, and oak trees, but is generally not as extensive (less wide) or mature.

Downstream of El Camino Real the creek has been channelized and concrete-lined for flood control by Santa Clara Valley Water District.

A mix of open space, low-density residential housing, and undeveloped private property covers the upland areas of the watershed. The downstream areas of the watershed have been highly modified and are either commercial or high-density residential.

A portion of the Matadero Creek watershed was listed in 1998 by the U.S. Environmental Protection Agency[1] as being pesticide (diazinon) impaired.

2.2 SIGNIFICANT LAND FORMS

2.2.1 Santa Cruz Mountains (Jasper Ridge)

A portion of the University is located on the lower, eastern flank of the Santa Cruz Mountains. The majority of this land form at Stanford is located in the Jasper Ridge Biological Preserve. The 1,200-acre Preserve is an academic research and teaching facility that is extensively used by students and researchers. The Preserve does provide significant conservation benefit to the region, but it is not operated as a refuge for native plants and animals. The Jasper Ridge Biological Preserve was designated as a research facility by the trustees of Stanford University. Public access is not allowed but docent-led tours are available.

Other land uses in this region include residential development, a vineyard, and equestrian facilities. Searsville Reservoir is located in the Jasper Ridge Biological Preserve and is managed by the University's Utilities Services in coordination with the Preserve.

2.2.2 Foothills

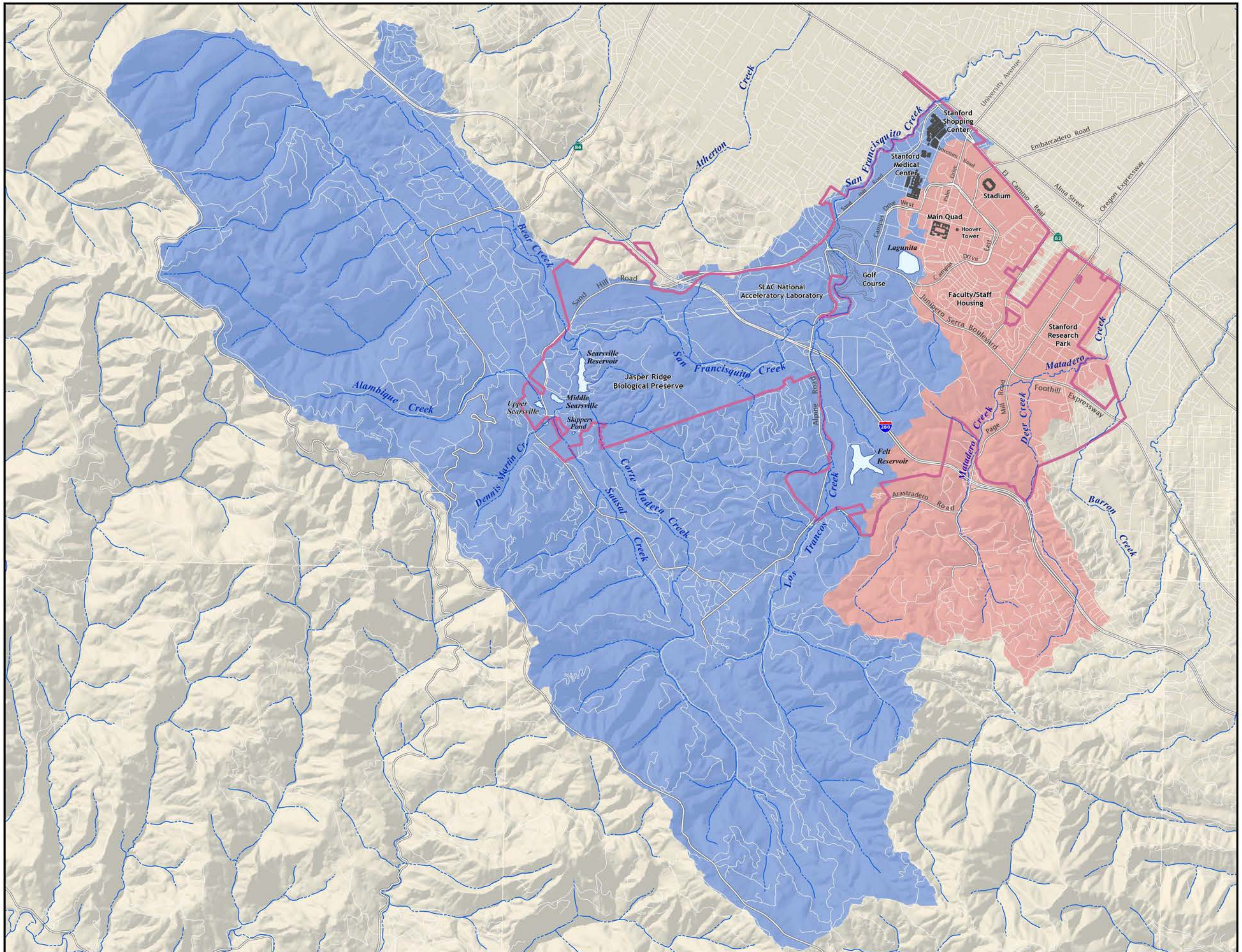
A wide-band of low, rolling foothills (generally 200 to 400 feet in elevation) are present from the edge of the main campus to the base of the Santa Cruz Mountains. The foothills are located south of Junipero Serra Boulevard and extend across Interstate 280 to Jasper Ridge. They consist of a mix of grassland, woodland, and riparian areas. The foothills are generally undeveloped, but do support a number of existing uses, primarily livestock grazing. A number of academic facilities are scattered across the foothills. These include radio telescopes, including the landmark Dish; a linear accelerator; solar observatory; student observatory complex; several academic think tanks; artist studio; and part of the Stanford golf course. Commercial communications facilities and four water supply-related facilities, including two enclosed reservoir tanks, are located in the Stanford foothills. Residential and commercial facilities also are located in the Stanford foothills.

Stanford allows public access to a limited portion of the foothills, but this recreational use is restricted to designated service roads. Formal public access points are located along Junipero Serra Boulevard and Alpine Road. Public use is monitored by Stanford University security, and dogs and bicycles are not allowed.

2.2.3 Alluvial Plain

Virtually all of the main campus is located on the comparatively flat areas located between the foothills and San Francisco Bay. Most of the alluvial plain area located north of Junipero Serra Boulevard/Foothill Expressway is developed with a relatively high density of housing, academic buildings, and commercial development. The alluvial plain areas south of Junipero Serra Boulevard are primarily agricultural, with crop plants farmed in areas near San Francisquito Creek, a commercial (wholesale) nursery that operates in several areas, and livestock (equestrian) uses scattered across most of the remaining areas. A few academic facilities are in these southern alluvial plain areas (e.g., a plant genetics laboratory and a plant growth facility).

[1] http://oaspub.epa.gov/tmdl/waters_list.tmdl_report?p_tmdl_id=32396



Stanford University Habitat Conservation Plan

Primary Watershed Basins

- Matadero Creek
- San Francisquito Creek
- Stanford Boundary

Note:
Complete stream basins not shown. Depicted are those primary basin areas that are adjacent to, within or upstream of Stanford University lands.

Sources:
Watershed: USGS, 1991, Nolte, 1999, SU/PO, 2004
Additional S.F. Creek drainage: Nolte, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 1 Mile
0 0.5 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 2-1

2.3 BIOLOGICAL SETTING

2.3.1 Annual Grassland

This community/habitat type consists primarily of non-native annual grasses and forbs forming a continuous cover of herbaceous vegetation. Annual grasslands are present in the alluvial plain and lower foothills portions of Stanford. Non-native species dominating these areas include ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), Italian rye (*Lolium multiflorum*), wild oat (*Avena fatua* and *A. barbata*), wall barley (*Hordeum murinum*), Italian thistle (*Carduus pycnocephalus*), storksbill (*Erodium species*), bristly ox-tongue (*Picris echioides*), purple star thistle (*Centaurea calcitrapa*), yellow star thistle (*Centaurea solstitialis*), common groundsel (*Senecio vulgaris*), geranium (*Geranium species*), and milk thistle (*Silybum marianum*). Several native grasses, most notably purple needlegrass (*Nassella pulchra*), are not uncommon in some areas of the grasslands at Stanford. Native forbs that commonly occur within this community include: California man-root (*Marah fabaceus*), California buttercup (*Ranunculus californicus*), blue-eyed grass (*Sisyrinchium bellum*), terrestrial brodiaea (*Brodiaea terrestris*), blue dicks (*Dichelostemma capitatum*), Ithuriel's spear (*Tritelia laxa*), suncup (*Oenothera ovata*), and mule's ear (*Wyethia species*). Occasional individual oak trees or small, open-canopied groupings of oaks occur within this community type.

Annual grasslands at Stanford provide habitat for a diversity of terrestrial wildlife. Amphibians include western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), and California tiger salamander (*Ambystoma californiense*). Reptiles include the western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleuca*), and western racer (*Coluber constrictor*).

A variety of bird species are at least seasonally present in the grasslands at Stanford. Avian seedeaters, including western meadowlark (*Sturnella neglecta*), nest in grazed annual grasslands, while other grassland species, such as red-winged blackbirds (*Agelaius phoeniceus*), are more likely to nest in taller, ungrazed vegetation. A variety of other species, including American goldfinch (*Carduelis tristis*), California towhee (*Pipilo crissalis*), loggerhead shrike (*Lanius ludovicianus*), and northern mockingbird (*Mimulus polyglottos*), nest in scattered shrubs throughout annual grasslands. Raptors, including white-tailed kite (*Elanus caeruleus*), red-tailed hawk (*Buteo jamaicensis*), barn owl (*Tyto alba*), and American kestrel (*Falco sparvarius*), nest in nearby trees and forage in grasslands. Burrowing owls (*Athene cunicularia*) have not been observed nesting at Stanford for nearly a century, but overwinter at several locations at Stanford. Aerial foragers, including northern rough-winged swallow (*Stelgidopteryx serripennis*), tree swallow (*Tachycineta bicolor*), violet-green swallow (*Tachycineta thalassina*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), and white-throated swift (*Aeronautes saxatilis*), also may frequent annual grasslands. Great blue herons (*Ardea herodias*) and great egrets (*Ardea alba*) frequently are observed foraging in the grasslands of Stanford.

Small mammals that forage on the plants found in this habitat type include deer mice (*Peromyscus species*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), California ground squirrel (*Spermophilus beecheyi*), and Botta's pocket gopher (*Thomomys bottae*). Larger mammals, such as bobcat (*Lynx rufus*), coyote (*Canis latrans*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), black-tailed jackrabbit (*Lepus californicus*), and black-tailed deer (*Odocoileus hemionus*), also use the annual grasslands at Stanford, though other habitats are generally required for cover. Badgers (*Taxidea taxus*) are apparently absent from Stanford and rarely sighted in the southern San Francisco Peninsula. Mountain lions (*Felis concolor*) are occasionally reported from the grasslands, riparian zones, and woodlands of the lower foothills region.

2.3.2 Oak Woodland/Savanna

This plant community occurs in a number of locations at Stanford. This community is dominated by a mix of coast live oaks (*Quercus agrifolia*), blue oaks (*Quercus douglasii*), valley oaks (*Quercus lobata*), and California buckeye (*Aesculus californica*). Understory species include shrubs such as poison oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), common snowberry (*Symphoricarpos albus*), blue elderberry (*Sambucus mexicana*), western leatherwood (*Dirca occidentalis*), and occasional dense patches of coyote brush (*Baccharis pilularis*) along the edges of the woodland. Common grass species and herbs found beneath the oak woodland canopy include ripgut brome, bedstraw (*Galium californicum*), wide-leaf filaree (*Erodium botrys*), soft chess, Italian rye, soft geranium (*Geranium dissectum*), Indian lettuce (*Claytonia parviflora*), and goldenback fern (*Pentagramma triangularis*).

The wildlife typically associated with oak woodland at Stanford include: bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), western gray squirrel (*Sciurus griseus*), California ground squirrel, black-tailed deer, deer mice, San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), broad-footed mole (*Scapanus latimanus*), acorn woodpecker (*Melanerpes formicivorus*), band-tailed pigeon (*Columba fasciata*), northern flicker (*Colaptes aurantus*), and western scrub jay (*Aphelocoma californica*). Oak trees and other hardwoods in this community provide shelter, shade, and breeding habitat for mammal species such as raccoon, striped skunk, and cottontail rabbits (*Sylvilagus audubonii*).

The abundant insect and plant life present in the oak woodlands provides food for bird species such as white-breasted nuthatch (*Sitta carolinensis*), California thrasher (*Toxostoma redivivum*), bushtit (*Psaltriparus minimus*), oak titmouse (*Baeolophus inornatus*), dark-eyed junco (*Junco hyemalis*), blue-grey gnatcatcher (*Polioptila caeurlea*), Bewick's wren (*Thryomanes bewickii*), spotted towhee (*Pipilo maculatus*), California quail (*Callipepla californica*), mourning dove (*Zenaida macroura*), Anna's hummingbird (*Calypte anna*), and ash-throated flycatcher (*Myiarchus cinerascens*). A wide variety of woodpecker species are primary-cavity nesters in oak trees, while house wren (*Troglodytes aedon*), western bluebird (*Sialia mexicana*), and American kestrel are secondary-cavity nesters (e.g., utilizing abandoned woodpecker cavities). Coastal oak woodland also is important to neotropical migrant songbirds (e.g., warblers, vireos, grosbeaks) providing feeding, resting, and nesting habitats. Raptors that nest and forage in the oak woodland habitat include great horned owl (*Bubo virginianus*), barn owl, western screech-owl (*Otus kennicotti*), red-tailed hawk, and red-shouldered hawk (*Buteo lineatus*). Cooper's hawk (*Accipiter cooperi*), white-tailed kite, and golden eagle (*Aquila chrysaetos*) are additional special-status bird species that have been recorded in woodlands and grasslands of the Stanford foothills.

More than 10 species of bats are common in the Stanford area, and individuals of some species roost in tree cavities. Townsend's big-eared bats (*Corynorhinus townsendii*) are occasionally recorded at Stanford and probably utilize local woodlands and riparian areas on a regular basis, at least for foraging.

Amphibian and reptile species that are found in the oak woodlands at Stanford include: California tiger salamander, western toad, Pacific treefrog, California slender salamander (*Batrachoseps attenuatus*), arboreal salamander (*Aneides lugubris*), sharp-tailed snake (*Contia tenuis*), ringneck snake (*Diadophis punctatus*), California kingsnake (*Lampropeltis getulus*), gopher snake, western terrestrial gartersnake (*Thamnophis elegans*), western skink (*Eumeces skiltonianus*), western fence lizard, southern alligator lizard (*Elgaria multicarinata*) and northern alligator lizard (*Elgaria coeruleus*). It is likely that California red-legged frogs (*Rana aurora draytonii*) regularly traverse many of the oak woodlands at Stanford.

2.3.3 Riparian Woodland and Creeks

Riparian woodland is well established along Matadero Creek and Deer Creek and along the creeks in the San Francisquito watershed. There also is a substantial riparian forest associated with the Searsville Reservoir. Vegetation along the creeks consists primarily of a moderately closed canopy of valley oak and coast live oak that ranges from approximately 20 to 40 feet in height. Associated species within this community include California buckeye, bay (*Umbellularia californica*), redwood (*Sequoia sempervirens*), willow (*Salix species*), and white alder (*Alnus rhombifolia*). An understory shrub layer occurs beneath much of the riparian canopy, particularly in areas where gaps in the overstory allow direct sunlight. Shrub species present include poison oak, California rose (*Rosa californica*), blackberry (*Rubus ursinus*), common snowberry, blue elderberry, bee plant, and coyote bush. The riparian forest associated with the Searsville Reservoir is dominated by willows, maples (*Acer species*), and dogwoods (*Cornus species*).

Small clumps of native and non-native grasses and forbs are present in the understory of the riparian woodland, including ripgut brome, wild oat, horehound (*Marrubium vulgare*), poison hemlock (*Conium maculatum*), wild radish (*Raphanus sativus*), field mustard (*Brassica rapa*), milk thistle, and California mugwort (*Artemesia douglasiana*). Aquatic vegetation found intermittently along the creek channels includes water cress (*Rorippa nasturtium-aquaticum*), iris-leaved juncus (*Juncus xiphioides*), broad-leaved cattail (*Typha latifolia*), and curly dock (*Rumex crispus*).

Riparian woodland provides abundant food, cover, and breeding habitat for wildlife. These factors and the structural diversity of riparian woodland are largely responsible for the high productivity of this habitat type. Bird species that are characteristic of this habitat at Stanford include California quail, mourning dove, orange-crowned warbler (*Vermivora celata*), Nuttall's woodpecker (*Picoides nuttallii*), black phoebe (*Sayornis nigricans*), black-crowned night heron (*Nycticorax nycticorax*), belted kingfisher (*Ceryle alcyon*), western wood-pewee (*Contopus sordidulus*), California towhee, and song sparrow (*Melospiza melodia*). Many of these species nest or roost in riparian woodlands and feed in adjacent habitat areas, such as annual grasslands. Stellar's jay (*Cyanocitta stelleri*) and western scrub jays are found in abundance in the riparian woodlands at Stanford, as are California thrasher, red-tailed hawk, Cooper's hawk, red-shouldered hawk, and sharp-shinned hawk (*Accipiter striatus*). Riparian woodlands also provide important feeding, resting, and nesting for neotropical songbirds such as warblers, vireos, grosbeaks, and flycatchers. Salt marsh common yellowthroat (*Geothlypis trichas sinuosa*) is relatively common at the margin of the riparian forest upstream of the Searsville Reservoir.

Common mammals found within this riparian woodland include: deer, opossum, raccoon, deer mice (including *Peromyscus* *truei* and *P. maniculatus*), Botta's pocket gopher, tree squirrels (*Scirus species*), San Francisco dusky-footed wood rat, California vole, coyote, gray fox, bobcat, striped skunk, and the non-native red fox (*Vulpes vulpes*). Merriam's chipmunk (*Eutamias merriami*) are also occasionally encountered in the riparian woodlands at Stanford, particularly in the large woodland track upstream from Searsville Reservoir. Recent work by a Stanford graduate student (Evelyn et al. 2004) indicates that the riparian areas at Stanford are used extensively by foraging bats. A number of bat species have been recorded including: Townsend's big-eared bat, red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), California myotis (*Myotis californicus*), Yuma myotis (*Myotis yumanensis*), long-ear myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), and western pipistrelle (*Pipistrellus hesperus*).

Amphibians and reptiles known to occur in this biotic community at Stanford include western toad, Pacific treefrog, California red-legged frog, arboreal salamander, black salamander (*Aneides flavipunctatus*), slender salamander, California newt (*Taricha torosa*), rough-skinned newt (*Taricha granulosa*), Santa Cruz ensatina (*Ensatina eschscholtzi*), California kingsnake, gopher snake, western night snake (*Hypsoglena torquata*), western fence lizard, southern alligator lizard, and western skink.

California tiger salamanders have not been recorded from Stanford's riparian zones. However, because of their ability to disperse from Lagunita, low numbers of salamanders could occur in riparian zones north of I-280.

Western pond turtles (*Clemmys marmorata*) are found scattered throughout San Francisquito Creek. They have been reported from Matadero Creek by local residents, but have not been observed during recent surveys. Newts (*T. torosa* and *T. granulosa*) are common in the San Francisquito system, but they have not been observed in Stanford's portion of the Matadero drainage during the recent surveys.

Native fish recorded from the Matadero and San Francisquito systems include three-spined stickleback (*Gasterosteus aculeatus*), roach (*Lavinia symmetricus*), Sacramento blackfish (*Orthodon microlepidotus*), Sacramento suckers (*Catostomus occidentalis*), and sculpin (*Cottus asper* and *C. gulosus*). Steelhead/rainbow trout (*Oncorhynchus mykiss*) are abundant in the San Francisquito system, but have not been recorded in the Matadero system in recent surveys conducted by Stanford (but have been reported as being historically present by numerous long-term local residents). Hitch (*Lavinia exilicauda*) are also present in the San Francisquito system.

San Francisquito Creek contains one of the few remaining steelhead runs in the San Francisco Bay drainage. Steelhead spawn throughout the San Francisquito Creek system, including those portions that flow through Stanford. Searsville Dam is a barrier to fish migration in the system, and isolates about 3 to 5 miles of suitable spawning habitat from migrating adults. Resident rainbow trout are present in the creeks above Searsville Dam (notably Corte Madera Creek and Sausal Creek), and are scattered throughout the system.

Native mussels (*Anodonta species*) are found scattered across the San Francisquito Creek system.

Non-native aquatic animals that have been recorded from the creeks at Stanford include bullfrog (*Rana catesbeiana*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), red-ear sunfish (*Lepomis microlophus*), mosquito fish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*), Louisiana red swamp crayfish (*Procambarus clarki*), and signal crayfish (*Pascifasticus leniusculus*). Bullfrogs are occasionally observed in the Stanford portions of Matadero Creek and Deer Creek; generally no more than three or four individuals are observed each year (and fewer than 10 bullfrog tadpoles have been encountered in Matadero and Deer creeks since the mid-1990s). Green sunfish are relatively common throughout the unincorporated Santa Clara County portion of Matadero Creek, but are limited in Deer Creek to reaches immediately upstream from its confluence with Matadero Creek (reaches that do not typically dry out). No young-of-the-year green sunfish have been observed in the Stanford portions of Matadero Creek and Deer Creek during annual surveys since 1997, suggesting that juvenile or adult sunfish may be dispersing into either downstream or upstream reaches. During recent annual surveys, only one largemouth bass was observed in the Stanford portion of the Matadero watershed and Louisiana red swamp crayfish are rarely encountered.

Mitten crabs (*Eriocheir sinensis*) have been observed in the San Francisquito system since at least 1996. The number of these invasive non-native crabs in the Stanford portions of the creeks varies each year. From 1996 to 1998, there were very few observations of crabs upstream of El Camino Real. In 1999 and 2000, hundreds of crabs were seen in San Francisquito Creek. Some individuals reach the confluence with Bear Creek. During 2001 through 2005, very few crabs were observed in the system. At the present time, the extent and impacts of this recent invasion are unclear.

In 2000, a mitten crab was observed in Matadero Creek, just downstream of the Foothill Expressway bridge (there were mid-1990s reports of mitten crabs at Matadero Creek's outflow into San Francisco Bay). Mitten crabs have not been observed in the areas of the creek that support red-legged frogs, but they could colonize the area in the future.

2.3.4 Serpentine Grasslands

There are two main areas of serpentine grassland at Stanford, both located in the Jasper Ridge Biological Preserve. These two areas are of limited extent, and the total acreage of serpentine grassland at Stanford is less than 25 acres. These grasslands have not been managed specifically to promote native biodiversity; a hands-off management policy has been in effect at the Preserve for more than 25 years. This policy was implemented in order to ensure that the inevitable vagaries of multi-year management activities did not unnecessarily affect the long-term research activities at the site. The grasslands do, however, still support an array of native plant and animal species, including California plantain (*Plantago erecta*), goldfields (*Lasthenia chrysostoma*), serpentine linanthus (*Linanthus ambiguus*), common linanthus (*Linanthus androsaceus*), red maids (*Calandrinia ciliata*), purple needlegrass, California man-root, California buttercup, poison oak, blue-eyed grass, terrestrial brodiaea, blue dicks, Ithuriel's spear, yarrow (*Achillia millifolium*), and common muilla (*Muilla maritima*).

Native insects are common in the serpentine grasslands at Stanford and the Lepidoptera in particular have been the focus of research efforts. The Bay checkerspot butterfly (*Euphydryas editha bayensis*) has been studied annually by Professor Paul Ehrlich's group at Stanford since 1960. This threatened butterfly subspecies formerly had two relatively robust populations at Stanford (a third population has been recorded in the literature [population "G"], but never supported butterflies for more than a few years). The Bay checkerspot butterfly has not been observed at Stanford since 1997 (despite hundreds of hours spent annually looking for them). Opler's longhorn moth (*Adela oplerella*) has not been recorded from Stanford, and is not expected since its obligatory host plant, California creamcups (*Platystemon californicus*), is rarely observed at Stanford. Several other species of Adela moths are common in the serpentine grasslands (*A. trigrapha* and *A. flammeusella*). Approximately 330 acres of grasslands at Stanford are designated as critical habitat for the Bay checkerspot butterfly.

A wide range of reptiles, mammals and birds can be found in the serpentine grasslands at Stanford. However, these are, by and large, the same species found in the annual grasslands and oak woodlands in the area. Botta's pocket gophers are typically found in very high densities in the serpentine grasslands at Stanford.

2.3.5 Chaparral and scrub

Chaparral and scrub are present at Stanford in several locations. There is a several-hundred-acre patch of chaparral located in the Jasper Ridge Biological Preserve. This chaparral includes dense stands of chamise (*Adenostoma fasciculatum*), buckbrush (*Ceanothus cuneatus*), yerba-santa (*Eriodictyon californicum*), toyon (*Heteromeles arbutifolia*), scrub oak (*Quercus berberidifolia*), poison oak, and black sage (*Salvia mellifera*). Scrub also is found on Coyote Hill and at Jasper Ridge. These areas are dominated by California sagebrush (*Artemisia californica*), coyotebrush, scrub oak, toyon, sticky monkeyflower, and California bee plant (*Scrophularia californica*).

Chaparral and scrub at Stanford provide habitat for a diversity of terrestrial wildlife. Amphibians include western toad and Pacific treefrog. Reptiles include western fence lizard, gopher snake, western racer, northern Pacific rattlesnake (*Crotalus viridus*), and western whiptails (*Cnemidophorus tigrus mundus*). Coast horned lizards (*Phrynosoma coronatum frontale*) have not been recorded at Stanford for several decades, but are present in chaparral located about 6 miles south of the University.

A wide range of mammals and birds can be found in the chaparral and scrub at Stanford. These are, however, primarily the same species found in the annual grasslands and oak woodlands in the area.

2.3.6 Seasonal Wetlands

The primary seasonal wetlands at Stanford are Lagunita and Skippers Pond. Both of these bodies of water support large numbers of aquatic invertebrates and vegetation. Pacific treefrogs are found in abundance in both bodies of water, and western toads frequently reproduce in large numbers in Lagunita. California newts do not typically use either of these waters. California tiger salamanders have been documented to reproduce in Lagunita since the early part of the 1900s. Bullfrogs are abundant in Skippers Pond in some years, and particularly when periods of above average rainfall allow the pond to retain water through the summer. A few bullfrogs are encountered in Lagunita every year, but no bullfrog tadpoles have been encountered there in at least 3 decades. Fish are generally not present in either Lagunita or Skippers Pond, but occasionally low densities of mosquito fish and goldfish are encountered. Crayfish also are found with some regularity in Lagunita. The timing of the crayfish's annual appearance always coincides with the annual crayfish cookout by one of the local dorms, so it has been assumed that the crayfish in Lagunita are the result of intentional releases. Pocket gophers are also abundant in the Lagunita area (so much so that the University Grounds Department must take active measures to control the numbers of gophers residing in the earthen dam that forms two-thirds of Lagunita's edge, as required by the California Division of Safety of Dams). Skunks and raccoons also are commonly encountered in the seasonal wetlands. Waterfowl are fairly abundant in Lagunita during the wet season. A number of reptile species occupy the Lagunita lakebed and surrounding grasslands, including western racer, kingsnake, gopher snake, and common garter snake (*Thamnophis sirtalis*).[2] Non-native red-eared slider turtles are also occasionally observed in the seasonal wetlands (presumably released into the sites by pet owners that do not understand the biological implications of releasing them).

2.3.7 Perennial Standing Water

Searsville Reservoir and Felt Reservoir support populations of fishes, most of which are non-native game species such as largemouth bass, black crappie, sunfish, and catfish. Neither Searsville Reservoir nor Felt Reservoir provide habitat for native aquatic species of conservation concern due to the presence of bullfrogs and abundance of non-native fishes. There are some roach, sculpin, hitch, and trout in the reservoirs, but the vast majority of fish in each are non-natives. However, prickly sculpins are common in Felt Reservoir, western toads reproduce well in Felt Reservoir, and both Searsville Reservoir and Felt Reservoir provide a habitat for water fowl and foraging areas for bats. Felt Reservoir and Searsville Reservoir are also used by both migratory and resident birds. Freshwater mussels (likely *Anodonta californiensis* and *A. oregonensis*) are present in Felt Reservoir. Non-native Chinese mystery snails (*Cipangopaludina chinensis*) and Lousiana red swamp crayfish are abundant in Felt Reservoir. Western pond turtles and non-native turtles (red-eared sliders) are also sporadically present in Felt Reservoir.

2.3.8 Urban/Suburban

Urban landscape includes both native and non-native vegetation growing within the main campus and around residential areas of Stanford lands. Vegetation consists of remnant native species, such as oaks, as well as non-native trees (primarily Eucalyptus), ruderal annual grasslands, and ornamental landscape plants.

In rare instances the urban/suburban areas can provide habitat elements for wildlife, including cover for nesting and roosting, and foraging sites. Except for the occasional tiger salamander that wanders into the main campus from Lagunita, the central campus and other developed areas do not support individuals of the Covered Species. It should be noted that the tiger salamanders which do find themselves in the main campus have an exceedingly low chance of getting back to either Lagunita or the ponds in the foothills; in addition to the large numbers of buildings, roads, drains, and simple curbs on the main campus, there many retaining walls and stairs located in the main campus. Since Lagunita is uphill from most of the main campus, these retaining walls and stairs form a unidirectional barrier to California tiger salamander dispersal; individuals dispersing from Lagunita can essentially fall down steps or over a retaining wall and reach the main campus, but the reverse trip is virtually impossible because the tiger salamanders have limited climbing abilities.

Native and introduced animals that are tolerant of human activities can thrive in urban landscapes. These species include: western fence lizard, southern alligator lizard, northern mockingbird, barn swallow, raccoon, striped skunk, European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), eastern grey squirrel (*Sciurus caralinensis*), fox squirrel (*Sciurus niger*), house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), black rat (*Rahus rattus*), and opossum. Highly urbanized areas such as the Stanford Shopping Center, Stanford University Medical Center, and the Stanford Research Park consist of very intensely developed landscapes that have little value to native wildlife (Blair 1996, Blair and Launer 1997).

2.3.9 Plant Species

More than 650 species of native vascular plants have been recorded from Stanford and vicinity. There are a number of these plant species that are considered by the California Native Plant Society as being of conservation concern. These include: Franciscan onion (*Allium peninsulare franciscanum*, CNPS 1b), western leatherwood (*Dirca occidentalis*, CNPS 1b), woolly-headed lessingia (*Lessingia hololeuca*, CNPS 3), serpentine linanthus (*Linanthus ambiguous*, CNPS 4), chaparral bush mallow (*Malocothamnus fasciculatus*, CNPS 1b [as *M. arcuatus*), Gairdner's yampah (*Perideridia gairdneri gairdneri*, CNPS 4), Michael's piperia (*Piperia michaelii*, CNPS 4), Mt. Diablo cottonseed (*Stylocline amphibola*, CNPS 3), Hickman's popcornflower (*Plagiobothrys chorisianus var. hickmanii*, CNPS 4), coast rock cress (*Arabis blepharophylla*, CNPS 4), fragrant fritillary (*Fritillaria liliacea*, CNPS 1b), mountain lady's slipper (*Cypripedium montanum*, CNPS 4), spring lessingia (*Lessingia tenuis*, CNPS 4), bristly linanthus (*Linanthus acicularis*, CNPS 4), California rockjasmine (*Androsace elongate acuta*, CNPS 4), showy Indian clover (*Trifolium amoenum*, CNPS 1b), and San Francisco blue-eyed marry (*Collinsia multicolor*, CNPS 1b). Most of the species have not been recorded at Stanford for many decades. If present, these species are found predominately on Jasper Ridge, although the western leatherwood is also found scattered through the oak and riparian woodlands of campus. While conservation measures enacted by Stanford during the course of this HCP will undoubtedly benefit several of these species, no plant species are explicitly covered by this HCP.

In addition to the native species of plants, more than 325 species of non-native plants have been found growing outside of landscaped areas at and near Stanford, and new species of non-native plants invade the area on a regular basis. Many of these exotic species are highly invasive and destructive weeds. Control of these species is often extremely difficult, and man-

[2] Studies have shown that the common garter snake found at Stanford appears to be an intergrade form between the San Francisco garter snake (*T. s. tetrataenia*) found to the north and west, and the red-sided garter snake (*T. s. infernalis*) found to the south and east (Barry 1994).

agement efforts are ongoing. Some of the more problematic exotic plant species at Stanford are mustard (*Brassica species*), ripgut brome, stinkwort (*Dittrichia graveolens*), Italian thistle, yellow star-thistle, purple star-thistle, pampas grass (*Cortaderia selloana*), storkbill (*Erodium species*), fennel (*Foeniculum vulgare*), broom (*Genista maderensis* and G. *monspessulana*), Italian ryegrass, Harding and canary grass (*Phalaris species*), wild radish, and medusa-head (*Taeniatherum caput-medusae*). Ivy (*Hedera helix*) and greater periwinkle (*Vinca major*) are found in high densities in a number of locations scattered along the creeks and in moist forested areas. Giant reed (*Arundo donax*) is present in a few locations at Stanford and has been the target of focused eradication efforts. Parrot's feather (*Myriophyllum aquaticum*) occasionally reaches potentially problematic densities at Searsville Reservoir.

2.3.10 Animal Species

Nearly 240 species of vertebrates, including 150 species of native birds, are found at and near Stanford. In addition to the native bird species, more than 45 species of mammals, 19 species of reptiles, 11 species of amphibians, and 8 species of fishes native to the area have been recorded. In addition, subfossil remains of a host of other vertebrate species have been found at Stanford. Grizzly bear (*Ursus arctos*), pronghorn (*Antilocapra americana*), tule elk (*Cervus elaphus*), and roadrunner (*Geococcyx californianus*) are among the species recently extirpated from the area.

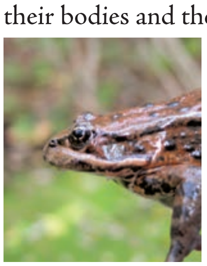
Approximately 30 non-native vertebrate species are present in the area and some pose problems for conservation efforts. The non-native centrarchids (sunfish and largemouth bass), bullfrog, starling, and red fox potentially cause the most difficulties for native wildlife.

In addition to the vertebrate species, a large number of species of invertebrates are found at Stanford, including more than 30 species of butterflies and skippers, and 55 species of odonates.

2.4 COVERED SPECIES

2.4.1 California red-legged frog

Description. California red-legged frogs are the largest frogs native to California, reaching sizes upwards of 4.5 inches in body length. Adult frogs are variable in color but are often characterized by the rich red coloration of the lower sides of their bodies and the under-surfaces of their hind limbs. Upper portions of red-legged frogs are red-pink to green-brown, with irregular black mottling on dorsal surfaces of the back and thighs. There are dorsolateral folds extending from the hips to eyes on both sides of the body.



Red-legged frog tadpoles are brown, often with a pinkish sheen on their undersides, and commonly reach 3 inches in total length. Tadpoles may be mottled with irregular dark spots, but they do not have the pencil-point black dots typical of bullfrog tadpoles. Juveniles are generally less than an inch in body length at metamorphosis, and more brown-green than red.

Eggs are laid in loose clusters, generally in shallow water. These rough egg masses are clear to yellow brown or grey in color, with a dark developing embryo in each individual egg.

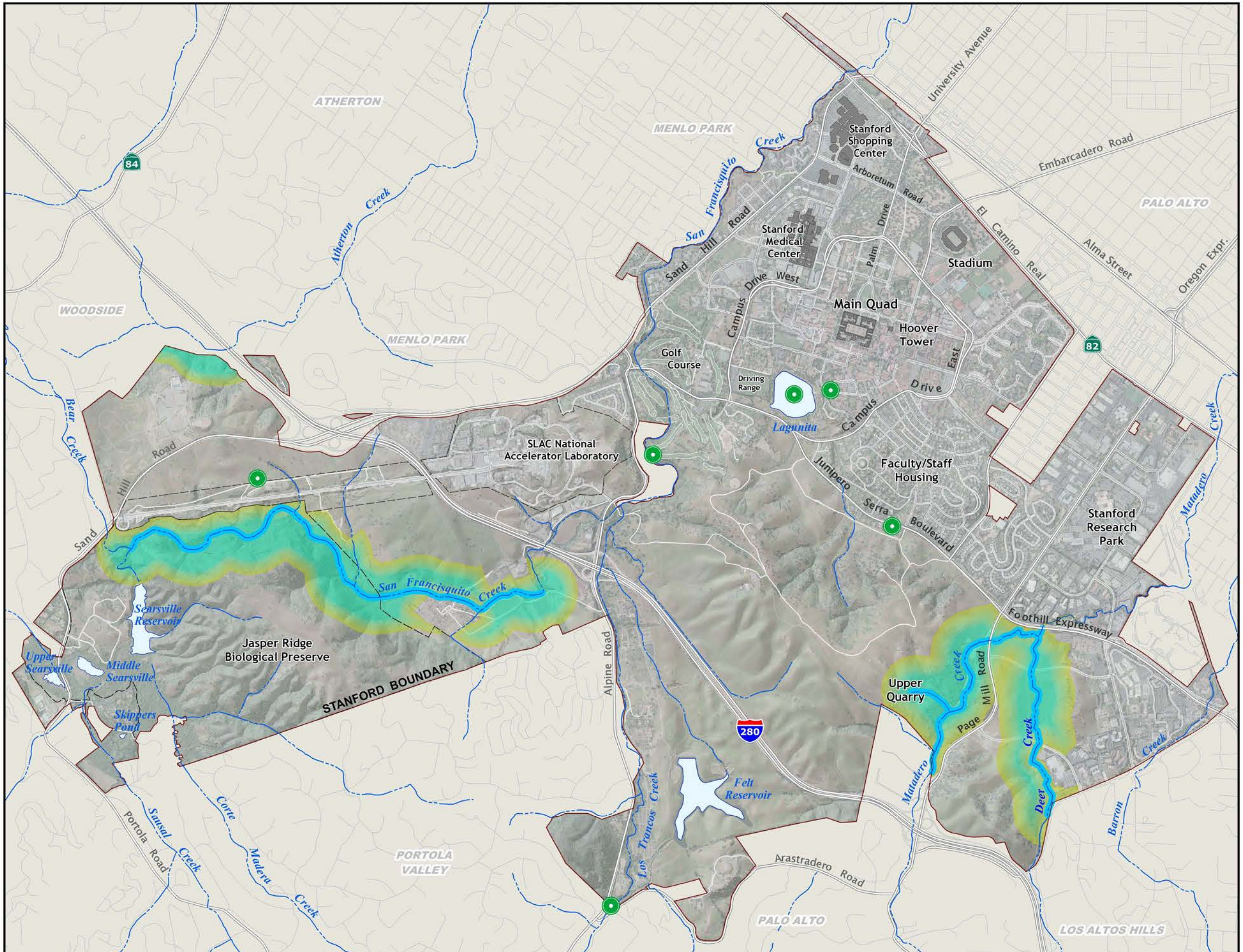
Natural History. Red-legged frogs typically live in still freshwater such as ponds, lakes, and marshes, or in slow flowing sections of creeks and streams. Local reproduction generally begins in late January and lasts through March. Minimum breeding age appears to be 2 years in males and 3 years in females (Jennings and Hayes 1985). Females lay 750-4,000 eggs in clusters attached to aquatic vegetation, 2 to 6 inches below the water surface. Eggs hatch in 2 to 3 weeks. Once hatched, the tadpoles generally take between 11-20 weeks to metamorphose, doing so between May and August. Tadpoles can reach 3 inches total length just prior to metamorphosis. Individual frogs average 1 ¼ inches in snout-vent length at metamorphosis.

Adults feed on a wide range of invertebrates and small vertebrates including aquatic and terrestrial insects, snails, crustaceans, fish, worms, tadpoles, small mammals, and smaller frogs (including members of their own species). The aquatic larvae (tadpoles) are primarily herbivorous. When threatened, adult and juvenile California red-legged frogs generally seek refuge in water; they will dive rapidly to the bottom of deeper pools and seek refuge under cover. R. a. draytonii is prey for a number of species, including bullfrogs, largemouth bass, snakes, raccoons, dogs, foxes, coyotes, cats, herons, and egrets. Crayfish are also thought to prey upon red-legged frog eggs and tadpoles. Newts may eat red-legged frog eggs. Late season heavy rains also wash away egg masses and young tadpoles.

The maximum longevity of red-legged frogs is not known, but an individual of a closely related subspecies (*Rana aurora aurora*) was known to live in captivity for 13-15 years (Cowan 1941).

Some scientists believe that California red-legged frogs are relatively inactive during dry periods of the year or during droughts. California red-legged frogs are known to occasionally disperse widely during autumn, winter, and spring rains. Juveniles use the wet periods to disperse outward from their pond or stream of origin, and some adults have been found to move considerable distances, often well away from aquatic resources. Frogs disperse through many types of upland vegetation and use a broader range of habitats outside of breeding season.

Habitat and Range. Populations of California red-legged frogs are thought to require permanent or nearly permanent bodies of water for persistence. Red-legged frogs are known to occur,



Stanford University Habitat Conservation Plan

California Red-Legged Frog at Stanford

Occupied Creek (Creek widths exaggerated)

Associated Uplands

Outliers / Historical Records

hectare

100

25

4

acres

Sources:
CRLF habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

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Figure 2-2

at least temporarily, in grassland, riparian woodland, oak woodland, and coniferous forest, but prefer quiet pools, slow-flowing streams, and marshes with heavily vegetated shores for reproduction. California red-legged frogs are frequently encountered in areas of relatively unfiltered sunlight. Seasonal bodies of water are frequently occupied by red-legged frogs, and in some areas these water bodies may be critical for persistence.

While typically associated with bodies of water, individual California red-legged frogs occasionally traverse many miles of non-wetlands during rainy periods. It is also thought that members of some California red-legged frog populations spend most of their lives well away from the wetlands where they reproduce, either in other wetlands or simply in moist, vegetation-covered areas. Historically, California red-legged frogs were found throughout California from Mendocino County in the north to Baja California in the south. The range is considerably reduced, particularly in southern and eastern areas of California, where the California red-legged frog has all but disappeared. A related subspecies (*Rana aurora aurora*) persists in northern California, and ranges north into British Columbia.

Threats. Natural threats to the California red-legged frog include predation by fishes, snakes, birds, mammals, and other frogs. However, loss of habitat and the introduction of non-native species that compete with or prey upon both adult and larval red-legged frogs are much more significant to the fate of the red-legged frog. Disruption or destruction of suitable habitat has been a major cause of the decline in California red-legged frogs over much of their former range (Davidson et al. 2001). Development of land for agricultural or urban uses has significantly reduced frog populations. Introduced species, such as bullfrogs, crayfish, sunfishes (*Lepomis* species), and largemouth bass, also pose challenges to red-legged frogs, competing for resources and often preying directly upon larval and adult frogs (Alvarez et al. 2003, Doubledee et al. 2003). The introduction of non-native species is also thought to play a role in the spread of disease, particularly chytridiomycosis. A chytrid fungus, very likely *Batrachochytrium dendrobatidis*, is the cause of chytridiomycosis and has been linked to numerous amphibian declines across the world. Given the vulnerability of the remaining populations of California red-legged frogs, this pathogen is considered a major threat.

California red-legged frogs at Stanford. California red-legged frogs have been monitored annually on Stanford lands since 1997. These surveys have documented two distinct frog populations, one along Matadero and Deer creeks, and one along San Francisquito Creek (Figure 2-2). Prior to the construction of Highway 280 and the general suburban buildup of the area, it is likely that these two populations were part of a single, more widespread population.

Annual surveys conducted since 1997 have documented red-legged frog reproduction in Deer Creek and Matadero Creek and in a pool associated with the "Upper Quarry." California red-legged frog reproduction in Matadero Creek appears to be very limited, with only a few tadpoles surviving to metamorphosis each year. In some years, Deer Creek is more productive, with large numbers of mature tadpoles (hundreds) and metamorphs (tens) observed in comparatively wet years. However, it appears that no successful red-legged frog reproduction occurs in Deer Creek during conditions of moderate to severe drought. Reproduction in the quarry pool is fairly consistent, but the pool is somewhat unusual because California red-legged frog tadpoles are present in the pool year-round. (Fellers et al. 2001).

California red-legged frogs also are found along the Stanford portions of San Francisquito Creek. Recent observation of red-legged frogs in San Francisquito Creek have been limited to the reaches located downstream from the confluence with Bear Creek (in the Jasper Ridge Biological Preserve) to within 2 miles (along the creek) upstream from the Interstate 280 bridge. Red-legged frog reproduction in this area has been variable, with few tadpoles (~20) seen most years since 1997, but with 50+ seen in some years (particularly when weather conditions have caused side-pools to form).

California red-legged frogs have been found in Los Trancos Creek upstream of Stanford, but only one red-legged frog has been found along Stanford's portion of the creek since the early-1990s. Los Trancos Creek provides cool, clear water that is not typically red-legged frog habitat. However, the creek corridor may serve as a dispersal corridor. Most of the recently observed frogs were found well upstream of Stanford, and there is only a single recent record of a California red-legged frog from Stanford's portion of Los Trancos Creek. In 1995, a single frog was repeatedly observed in the roots of a large bay tree located just downstream of the Los Trancos Diversion facility.

There have been other sporadic records of California red-legged frogs in the San Francisquito watershed. There are unsubstantiated records from the 1970s of red-legged frogs in San Francisquito Creek immediately south of the golf course, near the non-Stanford residences along Bishop Lane (a reach some 1.5 to 3 miles downstream from the frog's current distribution). Recent verified observations have been lacking.

While recent observations of red-legged frogs away from the creeks have been few, it is apparent that some individuals disperse far from the riparian zone. A large red-legged frog was found in January 2000 as a road-kill along Junipero Serra Boulevard, opposite Frenchman's Road (approximately 1 mile from the nearest creek site known to support frogs). In 2006, two red-legged frogs were reported from an area between SLAC and Sand Hill Road. Multiple subsequent surveys at the site failed to observe any California red-legged frogs, but, given the location, transient individuals are not unexpected. Other historic records of California red-legged frogs at Stanford indicate that in the early- and mid-part of the last century, they were occasionally found in Lagunita and in the goldfish pond of the Kingscote apartment building on campus. No California red-legged frogs have been observed at these central campus locations for many decades.

At Stanford, several factors threaten California red-legged frogs, including loss of habitat, predation and competition by non-native species, disruption of dispersal routes, and direct interaction with people and domestic animals. Historic reductions of riparian forests, loss of side pools, and degradation of seasonal tributaries have undoubtedly also impacted local frog populations.

The local populations of red-legged frogs have probably declined considerably during the last 50 years. Anecdotal accounts and specimen locations indicate that red-legged frogs were more widespread and probably abundant in many locations where the frog is now absent. Most likely, no single major reason for this decline exists, but rather the decline is the result of long-term changes to the area that have occurred with increased urbanization.

Notes. There is a sizable concentration of red-legged frogs located on the Lawler Ranch, which is adjacent to Stanford, west of Sand Hill Road. It is presumed that frogs reproducing in the ponds and creeks present in the Lawler Ranch occasionally occupy adjacent upland areas owned by Stanford. The Lawler Ranch population is separated from the red-legged frogs present in San Francisquito Creek by Sand Hill Road and the SLAC National Accelerator Laboratory (SLAC).

Rana aurora draytonii was first listed as a threatened species by the Service in 1996.

The California red-legged frog, *R. a. draytonii*, is different from the northern red-legged frog, *R. a. aurora*, having larger size, rugose skin, distinct spots with light centers along its dorsal line, and prominent dorsolateral folds. Behavioral and genetic differences are discussed by Hayes and Miyamoto (1984). Recent genetic analyses (Shaffer et al. 2004a) have further documented these differences, and many consider the California red-legged frog and the northern red-legged frog to be two distinct species (*Rana draytonii* and *Rana aurora* respectively)

2.4.2 Steelhead

Description. Steelhead are the anadromous form of Oncorhynchus mykiss; non-anadromous forms are referred to as rainbow trout. The coloration of adults is highly variable and may range from silvery with faint dark spotting to dark dorsal coloration with a faded lateral red band and heavy spotting; individuals that are in marine environments or have recently returned to freshwater from marine environments are usually quite silvery white-blue in color, with some dorsal spotting. Young steelhead, or parr, are similarly colored with the exception that they have between 8 and 13 widely spaced marks (parr marks) along the lateral line. During smoltification, the dark parr marks will usually fade, and the smolts become lighter and more silvery as they descend the streams and enter salt water. During the time that they are in freshwater, parr and smolt are generally less than 10 inches in total length; returning adults can be 15 to 25 inches in total length.

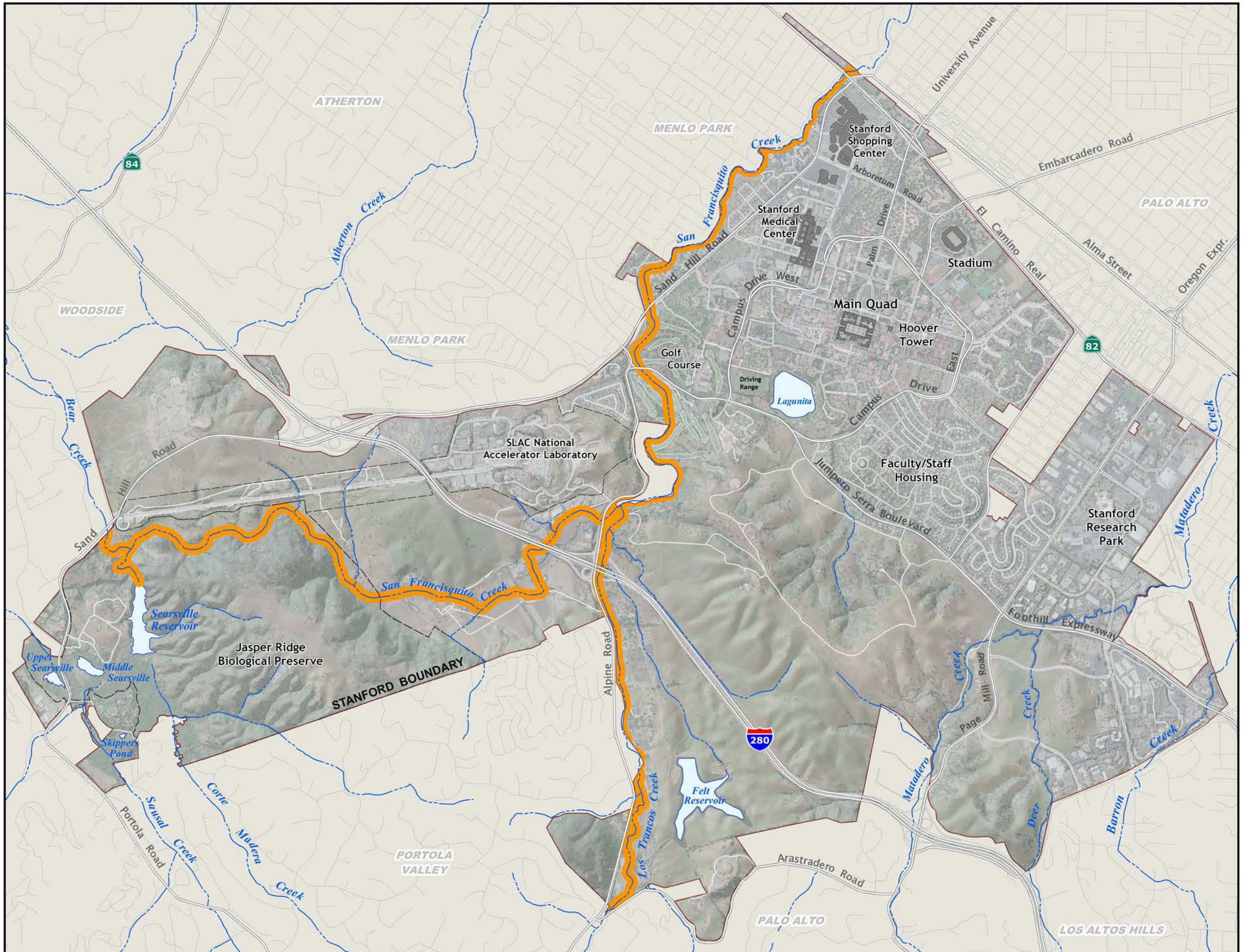
Natural History. Steelhead spawn in fresh water streams and rivers, and typically spend the first to second years of their lives as residents of their natal stream. After obtaining sufficient size, parr begin a transformation called smoltification, a physical and behavioral transition from freshwater form to a form that is able to survive in marine environments. In freshwater, steelhead feed on drift organisms, benthic invertebrates, and small fish. As with other salmon of the Pacific Basin (all members of the genus Oncorhynchus), steelhead return to the same stream in which they were hatched. Steelhead generally spend several years living in coastal marine environments prior to initial spawning or between repeated spawning events. Unlike other Pacific Basin salmon, not all steelhead die after spawning, and many individuals are able to complete the migration cycle multiple times in their lives (but only once per year). Spawning and the migration it requires are, however, quite difficult, and most individuals are unable to survive multiple spawning migrations. In most southern watersheds, including those on the Stanford campus, steelhead are late winter/early spring spawners, but in some systems there are fall or summer runs (Fukushima and Lesh 1998, McGinnis 1984, Shapovalov and Taft 1954). Maximum fish age is usually 7 or 8 years.

Habitat and Range. Steelhead are native to coastal streams from Baja California to Alaska (and parts of Asia). During their time as stream residents, steelhead require water that is generally cool, 10-21° C, and saturated with oxygen (Moyle 1976). These requirements are best satisfied in sections of stream that have cool and clear water input, and are relatively fast-moving. Breeding steelhead have similar temperature and oxygen requirements for creating their nests (redds), and typically spawn in shallow-water gravel beds with rapid flow. Water flow within the gravel beds promotes egg and alevin survival. Adult steelhead that are waiting to spawn also are restricted to relatively cool water and tend to hold in deep pools. Reaches of stream used for rearing by fry and parr benefit from cover, in the form of woody debris, large boulders, and undercut banks. Shade-providing riparian vegetation is often very beneficial for steelhead because it keeps water temperatures low supports insects which are a source of food. Surface turbulence, areas of white water, also provides cover for steelhead and saturates the water with oxygen.

Threats. There has been a long-term decline of steelhead populations in the last century leading to the listing of Central California Coast (CCC) steelhead as threatened under the ESA in 1997. Degradation of spawning streams has been cited as a main factor in their decline (Moyle 1976). Dams and

Stanford University Habitat Conservation Plan

Steelhead at Stanford



Occupied Creek
(Creek width exaggerated)

hectare
100
25
4
acres

Sources:
SH habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

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Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

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Figure 2-3

other water migration barriers, water diversions, removal of riparian vegetation, decreased water quantity and quality, and the presence of non-native fish all affect the quality of habitat in steelhead spawning streams. Pollution is also a threat to salmonids, including steelhead. The presence of non-native species, including non-local forms of rainbow trout, can also threaten steelhead populations.

Steelhead at Stanford. Steelhead have long been documented to be present in the San Francisquito watershed (Figure 2-3), but, as with the vast majority of salmonid runs, few specifics are known about the mean number of individuals annually spawning in the system. Estimates range from zero in drought years to several hundred adult fish during wet years. At Stanford, relatively large numbers of parr are typically found in Los Trancos Creek and in a few portions of San Francisquito Creek and Bear Creek. Given the flashy nature of the system and physical limitations of the creek beds, redd surveys have not yielded results that are quantitatively valid. Following a working definition from NOAA Fisheries, all *O. mykiss* from within a zone of anadromy, an area where at least some of the individuals are migratory, are considered steelhead. At Stanford, all *O. mykiss* downstream of Searsville Dam, including Los Trancos and Bear creeks, are classified as steelhead. All *O. mykiss* upstream of Searsville Dam are considered rainbow trout, because they never migrate to marine environments.

There are non-migratory adults in the downstream reaches of San Francisquito, Los Trancos, and Bear creeks and would be called rainbow trout if they were not found in the zone of anadromy. These individuals exhibit color patterns typical of rainbow trout: silvery green-white base color with many spots, a wide pinkish band along the lateral line, and generally a pinkish red gill cover.

At Stanford, spawning typically occurs from February to April. Parr generally rear in the creeks for one to two summers, but are commonly land-locked for additional years if drought conditions are present. Searsville Dam is a barrier to fish migration on Stanford lands. Resident rainbow trout also are found in the San Francisquito Creek watershed.

Pollutants, including those that originate upstream, can negatively affect steelhead at Stanford. Throughout the system, eutrophic runs and pools are not uncommon by the end of summer. In portions of the creek immediately downstream from Searsville Dam, the water becomes tainted with a naturally occurring heavy load of decaying plant material, resulting in coffee-colored water by the end of summer. Non-native fishes and invertebrates also present a threat to steelhead in the San Francisquito watershed. However, most of the non-native fishes are concentrated in the portion of the system immediately downstream from the Searsville Dam, and very few non-native fishes are encountered farther than 0.5 miles downriver from the dam. Since the mid-1990s, non-native fishes have only spawned downstream of the reservoir on a few occasions, and it is therefore assumed that Searsville Reservoir is the primary source of non-native fishes in the system. The live bearing non-native mosquito fish, *Gambusia affinis*, is an exception and is found in low abundance throughout the system. Stanford annually performs efforts to monitor and control infestations of non-native fishes. These efforts were initiated in 1997 and appear to have been successful at reducing the presence of non-native fishes in areas immediately downstream from Searsville Dam.

Perhaps the primary limiting factor for steelhead in this portion of their range is the low amount of water present in the system during the annual dry season and during periods of drought. San Francisquito Creek frequently experiences drought and low water conditions. During most years, fairly extensive portions of the system dry out. During drought years, particularly during the summer months, creek drying is much more extensive and portions of the creek become dry as early as late April. The impacts of creek drying on steelhead are manifold: even short-distance dispersal through the natural channels is prevented, water quality can be rendered unsuitable, and steelhead become overly concentrated in small areas. Concentrating individuals in areas of declining water quality can increase mortality due to physiological stress and increased predation. Other potentially limiting factors include relatively low channel/stream complexity (e.g., low levels of large woody debris and other structure-providing features), the general paucity of suitable spawning sites, and the variable quantities of prey.

Non-native crayfish are widespread in the system, but are uncommon in Los Trancos Creek. Mitten crabs have recently been observed in the San Francisquito watershed, but their numbers present at Stanford vary considerably from year to year. There is no direct evidence that the steelhead population reproducing in the San Francisquito watershed has declined in the last 100 years or is declining at the present time.

2.4.3 California tiger salamander

Description. California tiger salamanders are large salamanders, with adults frequently reaching 7.5 inches or more in total length. These are thick-bodied salamanders with broad heads and blunt snouts. Adults are black or dark grey, with oval to bar-shaped spots ranging in color from white to yellow. Juveniles are dark olive green in color and do not generally have any lighter markings.

Larval tiger salamanders have external gills and are olive green in color, generally with very fine dark markings (stippling).

Eggs are laid underwater singularly or in small groups, on subsurface portions of emergent vegetation or other debris. Each egg is approximately 0.25 to 0.5 inches in diameter, including a thick gelatinous layer.

Natural History. Adult tiger salamanders are rarely seen, even during the breeding season when they are most active above ground. For most of the year, they live in the burrows of ground squirrels, gophers, and other rodents in open wooded or grassy areas. Occasionally, tiger salamanders are found in various man-made structures including buildings and drainage pipes. They are found on the surface during periods of damp weather, almost exclusively at night.

Breeding occurs during the winter rainy season. The breeding season begins with a migration of adults to the seasonal wetlands where breeding occurs. This migration typically begins with the second or third heavy rain of the season, and may consist of moves in excess of 0.5 miles, though most movements are less than 500 yards (Loredo et al. 1996, Trenham et al. 2001, Trenham et al. 2000). Movement occurs on the surface, and possibly underground through rodent burrows as well. Most male tiger salamanders at Stanford are ready to start breeding when they are 3 years old; most females require an additional year to reach sexual maturity.

Eggs are laid underwater singularly or in small groups, on subsurface portions of emergent vegetation or other debris. Young are aquatic and prefer the cover of vegetation to open water. Larvae feed on anuran tadpoles and various aquatic invertebrates such as crustaceans, zooplankton, snails, and insect larvae. These salamanders metamorphose into land-dwelling juveniles by May or June. After metamorphosis, the juvenile salamanders eat a wide variety of insects and other invertebrates. Juveniles generally remain near the breeding site until autumn rains, at which time they disperse to upland areas.

Habitat and Range. California tiger salamanders require a complex mixture of habitats, consisting of seasonally filled pools located in or near grasslands or oak woodlands (Trenham 2001, Trenham and Shaffer 2005). Semi-permanent ponds and reservoirs, and portions of slow-moving, seasonal creeks, also may be used. Safe and easy access between these habitats is vital, as migration between them is a vulnerable part of the salamanders' life cycle. Seasonal water is important because it usually has fewer predators than permanent bodies of water. Fish in particular are known to have a "significant negative impact on the survival of [salamander] eggs and larvae" (Shaffer et al. 2004b).

The California tiger salamander ranges from west of the Sierra Nevada crest, from Sonoma and Yolo Counties in the north to Santa Barbara County in the south, and west to the outer coast range. It is believed that the salamander population on the Stanford University campus represents the only population remaining on the San Francisco Peninsula. These salamanders apparently live in the grassland and foothills surrounding Lagunita and migrate to Lagunita to breed.

Threats. California tiger salamander populations have declined significantly in California. The main cause is fragmentation and destruction of habitat by agricultural and urban development. Introduced species, such as other species of salamanders that hybridize with native tiger salamanders, may be a problem in some locations (Fitzpatrick and Shaffer 2004, Riley et al. 2003). Natural predators of tiger salamanders include herons, waterfowl, raccoons, snakes, and small mammals such as skunks. Weather is a very important determinant of salamander reproductive success. In seasons with heavy early rain, which will trigger migration and reproduction, but little or no mid- to late-season rain, many salamander larvae will not grow enough for successful metamorphosis and survival. Likewise, un-seasonally heavy rains can trigger salamander migrations that result in high levels of mortality (Holland et al. 1990).

California tiger salamanders at Stanford. At the present time, California tiger salamanders are concentrated around Lagunita, with the density of salamanders decreasing significantly as the distance from Lagunita exceeds 0.75 miles (Figure 2-4). The distribution of salamanders is not random, and in the heavily developed area of campus very close to Lagunita, few, if any salamanders are present. Much of the main campus is a population sink for salamanders, which means that any individual unlucky enough to get into the main campus will find it virtually impossible to migrate back to Lagunita. Most of the main campus is downhill from Lagunita, and a myriad of curbs, steps, buildings, drains, and retaining walls block migrating salamanders from reaching Lagunita. Therefore, salamanders found in the main campus are essentially lost from the breeding population, because they have virtually no chance of reproducing successfully.

Scientists have studied the California tiger salamander at Stanford and vicinity for more than 70 years (Twitty 1941). Early work focused on local distribution and factors associated with migrations. Recent work has been centered on conservation planning for the salamanders. This work, which started in the early 1990s, has involved many Stanford-affiliated workers and researchers, including undergraduates (two of whom conducted honors work on the local salamanders), graduate students, post-doctoral fellows, research associates, and hired consultants and other experts. Work by non-Stanford scientists on the Lagunita population has also been conducted on a sporadic basis (Barry and Shaffer 1994).

Much of the recent work was conducted to implement the California Tiger Salamander Management Agreement. This agreement is between Stanford, Santa Clara County, California Department of Fish and Game (CDFG), and the Service and was signed in June 1998. One of its key elements was the designation of a California Tiger Salamander Management Zone. Another important element of the California Tiger Salamander Management Agreement was the construction in the late 1990s of five small seasonal wetlands (ponds) south of Junipero Serra Boulevard. These ponds were classified as experimental and

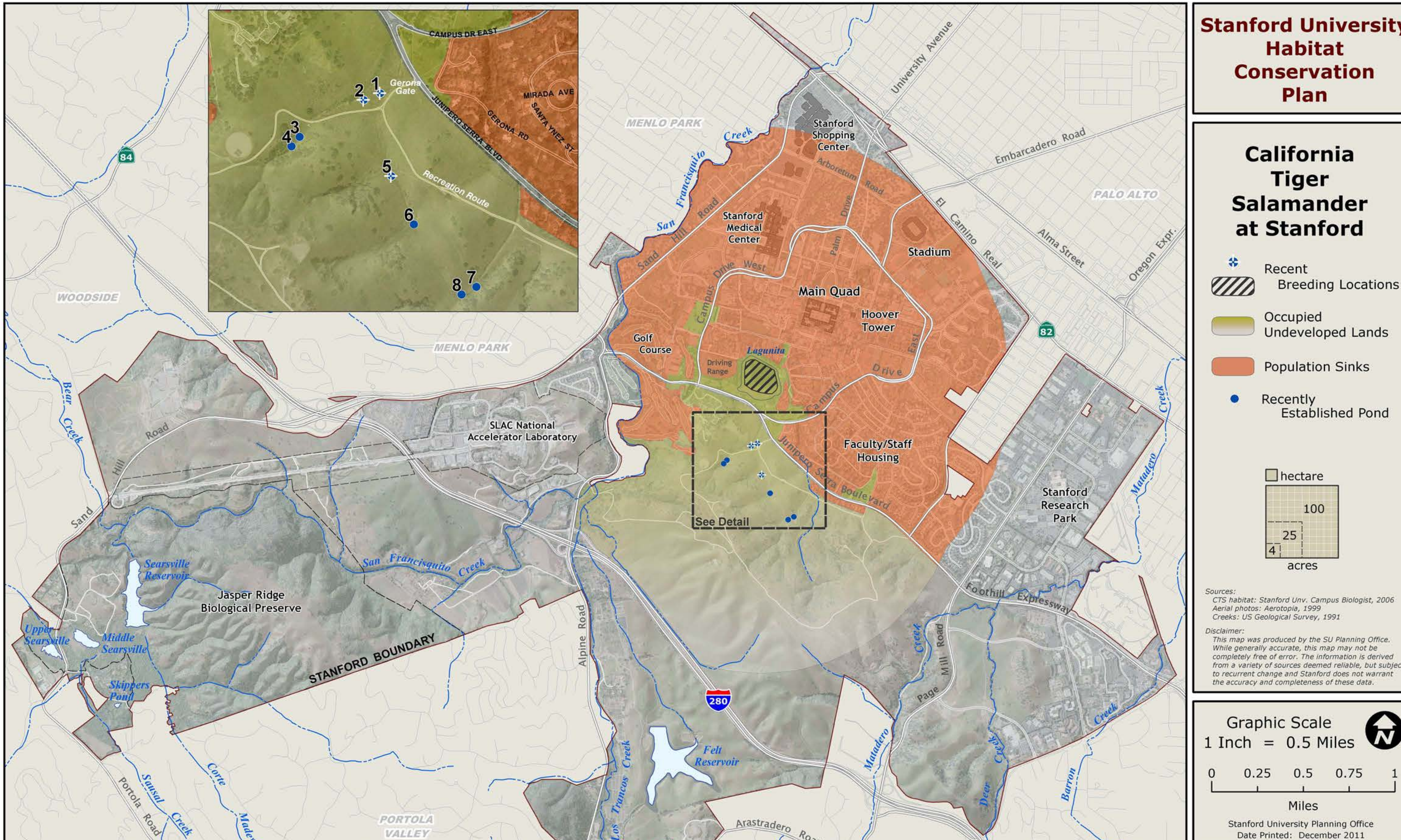
Stanford University Habitat Conservation Plan
California Tiger Salamander at Stanford
Recent Breeding Locations
Occupied Undeveloped Lands
Population Sinks
Recently Established Pond
hectare
100
25
4
acres
Sources:
CTS habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991
Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.
Graphic Scale
1 Inch = 0.5 Miles
0 0.25 0.5 0.75 1
Miles
Stanford University Planning Office
Date Printed: December 2011
CAMPUS DR EAST
Gerona Gate
MIRADA AVE
SANTA YNEZ ST
GERONA RD
JUNIPERO SERRA BLVD
Recreation Route
1
2
3
4
5
6
7
8
MENLO PARK
WOODSIDE
PALO ALTO
PORTOLA VALLEY
LOS ALTOS HILLS
84
82
280
University Avenue
Embarcadero Road
El Camino Real
Alma Street
Oregon Expr.
Stanford Shopping Center
Arboretum Road
Palm Drive
San Francisquito Creek
Sand Hill Road
Stanford Medical Center
Stadium
Campus Drive West
Campus Drive East
Main Quad
Hoover Tower
Golf Course
Driving Range
Lagunita
See Detail
Junipero Serra Boulevard
Faculty/Staff Housing
Stanford Research Park
SLAC National Accelerator Laboratory
Bear Creek
Searsville Reservoir
Jasper Ridge Biological Preserve
Upper Searsville
Middle Searsville
Skippers Pond
STANFORD BOUNDARY
Alpine Road
Felt Reservoir
Los Trancos Creek
Foothill Expressway
Page Mill Road
Matadero Creek
Deer Creek
Barron Creek
Arastradero Road
Portola Road
Sausal Creek
Corte Madera Creek

Figure 2-4

were expected to be modified as their performance was evaluated. The goal of these wetlands is to provide supplemental breeding locations for California tiger salamanders, reduce the reliance of the local population on Lagunita, and extend their effective range farther into the foothills. By 2001, Stanford determined that two of the ponds were essentially non-functional and a third lost capacity during the floods of 1998. The two remaining ponds worked as designed, but were considered too small to contribute significantly to the persistence of the local California tiger salamander population. The constructed wetlands, however, supported large numbers of Pacific treefrogs and western toads, an array of invertebrates, and were used by a wide variety of mammal and bird species. In Fall 2003, following 2 years of consultation and permitting by the Service, CDFG, California Regional Water Quality Control Board, U.S. Army Corps of Engineers, and Santa Clara County, the two remaining ponds were reconstructed and enlarged, and six additional ponds were built. By 2010, California tiger salamanders had reproduced in three of the ponds (Launer 2010). Two of the ponds have successfully supported California tiger salamander reproduction during multiple years (California tiger salamanders have reproduced in Pond #1 during four seasons and have reproduced in Pond #5 in two seasons). California tiger salamanders have reproduced in Pond #2 during one season. Four additional ponds have held water long enough to support California tiger salamander larval development during multiple years, but were not utilized by California tiger salamanders.

In addition, Stanford installed three amphibian tunnels under Junipero Serra Boulevard to help reduce traffic-caused mortality of salamanders during their migration between Lagunita and the lower foothills.

Non-native tiger salamanders are occasionally found at Stanford. During the last decade, intensive annual fieldwork has turned up three individuals that were clearly not California tiger salamanders (out of more than 1,000 observations of adult and juvenile tiger salamanders). Researchers at UC Davis found that the tiger salamanders at Stanford are native salamanders, of distinct genetic stock, and have not been compromised by introgression with non-native species (Shaffer et al. 2004b). At the present time, non-native tiger salamanders are not considered a huge threat to the local salamander population. But, the threat from non-native salamanders remains a concern because virtually every pet store in the vicinity regularly sells a number of non-native tiger salamander species, and hybridization is a big problem elsewhere in the state.

Mortality due to traffic is quite high, a finding first noted by Victor Twitty at Stanford more than 50 years ago (Twitty 1941). This finding has been confirmed by more recent data from ongoing work by Stanford and by a study by the Coyote Creek Riparian Station (Rigney et al. 1993).

Old records indicate that California tiger salamanders were more widespread in northern Santa Clara and southern San Mateo counties. At Stanford, it is unclear whether the population is declining or remaining steady. It is quite possible, however, that the local California tiger salamander population increased dramatically 100 years ago with the construction of Lagunita.

The Service listed the California tiger salamander as threatened in 2004. The California tiger salamander was listed as threatened in 2010 under the California Endangered Species Act (CESA).

Notes. For a period during the late 1970s and 1980s, the population of tiger salamanders at Stanford was believed by some to be extinct. This was apparently due to a conspicuous lack of suitable observers. The salamanders "publicly" appeared during the winter of 1991-1992 and have been monitored annually since their reappearance.

At least two other "populations" of tiger salamanders once existed in the Stanford area, and there were reports of California tiger salamanders at the Jasper Ridge Biological Preserve in the early 1980s. All attempts to locate these populations (indicated in Twitty 1941) indicate that these populations are no longer in existence.

2.4.4 Western pond turtle

Description. Western pond turtles are freshwater turtles with carapaces measuring 4 to 7 inches in length when fully grown. Generally, they are olive, dark brown, or blackish in color, with a network of dashes of brown or black that radiate outwards from the centers of their shells. However, shell coloration is highly variable. The ventral color of adults is yellow with patches of brown or black. Seeliger (1945) found juveniles and smaller specimens to be much more irregularly colored. Western pond turtles show little sexual dimorphism, although the male has a more depressed shell than the female.

Natural History. These turtles are wary and secretive. When disturbed, they seek cover in water, diving beneath the surface and hiding in vegetation or beneath submerged rocks and debris. They prefer calm waters with vegetated banks, and typically avoid rapidly running waters. In many locations, western pond turtles move away from creeks during the rainy season, presumably in an effort to avoid being swept away during seasonal flooding. Western pond turtles are omnivorous with a preference for animal matter, although plant material is occasionally eaten. Food includes aquatic plants, fishes, aquatic invertebrates, and carrion. This species is a scavenger and an opportunistic predator with a preference for live prey. The diets of males, females, and juveniles differ in prey size and proportions of food items (Bury 1986). Juveniles in particular appear to be principally carnivorous, shifting to a more omnivorous diet as they mature.

Five to 11 eggs are laid between May and August, in buried nests in sunny areas near water. Hatching time is roughly 73-80 days, after which the 1-inch-long young remain in nests through the winter. Eggs and young are extremely vulnerable to predation (see Threats below). Sexual maturity is believed to be attained after 8 years.

Western pond turtles have been found to feed and reproduce in limited geographic regions of suitable habitat. Daily movements tracked among four turtles near San Simeon averaged between 150 and 250 feet along a stream drainage (Rathbun et al. 1992). Such areas are often inhabited year after year by the same turtles. Juveniles are comparatively sedentary (Bury 1972).

Habitat and Range. Preferred habitat for the pond turtle consists of calm waters such as streams or pools with vegetated banks and basking sites such as logs or rocks, and they may utilize habitat extending as far as 0.25 miles away from water (Rathbun et al. 1992). It has been suggested that two types of nesting sites may be utilized (Storer 1930). Most commonly, eggs are laid in sandy banks adjacent to water. Occasionally, eggs may be laid considerable distances away from water. Nests located out of the flood plain may confer some reproductive advantage in regions that are prone to periodic flooding. Upland habitats are quite important for western pond turtles for wet season refugia and nesting sites (Reese and Welsh 1997).

Records indicate that western pond turtles were historically found from British Columbia to San Diego. The turtles' known range is now considerably decreased. The northwestern subspecies ranges from southern British Columbia south to central California, while the southwestern subspecies ranges northward from extreme southern California to the central portion of the state. The two subspecies intergrade from south of the San Francisco Peninsula region to Kern County (Seeliger 1945).

Threats. Habitat loss and fragmentation are the main threats to western pond turtles. Development in the riparian zone is a significant problem for western pond turtles because of their strong tendency to leave the waterways during periods of high water. Buildings, roads, trails and other human-altered landscapes in areas within several hundred yards of a creek occupied by pond turtles will likely adversely affect turtle survival. Other threats to the turtle include a large number of natural and introduced predators that prey on eggs, hatchlings, and juveniles. Predators include largemouth bass, snakes, wading birds, bald eagles, bullfrogs, black bears, coyotes, otters, and dogs. Raccoons have been cited as a major predator on turtle eggs (Temple 1987). Adult pond turtles are relatively free from predation, and have a long life span. This belief is supported to some degree by findings that the population structure of most turtle populations includes a high percentage of adults (Bury 1972). Dessication of young hatchlings is also believed to be a major mortality factor under hot and dry conditions. Alteration of hydrologic regimes by dams may also threaten western pond turtles (Reese and Welsh 1998). While it is unlikely that people continue to harvest pond turtles for food, it is not uncommon to hear of turtles being picked up during their rainy season wanderings by well meaning people.

Suitable habitat for the pond turtle has been disappearing rapidly as development and construction alters or eliminates the streams and ponds upon which the turtles depend. Direct hunting of turtles for sport or consumption has also played a role in the turtles' decline. Two accounts of turtle trapping for human consumption were included in Storer's 1930 article, which detailed methods used to trap pond turtles and also noted that the turtles commanded "$3 to $6 per dozen and were most in demand about April" (Storer 1930). Trapping or hunting is a particular problem for turtle populations because very few turtles manage to survive long enough to reach sexual maturity.

Western Pond Turtles at Stanford. Western pond turtles are the only native turtles found at Stanford. They are found scattered throughout San Francisquito Creek, from Searsville Dam to the downstream edge of Stanford's boundary (Figure 2-5). In the Jasper Ridge Biological Preserve, they have been historically found along marshier areas of Searsville Reservoir. Western pond turtles were found in Searsville Reservoir through the mid-1990s, but there have been no recent records from the reservoir. Likewise, surveys in creeks and ponded areas upstream from Searsville Reservoir have not documented the presence of western pond turtles in the last 5 years.

The number of turtles, including both western pond turtles and various non-native turtles, present at Felt Reservoir appears to vary considerably from year to year. Stanford Utilities Services and Public Safety staff report that over the last 40 years or so turtles have been irregularly observed at Felt Reservoir. In some years, no turtles are observed; while in other years upwards of 10 turtles have been observed. Biological surveys during the last decade have also found inconsistent numbers of turtles at Felt Reservoir. Some of this variation is undoubtedly due to differences in the observers and to the variable physical factors of the reservoir (mainly the large fluctuations in water level) that make it difficult to see turtles that may be present in the reservoir when it is relatively full.

Non-native turtles are clearly individuals released at or near the reservoir by people who do not realize the biological implications of releasing the turtles. Some of these non-native turtles were probably released directly into Felt Reservoir, and some were probably released elsewhere in the vicinity and subsequently dispersed to the reservoir by their own accord. In recent years, red-eared sliders have been observed in Lagunita (2008), the hotel mitigation ponds constructed at Webb Ranch (2008), and at Jasper Ridge (2006). All three of these records are from areas where it would have been impossible or at least very unlikely for turtles to have been present in the previous year. Additionally, members of the public have reported that two other red-eared sliders were recently released

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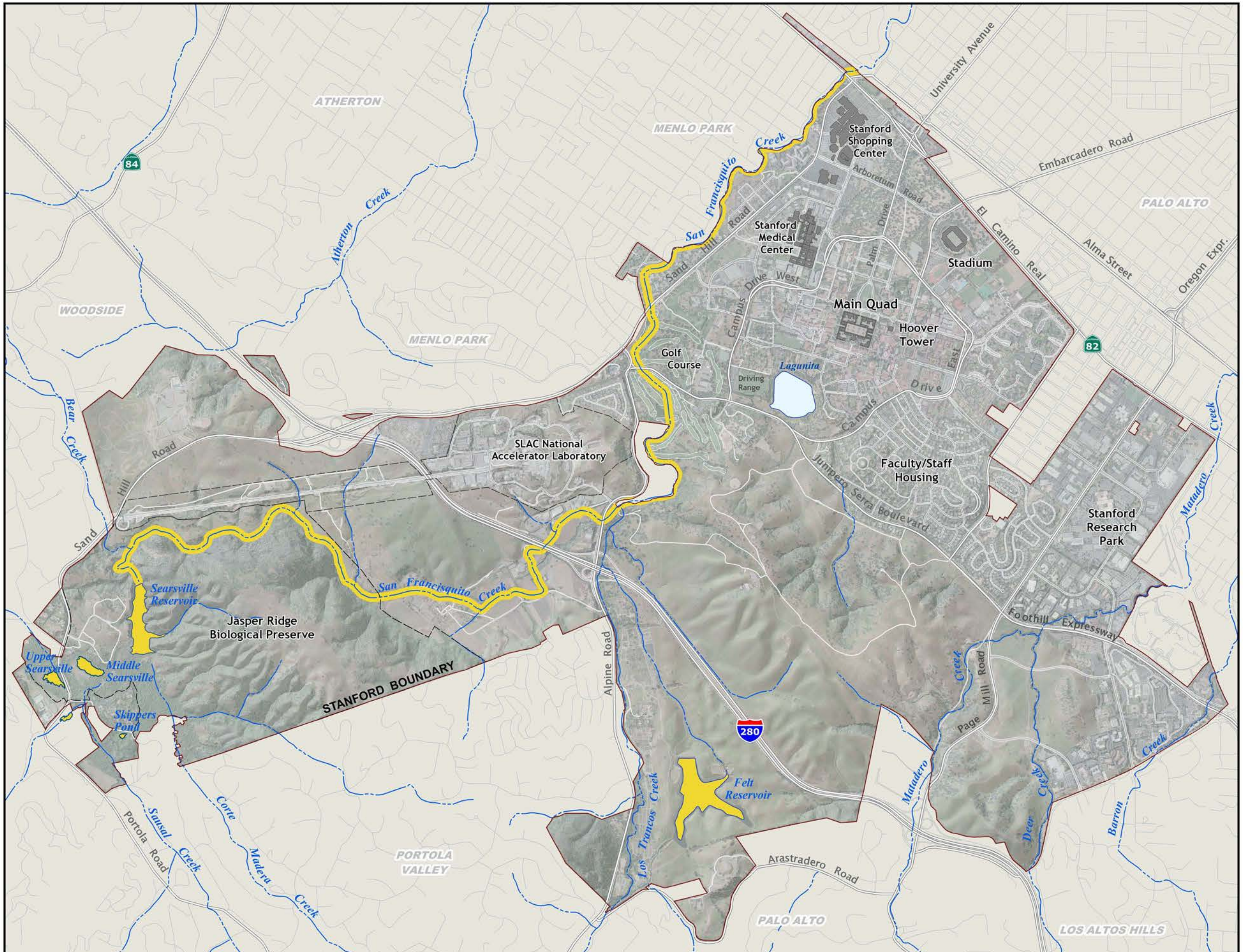


Western Pond Turtle at Stanford

Recently Occupied Creek (Creek width exaggerated)

Recently Occupied Reservoir

hectare

100

25

4

acres

Sources:
WPT habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 2-5

in Stanford waterways: one each in Skippers Pond and lower San Francisquito Creek.

Western pond turtles present in Felt Reservoir likely include individuals released at the site. There are no areas recently occupied by the species within a distance a pond turtle could reasonably expect to disperse. San Francisquito Creek is approximately 1.1 miles from Felt (at its closest point), but a turtle would need to cross either Alpine Road and Los Trancos Creek, or Highway 280 to go overland directly to Felt Reservoir. The intervening agricultural lands would also make overland dispersal from San Francisquito Creek to Felt Reservoir very unlikely. It is also unlikely that a turtle would disperse upstream in Los Trancos Creek from San Francisquito Creek and then either travel overland for 0.25 miles to the reservoir, or traverse the entire 2.25 miles of Los Trancos Creek on Stanford property then, go down the cement-lined water diversion flume 0.5 miles to Felt Reservoir. Despite annual surveys of the creek since the mid-1990s, there are no records of any turtles in the Stanford portion of Los Trancos Creek.

The highly fluctuating water level, lack of emergent vegetation, and lack of suitable nesting habitat at Felt Reservoir is not conducive to successful turtle reproduction; however, an individual could survive at the reservoir for multiple years. Any western pond turtle that did survive at Felt Reservoir would be isolated from the local population found at San Francisquito Creek.

While no pond turtles have been observed by recent surveys in Matadero and Deer creeks, local residents report that turtles were present in the area, at least through the 1980s. Western pond turtles have not been found at Los Trancos Creek, which provides cool, clear, flowing water that is not typically western pond turtle habitat.

Western pond turtles are occasionally found well away from waterways: along paths and roads at Jasper Ridge, near the Stanford golf course, along Palm Drive, and the Stanford Shopping Center. These specimens are probably either individuals leaving the creek-bed during the beginning of the rainy period (when many turtles apparently take cover in upland areas), or are females looking for places to lay eggs.

Perhaps the greatest threat to western pond turtles at Stanford is human interference, primarily due to habitat loss and human presence near creeks. Female turtles searching for places to lay eggs, in particular, are quite sensitive to interactions with humans and human-built environments, and will retreat to the creek if sufficiently disturbed without laying eggs. The abundance of raccoons, dogs, cats, rats, and other animals associated with suburban development also may be taking a large toll on pond turtles.

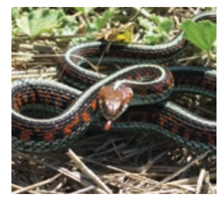
There are no historic quantitative records of turtle abundance or distribution. Therefore, it is unclear whether the local population is stable. The paucity of sightings of adult turtles and nearly complete absence of juvenile turtles strongly implies, however, that the local turtle population is in danger of extinction.

The western pond turtle is not currently protected under the ESA.

Notes. Two subspecies are found in California, the northwestern (*Clemmys marmorata marmorata*) and the southwestern (*Clemmys marmorata pallida*). Distinguishing between the two subspecies is difficult. The northern subspecies has inguinal scutes and a more lightly colored throat than the sides of its head (Pritchard 1979). Seeliger notes that *Clemmys marmorata marmorata* also has a pair of triangular inguinal plates that are larger than the small or even absent inguinal plates of the southern variety. The two subspecies of western pond turtle transition just south of the San Francisco Bay Area. Seeliger lists localities from which intergrades have been examined, including Alameda County, Contra Costa County, and Palo Alto.

2.4.5 San Francisco garter snake

Description. The San Francisco garter snake (*T.s. tetrataenia*) and red-sided garter snake (*T.s. infernalis*) are two distinct subspecies of the common garter snake (*Thamnophis sirtalis*). The San Francisco garter snake is listed as endangered under the ESA. The red-sided garter snake is not a federally listed species. Both subspecies are found on the San Francisco Peninsula.



On the San Francisco Peninsula there is a fairly well documented intergrade zone between the San Francisco garter snake and red-sided garter snake. This intergrade zone is located on the eastern flank of the Santa Cruz Mountains (Barry 1994, Fox 1951). Stanford is within this intergrade zone. The intergrade populations are not considered either the red-sided garter snake subspecies or the San Francisco garter snake subspecies. In this HCP, the San Francisco garter snake, red-sided garter snake, and integrade populations are referred to collectively as "local subspecies" or "garter snakes" (Table 2-1).

Table 2-1 Characteristics of Local Garter Snakes

 San Mateo County © Gary Nafis	**San Francisco garter snakes** have a bright turquoise blue to yellow dorsal stripe, which is bordered on both sides by black stripes. Below the black stripes, there are solid red to orange stripes that are bordered by another pair of black stripes. Below the second black stripes and on the underside, the color is generally the same as the dorsal stripe (turquoise to yellow), but is typically slightly darker. There are often some minor dark or red markings below the second dark stripe. In some individuals the red/orange stripe is partially interrupted by black markings. The interruption of the red/orange stripe is particularly evident at the anterior end of some individuals. The dorsal surface of the head is red to orange. In summary, while there is considerable individual and population-level variation, the basic color pattern of this subspecies is a series of four stripes along each side (a turquoise to yellow dorsal stripe, which is bordered by a black stripe, then a red stripe, which is followed ventrally by a black stripe, with a bluish lower body and underside).
 Marin County © Gary Nafis	**Red-sided garter snakes** have a light turquoise blue to yellow dorsal stripe, which is bordered on both sides by black stripes. Below the black stripes, there are areas of alternating red/orange and black markings, forming red/orange checkered stripes. The red/orange markings are generally square to slightly rounded in shape and slightly larger in width than the black markings. Below these checkered stripes, there is typically no black stripe, and the body color is similar to that of the dorsal stripe, occasionally with darker markings. In some individuals the red markings dominate and nearly form a more-or-less solid red stripe (with minor black markings), particularly along the posterior part of the body. The dorsal surface of the head is red to orange. In summary, the basic color pattern is a series of three stripes along each side of the body (a light turquoise blue to yellow dorsal stripe, which is bordered by a black stripe, which is then bordered ventrally by a red and black checkered stripe, with the lower body and underside bluish in color). There is individual and population-level variation in color pattern.
 Stanford	The color pattern of individuals from **intergrade populations** can be quite variable, but individuals from these populations generally exhibit at least some characteristics of both the San Francisco garter snake and red-sided garter snake. Individuals from intergrade populations can, however, look very similar to either of the two subspecies. The color patterns of intergrade individuals are also often asymmetrical. Populations classified as intergrade do not necessarily include individuals with color patterns that are typically characteristic of either of the two subspecies. Intergradation only implies some mixing of two slightly different gene pools. The mixing could be of recent origin or could be the result of events that happened many generations previously.

In general, populations in the northern portion of the intergrade zone have more individuals that are partially or completely striped, which is more similar to the patterns that are diagnostic of San Francisco garter snakes (Barry 1994). In the southern portion of this zone, which includes Stanford, most of the individuals exhibit the alternating red and black markings that are characteristic of red-sided garter snakes.[3]

Natural History. The local subspecies feed on a wide range of animals, including frogs, salamanders, small fishes, and invertebrates. Small rodents and birds may also be consumed. The San Francisco garter snake is often considered a specialist on ranid frogs, and California red-legged frogs are a major component of the diet of adult snakes in many locations. Juvenile San Francisco garter snakes will prey heavily on Pacific treefrog metamorphs. Prey is usually captured in wetlands, either in the emergent vegetation or in areas of shallow water.

The local subspecies are prey for a number of species, including bullfrogs, large red-legged frogs, snakes, raccoons, dogs, foxes, coyotes, cats, fishes, raptors, herons, and egrets. They can reach 4 feet in length, but most individuals are less than 3 feet in length.

The local subspecies mate in the late winter to early spring, and the young are born in summer to early fall. They are livebearing

[3] It is difficult to determine whether a specific population within an intergrade zone is more closely related to one or the other of the parental subspecies. In the case of the San Francisco/red-sided garter snake intergrade zone this is made more difficult since traditional taxonomic treatments of these snakes rely heavily on color pattern and scale counts – both of which are known to vary within subspecies.

at birth and generally range from 5 to 8 inches in length. Clutch size varies with size of female and year, but generally ranges from eight to 20 young. Females typically bear their young in secluded areas, either hidden in dense vegetation or under some type of cover. In the Bay Area, the local subspecies are generally dormant during the coldest part of winter and may also have a dormancy period during prolonged periods of exceptionally hot and dry weather. The local subspecies generally "hibernate" individually, or in small groups, and not in large numbers, which is typical of other common garter snake subspecies in more northern areas. Their maximum life expectancy is unknown, but it is unlikely that many individuals survive a decade in the wild.

Habitat and Range. The common garter snake is one of the most widely distributed snake species in North America. It is found from coast to coast, from mid-Canada to the Mexican border, being absent from only the most extreme dry and cold areas.

The lack of consensus over the taxonomic status of common garter snake subspecies makes it difficult to identify the range of a particular subspecies. The current view is that San Francisco garter snakes are found on the west-side of the crest of the Santa Cruz Mountains, along virtually the entire coast of San Mateo County, north to San Francisco County. On the coastside, the San Francisco garter snake may stray south into extreme northern Santa Cruz County. East of the crest of the Santa Cruz Mountains, the San Francisco garter snake is found from the City of South San Francisco and the San Francisco airport, south to Crystal Springs Reservoir (all San Mateo County).

Red-sided garter snakes are currently recognized as having a disjunct distribution, with populations being found from coastal Humboldt County south to coastal Monterey County (surrounding the distribution of San Francisco garter snakes). The garter snakes that have been found in Santa Clara County have been identified as red-sided garter snakes.

The red-sided/San Francisco garter snake intergrade zone that includes Stanford is located on the eastern flank of the Santa Cruz Mountains, extending approximately 12 miles from the vicinity of Boronda Lake in Palo Alto (Foothills Park) to Upper Crystal Springs Reservoir (Barry 1994, Fox 1951).

Populations of the local subspecies are typically associated with permanent or nearly permanent bodies of water, usually areas of shallow water and heavily vegetated shores. However, they are known to occur, at least temporarily, in grassland, riparian woodland, oak woodland, and coniferous forest. Sag ponds in the San Andreas Fault rift zone and freshwater coastal marshes are considered prime habitat for the San Francisco subspecies.

Threats. Natural threats include predation by fishes, snakes, birds, and mammals. However, loss of habitat and the subsequent isolation of formerly interacting populations are the most problematic factors on the San Francisco Peninsula. Urbanization of the eastern flank and bay shore portions of the Peninsula, in particular, has been pervasive and many snake populations have been lost. Those surviving individuals and populations face an array of human-related threats, including being killed on roads, trapped in drains/sewers, poisoned by biocides or pollutants, or any of a myriad of other factors associated with the built environment.

Overcollecting may also be a threat, particularly for the San Francisco garter snake. Garter snakes are relatively easy to maintain in captivity and are very popular as pets. Given the vibrant color of the San Francisco garter snake and the allure of keeping a rare specimen, these snakes have been collected, illegally since 1967, for the pet trade for decades.

The large number of captive specimens also presents another problem for the conservation of the subspecies. The release of specimens from captive bred lineages could be problematic for several reasons, including having a genetic make-up not typical of wild stocks (captive breeding invariably introduces an element of artificial selection or genetic drift) or by transmitting disease.

Garter snakes at Stanford. Stanford is within the southern portion of the red-sided/San Francisco garter snake intergrade zone. As such, the intergrade populations found at Stanford exhibit color patterns that are generally more characteristic of red-sided garter snakes.

The intergrade populations have been studied at Stanford and the vicinity sporadically for nearly 100 years. At the present time, the common garter snake is infrequently encountered at Stanford. A few individuals are encountered at Lagunita every year, but specimens from other locations at Stanford are only very infrequently observed. Given the number of museum records and mentions in the scientific literature, it is likely that historically the intergrade populations were more common in the area.

A 1994 study of 47 snakes found in the Palo Alto area, which included Lagunita and areas near San Francisquito Creek, found that approximately 20 percent of the 47 snakes exhibited a red-sided garter snake color pattern and the remaining, approximately 80 percent, exhibited an intergrade color pattern (Barry 1994). An additional 12 snakes that the study observed just south of Stanford, at Boronda Lake in Foothills Park in Palo Alto, all exhibited a red-sided garter snake color pattern (Barry 1994). The results of this study, therefore, indicate that based on color patterns, the integrade population (or populations) at Stanford have a color pattern that is more similar to the red-sided garter snake than to the San Francisco garter snake.

This conclusion is further supported by California Academy of Science specimens as noted in a 1981 study of 35 individual snakes collected at and near Stanford (Seib and Papenfuss 1981). The museum records classified 18 as red-sided garter snakes, 16 as having an intergrade color pattern, and one as a San Francisco garter snake.

On Stanford lands in southern San Mateo County the taxonomic status of the local subspecies is less clear. Stanford and other researchers have repeatedly surveyed areas near Sand Hill Road and Highway 280 for red-legged frogs and San Francisco garter snakes. These surveys were done at the SLAC National Accelerator Laboratory (SLAC) and the nearby former Christmas tree farm (Barry 1976, Balgooyen 1981, Seib and Papenfuss 1981, Westphal et al. 1998, Launer 2006). With the exception of one intergrade individual captured in 1981 in a drainage near the main SLAC accelerator building, no snakes were observed during any of these surveys.

Although garter snakes have not been observed in the vicinity of San Francisquito Creek or Searsville Reservoir, those areas provide potential habitat. Garter snakes have not been found at Los Trancos Creek, which provides cool, clear, flowing water that is not typically garter snake habitat.

Additionally, extensive environmental work on property immediately north of Stanford did not find any local subspecies (H.T. Harvey and Associates 2001, Wagstaff and Associates 2002). In 2007, however, two intergrade individuals were found in Woodside, at a site less than a mile north of Stanford (Swaim Biological 2007).[4]

Notes. Populations found in an intergrade zone generally include individuals exhibiting a range of color patterns and frequently, but not always, include individuals with physical characteristics of one or both of the two subspecies. In order to assign a population with variation to one of the two subspecies, the variation would need to be quantified, which requires an adequate sample size and knowledge of the genetic basis and linkage of the traits being used for the analysis. Since there is considerable variation in populations, such an analysis would also require a known non-intergrade population. Subspecies determinations based on a single or few specimens are scientifically invalid. Genetic analyses may be helpful in determining the "relatedness" of a series of populations and might aid in the clarification of subspecies determinations.

Thus, one of the key problems to answering questions concerning whether the intergrade populations are more closely related to the red-sided garter snake or San Francisco garter snake is that at the present time neither of the two subspecies are commonly found in most locations. This is problematic because a large sample size is necessary in order to determine the precise genetic make-up of the local population (Amadon 1949, Cicero and Johnson 2006, Mayr 1942, Rand 1948). Additionally, while molecular-level analyses with small sample sizes may be able to address some questions pertaining to population-level relationships, if significant variation is present, they too will need to have a sufficient number of specimens in order to resolve many taxonomic ambiguities.

Moreover, the legal status of the intergrade form currently is not clear. The San Francisco garter snake was listed as endangered by the Service in 1967.[5] However, the ESA listing does not specifically include the intergrade form as a protected form of the San Francisco garter snake subspecies, and the Service has not adopted final regulations clarifying the status of the intergrade populations.

Because of the uncertain legal status of the intergrade populations, difficulties in discerning whether a specific population within the intergrade zone is more closely related to the federally listed San Francisco subspecies or the non-listed red-sided subspecies, and the lack of definitive genetic information, the San Francisco garter snake has been included in this HCP. As such, the HCP will protect all garter snakes found at Stanford, regardless of their ultimate taxonomic or legal classification.

[4] From the photographs provided, the two specimens from the Woodside site appear to be an intergrade form of red-sided and San Francisco garter snakes. Further specimens were reportedly captured at this site in 2008, but no information about these specimens is available.

[5] It is also a Fully Protected species under the California Endangered Species Act (CESA). Under the CESA, the CDFG cannot authorize the lethal take of a Fully Protected species. To avoid any inconsistencies with State law, Stanford is not seeking a federal incidental take permit that would allow lethal take of the San Francisco garter snake.

SECTION 3
COVERED ACTIVITIES AND THEIR IMPACTS

3.0 COVERED ACTIVITIES AND THEIR IMPACTS

As part of the HCP, Stanford is seeking a Section 10(a) incidental take permit from the Service and NOAA Fisheries. An incidental take permit can be issued for one-time site-specific activities or projects, or for a broader program of multiple ongoing or annual maintenance activities. Stanford is seeking the latter type of incidental take permits that will allow it to operate and develop the University, and perform the Covered Activities described below.

This section describes the Covered Activities that Stanford routinely performs, including the construction of new facilities. **All of the activities described below are Covered Activities, unless the HCP specifically excludes them from coverage.** The Covered Activities include activities related to water management, academic uses, maintenance and construction of urban infrastructure, recreational and athletic uses, general campus management and maintenance, activities that are carried out by Stanford's tenants, and future development. All of these activities are necessary to keep the University operating, and most of these activities have been ongoing for many years. These activities represent the type of University operations that could affect the Covered Species, and allow the University to analyze the potential effect of its operations on the Covered Species. But, because of the size and diversity of operations, and the changes in technology that are continually occurring, it is not possible to describe all of the University's actions in complete detail. Therefore, the discussion of impacts on the Covered Species by the Covered Activities is addressed qualitatively in this section. The cumulative effect of these activities, with the implementation of the HCP's Conservation Program, are then quantitatively assessed in Section 5.3 of the HCP. Section 4.0 of the HCP describes the Conservation Program that will avoid or minimize the take of Covered Species caused by the Covered Activities.

This section describes many activities that individually present a very low chance of causing take of Covered Species. When viewed cumulatively, however, these common activities likely would result in take, and if this take were not minimized or mitigated for, it could, over time, have a potentially significant effect on the Covered Species. The HCP is designed to benefit the Covered Species and increase the likelihood of their persistence at Stanford. If the HCP is successful, the Covered Species populations at Stanford will increase, and, as the Covered Species become more abundant, they will inhabit more areas at Stanford. Although this will provide a significant benefit to the Covered Species, the number of individuals of the Covered Species that are taken, particularly while conducting routine activities could increase when the Covered Species start inhabiting areas that are currently uninhabited. The percentage of the local populations impacted, however, will remain the same or will decrease as the overall population of Covered Species continues to increase. Therefore, while any one of the Covered Activities, at any given time, may not result in the take of Covered Species, the activities are all considered Covered Activities because, on a cumulative basis, they could result in take.

3.1 LOCAL WATER FACILITIES

Stanford University uses both potable and non-potable water. The San Francisco Public Utilities Commission Water Department (SFPUC) supplies Stanford with potable water and Stanford operates and maintains potable water-related infrastructure. Stanford also operates and maintains groundwater wells that are routinely monitored and are of potable-water quality.

The non-potable water supply currently is used mainly for irrigation and as a backup to potable water for fire protection. Water diversions from Los Trancos Creek, San Francisquito Creek, and Searsville Reservoir each independently supply Stanford with non-potable water[1] and the wells also occasionally supplement this water supply. Non-potable water is stored in Felt Reservoir and Searsville Reservoir (Figure 3-1). Searsville Dam and Reservoir, and operations and maintenance activities at Searsville, are not Covered Activities and are therefore not described below.

Stanford Utilities Services is responsible for the planning, operation, and maintenance of the potable and non-potable water supply systems, chilled water/steam system, and the sanitary sewer and storm drainage systems. These systems include many components, such as water diversion facilities; creek monitoring devices; dams; reservoirs; deep wells; over 200 miles of water, sewer and drainage piping; open channels; fire hydrants; manholes; and meters. All of these water management facilities and activities are needed to support academic research and a daily campus population of about 30,000 people.

3.1.1 Water Diversions

Stanford University holds and exercises riparian and pre- and post-1914 appropriative water rights and licenses for the Los Trancos diversion located on Los Trancos Creek and a pump station[2] on San Francisquito Creek at the Stanford golf course (Figure 3-1). Felt Reservoir is the largest storage reservoir at Stanford.

Operation of Los Trancos Creek Diversion. Water from Los Trancos Creek is diverted by an in-stream structure located on Los Trancos Creek just downstream from the Stanford property boundary near Arastradero Road. The Los Trancos Creek

[1] The diversion from Los Trancos Creek, the diversion from Searsville, and the diversion from San Francisquito Creek are all separate water supply diversions, and are operated independently and can each supply Stanford with non-potable water.

[2] There are two sets of pumps on San Francisquito Creek; these are referred to as the Felt pumps and the Lagunita pumps, and are combined into one facility.

diversion facility includes a small diversion dam, a by-pass channel/fish ladder, screen, and a concrete-lined conveyance channel (flume). From this structure, the water is contained in the flume and flows by gravity to Felt Reservoir. To facilitate fish passage the structure was modified in the mid-1990s, using a design provided by the CDFG. The modified structure improved fish passage and helped prevent the diversion of fish into the conveyance flume. However, that fish ladder and screen were highly labor intensive, negatively affected diversion operations, and resulted in a reduction in the amount of water that can be diverted from Los Trancos Creek to Felt Reservoir, particularly during high flows.

Stanford, in consultation with NOAA Fisheries and the CDFG, studied ways to enhance conditions for steelhead through improvements to the water diversion facilities. The structural modifications and operational changes to the Los Trancos Creek and San Francisquito Creek pump station diversions, and accompanying maintenance to restore storage capacity at the Felt Reservoir, are known as the Steelhead Habitat Enhancement Project (SHEP). The design for the proposed modifications and operating protocols for the SHEP were finalized by Stanford, in consultation with the CDFG, and NOAA Fisheries. NOAA Fisheries issued a Biological Opinion to the US Army Corps of Engineers for the project in April 2008 and CDFG issued a 1602 Lake and Streambed Alteration Agreement (SAA) in September 2008 (Appendix A). Construction of the SHEP was completed in October 2009. Operation of the diversion since that time has been in accordance with the SHEP agreement. The new protocols substantially increase flows through the fish ladder, which enhance conditions for steelhead migration and spawning. These enhancements also will accommodate the upstream and downstream movement of juvenile steelhead.

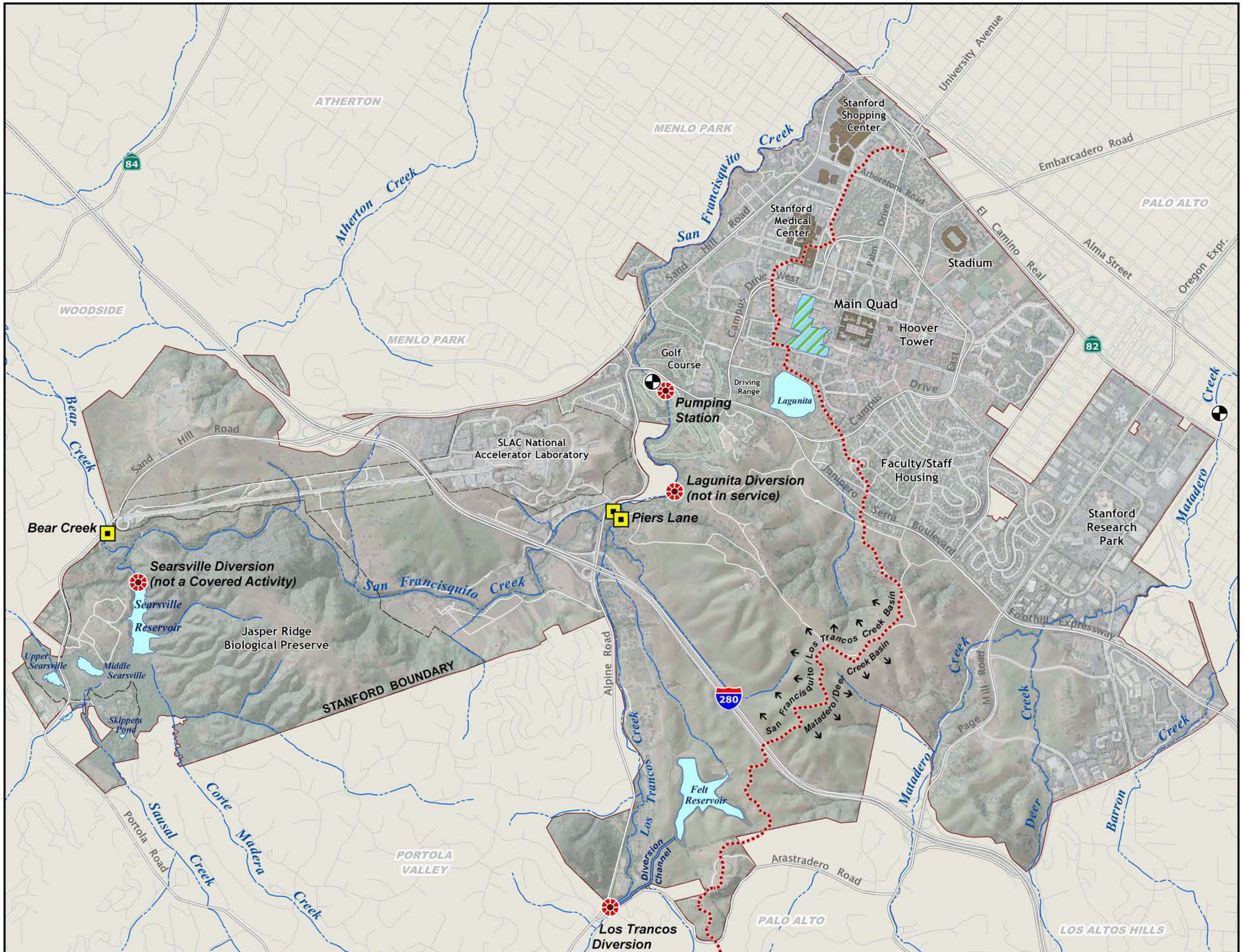
Operation of San Francisquito Creek Pump Station. Stanford has operated a water diversion in San Francisquito Creek near the Stanford golf course for more than 100 years. Although the diversion is located adjacent to the golf course, it is unrelated to the operation of the golf course. In February 1986, the diversion was moved from the currently non-operating in-stream Lagunita diversion downstream to its present location because of extensive collapsing of the flume. It was configured with an in-stream weir and pumping facilities with perforated pipe intakes that are essentially at-grade. In 1998, under permits from Santa Clara Valley Water District, CDFG, and Santa Clara County, the station was completely reconstructed and now consists of an infiltration gallery and two sets of subsurface pumps: the Lagunita pumps, which convey water to Lagunita through a flume, and the Felt pumps, which convey water to the pipeline that extends from Felt Reservoir to campus. Both sets of pumps are located in a single pump station facility. One purpose of the Felt pumps is to pick up the Los Trancos Creek water bypassed at the fish ladder facility. The losses at Los Trancos have not been consistently made up by the San Francisquito Creek pump station for various reasons, including limited pump capacity. The SHEP included structural modifications and operational changes to this diversion facility which, as described above, were in place in October 2009 and provide enhanced steelhead habitat and downstream passage.

Construction of the two modified diversion facilities and the accompanying sediment removal to restore storage capacity at the Felt Reservoir were permitted by NOAA Fisheries, CDFG and various other federal, state, and local agencies separately and therefore are not Covered Activities under this HCP.

The physical presence of the Los Trancos diversion and San Francisquito Creek pump station, ongoing operation of the facilities as approved under the SHEP, and the future maintenance of these facilities are Covered Activities under this HCP.

Maintenance of the Los Trancos Creek Diversion Facility. Maintenance of the Los Trancos Creek diversion facility consists of activities both during the diversion season and the off-season. Diversion season maintenance includes occasional repair of the fish screen brush mechanism, frequent clearing of accumulated gravel and debris from all of the flow paths (radial gate, ladder, bypass channel and flume), and occasional repair of the gate mechanism. Generally, high creek flows trigger the need for this maintenance work. For safety reasons, all of this work is done after high creek flows (when problems typically occur) have subsided, and there is minimum disturbance to creek flow. These activities usually take a few hours, and usually occur several times each diversion season. When necessary to facilitate maintenance activities in the ladder and bypass channel, the creek flow is temporarily rerouted through the opened radial gate; no coffer dams or piping of creek flow is necessary for this routine maintenance.

Maintenance of the San Francisquito Creek Pump Station. Maintenance of the San Francisquito Creek pump station involves much less invasive activity than maintenance of the Los Trancos Creek diversion facility because of the pump station's configuration. Pump station maintenance activities consist primarily of backwashing of the infiltration gallery and piping with water, and pump repairs. Backwashing of the gallery involves periodic (up to daily, depending on operations and creek



Stanford University Habitat Conservation Plan

Water Diversions & Creek Monitoring Facilities

- Creek Monitoring Facility
- US Geological Survey Stream Gaging Station
- Diversion
- Waterbody
- Watershed Boundary
- Additional San Francisquito Creek basin area connected via storm drainage system

hectare

100

25

4

acres

Sources:
Stream Monitoring Facilities: SU/PO, 2004
Detention Ponds: SU/PO, 2004
Diversions: SU/PO, 2004
Watershed: Nolte, 1999 and SU/PO, 2004
Additional S.F. Creek drainage: Nolte, 1999
Gaging Stations: US Geological Survey, 1991
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 3-1

sediment conditions) valve exercising (opening and closing) in the piping near the top of bank, and agitation of accumulated sediments above the gallery in the creek. During routine pump servicing, the out-of-water top of the vault is simply opened and work can proceed with no direct contact with the creek.

Repair of the pumps is typically performed in the summer low-flow periods; however, in rare emergencies, the pumps in the vaults may need to be accessed for repair/removal during the diversion season. If extensive maintenance is required, the adjacent creek is blocked off from the vault area by seines and cleared of fishes before workers enter the vault area. This is rarely needed and is done on average once every 20 years and affects an area approximately 50 feet in length.

3.1.1.1 Potential Effects of the Water Diversions on the Covered Species

Stanford's San Francisquito Creek pump station and Los Trancos Creek diversion facility were modernized during the 1990s and again in 2009 to protect steelhead. Physical and operational changes were made at these times. The physical changes to these two facilities included the installation of fish screens and ladders. These physical changes and changes in the operation of the San Francisquito Creek pump station and Los Trancos Creek diversion facility have significantly reduced the effects of the water diversions on the Covered Species. However, the operation of these diversions may still result in the incidental take of steelhead.

Operation of the Los Trancos Diversion. On April 21, 2008, NOAA Fisheries issued a Biological Opinion and Incidental Take Statement for the SHEP (Appendix A). This Biological Opinion evaluated the effects on steelhead and impacts to designated Critical Habitat of constructing, operating, and maintaining the SHEP facilities. The Biological Opinion found that the SHEP will result in minor and short-term adverse effects to steelhead and Critical Habitat during construction, and that the long-term effects of the SHEP are beneficial to steelhead and designated Critical Habitat by largely eliminating the impacts of Stanford's water diversions on stream flows that are important to steelhead (Appendix A at pgs. 38-39). The SHEP included modifications to the design of the fish ladder and fish screen that more efficiently divert water during periods of high flows. The new fishway was also designed to comply with current CDFG and NOAA Fisheries criteria for anadromous fish passage. By increasing diversions during high flow periods, Stanford will have greater flexibility to increase bypass flows during low-flow periods. This flexibility, along with an improved fishway, will enhance creek conditions for steelhead during both low- and high-flow periods. The effects of the diversion operation on steelhead have been described in the SHEP Biological Opinion and in the SAA.

However, take of steelhead would occur; thus, the presence, operation, and maintenance of the Los Trancos Creek diversion facility are covered under this HCP.[3] NOAA Fisheries' Biological Opinion and Incidental Take Statement to the Corps on April 21, 2008 sets a limit on the amount of take that is authorized and imposes reasonable and prudent measures and terms and conditions that NOAA believed were necessary and appropriate to minimize take of steelhead (Appendix A at pgs. 39-46). As part of the HCP's conservation program, Stanford's long-term operation of this facility will continue to be as described in the SHEP. As a Covered Activity in this HCP, Stanford requests that the NOAA Fisheries incidental take permit include the long-term operation of the Los Trancos diversion facility.

California tiger salamanders do not occupy the diversion site or any downstream reaches. Operation of the diversion facility therefore does not affect them. Garter snakes and western pond turtles do not occupy the diversion site, but may be found in the downstream reaches of the creek. California red-legged frogs may use Los Trancos as a dispersal corridor. The operation of the Los Trancos diversion results in changes to downstream water flows. This does not affect any of these Covered Species because the volume of diversion is small relative to the creek flows.

Operation of the San Francisquito Creek Pump Station. The San Francisquito Creek pump station has been modified to divert the additional bypass flows at the modified Los Trancos diversion. As part of the SHEP, the Felt pumps were modified so that they can accommodate up to 8 cfs, an increase of 4 cfs over the current 4 cfs rate (Appendix A). The Lagunita pumps were not changed. The SHEP included modifications to the protocols for operating the modified pump station. The modified protocols will improve creek conditions for steelhead passage.

However, take of steelhead would occur; thus, the presence, operation, and maintenance of the San Francisquito Creek pump station diversion facility are covered under this HCP. NOAA Fisheries' Biological Opinion and Incidental Take

[3] Take of steelhead from the presence, operation, and maintenance of the modified facilities also will be addressed in the Biological Opinion prepared by NOAA Fisheries as part of the review and permitting of this HCP.

Statement issued to the Corps for the SHEP sets a limit on the amount of take that is authorized and imposes reasonable and prudent measures and terms and conditions that NOAA believed were necessary and appropriate to minimize take of steelhead (Appendix A at pgs. 39-46). As part of the HCP, Stanford's long-term operation of this facility will comply with the Incidental Take Statement issued by NOAA Fisheries and the SAA with CDFG for the SHEP. As part of the HCP's conservation program, Stanford's long-term operation of the San Francisquito Creek pump station will continue to be as described in the SHEP. As a Covered Activity in this HCP, Stanford requests that the NOAA Fisheries incidental take permit include the long-term operation of the San Francisquito Creek pump station. Operation of the San Francisquito Creek diversion does not affect California tiger salamanders because this species is not found at the diversion site or in areas downstream, and these areas do not provide suitable tiger salamander habitat. California red-legged frogs, garter snakes, or western pond turtles have not been observed at this location for at least a decade. However, the area does provide potential habitat for these species and they may intermittently occupy the area in the future. The operation of the pumps will not impinge or entrain these species. Because of the flashy nature (i.e., often rapidly fluctuating flow level) of the creek, the manipulation of water levels caused by the diversions will not affect western pond turtles, red-legged frogs, or garter snakes that may infrequently inhabit downstream areas.

Maintenance of the Diversion Structures. The maintenance activities associated with the current diversion facilities could have short-term adverse effects on the Covered Species, particularly steelhead. Maintenance of the diversion structures involves work in the creeks, though this work typically occurs during the summer or fall, when the creeks are low or dry. Maintenance occasionally requires isolating a short portion of the creek affected by the work with coffer dams and temporarily confining flows to a short length of pipe.

Maintenance of the Los Trancos Diversion. California tiger salamanders, garter snakes and western pond turtles do not occupy the Los Trancos diversion site. Maintenance of the diversion facility therefore does not affect them. California red-legged frogs may use Los Trancos as a dispersal corridor. Maintenance of the diversion facility could affect California red-legged frogs. Red-legged frogs could be adversely affected by maintenance workers and equipment. The effects of the diversion maintenance on steelhead have been described in the Biological Opinion for the SHEP issued to the Corps in April 2008 and in the SAA (Appendix A).

Maintenance of the San Francisquito Creek Pump Station. Maintenance of the San Francisquito Creek diversion does not affect California tiger salamanders because this species is not found at the diversion site, and this area does not provide suitable tiger salamander habitat. California red-legged frogs, garter snakes, or western pond turtles have not been observed at this location for at least a decade. However, the area does provide potential habitat for these species and they may intermittently occupy the area in the future. Maintenance workers and equipment could adversely affect these species.

Maintenance activities associated with the facility could produce short-term impacts to steelhead when steelhead are excluded or moved from the area of the station, or with a change in water quality as sediments are stirred up during maintenance activities. The effects of the diversion maintenance on steelhead have been described in the Biological Opinion for the SHEP issued to the Corps in April 2008 and in the SAA (Appendix A).

3.1.2 Creek Monitoring Facilities

Two semi-automated water quality and sediment monitoring devices were installed by the City of Palo Alto in 2002 in the San Francisquito watershed on: (1) Los Trancos Creek (at Piers Lane), and (2) San Francisquito Creek (at Piers Lane) (Figure 3-1). The equipment was installed by, and continues to be owned by, the City of Palo Alto. The stations are operated by Stanford as part of the San Francisquito Watershed Council's Long-Term Monitoring and Assessment Program (LTMAP).

Equipment at each of the stations is mounted on a 4.5' x 4.5' concrete pad located near the top of bank. Cables extend from the automated equipment into the creek for the purpose of continuous monitoring of factors such as pH levels and temperature. Flexible Teflon tubing extends from the equipment into the stream and draws water quality samples at a frequency of six times per year. These samples are collected and transported to local laboratories for more thorough water quality analysis and testing. Strainers are installed on the tubing to prevent vegetation, fish, or invertebrates from being trapped in the tubing. Samples are drawn at varying flow rates throughout the rainy season.

The tubing, cables, and probes that extend into the stream are occasionally damaged by high-flows. These are replaced during low-flow periods as needed, which is generally once per year.

A third monitoring device, which is operated by the City of Palo Alto and therefore not covered by the HCP, is located on lower San Francisquito Creek at Newell Road. In 2004, as part of the LTMAP and to provide additional data from the San Francisquito Creek watershed, Stanford installed an additional monitoring station on Bear Creek, downstream from Sand Hill Road in Stanford's Jasper Ridge Biological Preserve. Stanford also maintains a stream flow and sediment transport gauge on Corte Madera Creek at Westridge Drive. This site is not on Stanford's property, but is operated by the University.

3.1.2.1 Potential Effects of the Creek Monitoring Facilities on the Covered Species

The presence and operation of the water quality and sediment monitoring devices will not affect any of the Covered Species.

These facilities extend minimally into the creeks (only probes to collect water quality samples and data are located in the channels) and will not trap individual steelhead during water sampling, or inhibit their dispersal.

Maintenance of these facilities could affect steelhead and red-legged frogs. Steelhead and frogs frequently hide under in-stream objects, including pipes and tubes, and are found in the vicinity of the creek monitoring devices. Although unlikely, workers repairing these facilities could therefore inadvertently disturb an individual steelhead and frog. However, such impacts would not have any long-term effects on steelhead or frogs. None of the other Covered Species are expected to be encountered during maintenance of the creek monitoring facilities because they would be unlikely to be hiding under in-stream objects.

3.1.3 Open-Water Reservoirs

Stanford maintains Felt Reservoir and Lagunita (Figure 3-1).

Felt Reservoir (DWR # 614-002; National ID# CA00670). The storage capacity at Felt Reservoir is approximately 1,050 acre-feet (341,250,000 gallons), and the current dam was completed in 1930. The earthen berm is 67 feet tall and 590 feet in length. Felt Reservoir is an off-channel reservoir located in the lower foothills between Highway 280 and Alpine Road, in Santa Clara County (Figure 3-1). The surrounding land is rolling grasslands that are used for livestock grazing. Felt Reservoir is a manmade water storage basin and it is filled primarily from the Los Trancos Creek diversion; however, some water is also supplied by the pumping station on San Francisquito Creek (located at the Stanford golf course) and Searsville Reservoir. A booster pumping station was constructed in 2004 on a water system pipeline approximately 2 miles below Searsville Reservoir, which allows water from Searsville Reservoir to be moved to Felt Reservoir for storage and distribution. The San Francisquito Creek pump station contains a pair of pumps that can convey up to 8 cfs of water from San Francisquito Creek to Felt Reservoir.

In 2008, the historic capacity of Felt Reservoir was restored by the removal of approximately 150,000 cubic yards of accumulated sediment, which was then placed as compacted fill on the areas surrounding the reservoir. Prior to this excavation, the reservoir's capacity was approximately 937 acre feet. The Felt Reservoir Capacity Restoration Project was permitted by the state, federal, and local agencies as part of the SHEP facility improvements in 2008 (Appendix A).

Stanford is required by the California Division of Safety of Dams to control rodent activity on the dam to preserve structural integrity. Rodent abatement takes place as needed, using County, State, and federally approved control methods. The reservoir and dam are annually cleaned to remove accumulated debris and function-impacting plant growth. The valves and pipes are subject to annual blow-off testing. Minor repairs to the dam structure are conducted as needed. It is anticipated that within the term of this HCP, sediment will have to be removed from Felt Reservoir again to retain the reservoir's operating capacity. Sediment removal in Felt Reservoir will occur in the dry season, when the water level is low (i.e., approximately 20 percent of reservoir's capacity of water is present), and areas requiring sediment removal are exposed. Backhoes and other heavy equipment will be used to remove and relocate sediment.

Lagunita (DWR #614-003; National ID# CA00671). Lagunita is an off-channel seasonal reservoir that was created in the late 1870s as a stock pond and water-holding facility for Leland Stanford's Palo Alto Stock Farm and vineyard. The earthen berm is 16 feet tall and 2,500 feet in length. It is located in the developed portion of the campus, just to the north of Junipero Serra Boulevard. The University's main campus borders Lagunita on three sides, and Junipero Serra Boulevard separates Lagunita from the lower foothills.

In most years, Lagunita partially fills with rainwater runoff during the winter. The runoff amount varies widely with the amount and intensity of rainfall. The Lagunita lakebed and berm are permeable (losing an estimated 500 gallons a minute to percolation), and in order for Lagunita to hold water for more than a few weeks at a time, and provide suitable California tiger salamander breeding habitat, water needs to be added. Historically, in most years of above average winter rainfall, Stanford added water to Lagunita, usually between mid-March and mid-June. In those wet years that Stanford added supplemental water to Lagunita, the reservoir was filled to the desired water level by late March and water levels were typically maintained through University commencement (mid-June). Managed water levels have varied considerably over the last 100 years, depending on water availability in San Francisquito Creek, projected use of Lagunita, and functioning of the di-

version system and storage facility. In years that Lagunita is supplemented with creek water, the reservoir will typically retain water for approximately 1 month after the addition of water ceases and will be dry by late July. Even in years with exceptionally high rainfall, Lagunita dries by late spring or early summer without supplemental water, and in most years it would be dry by May without the addition of supplemental water. During years with below average rainfall (or during years when the timing of storms resulted in a lower than average creek flow), Lagunita is often dry in late January.

Stanford will continue to manage Lagunita water levels to support California tiger salamander reproduction. Specifically, Stanford will operate its water systems to maintain a depth of 3 to 5 feet at the drain during the period of tiger salamander early larval development (generally February to early May), if the monitoring surveys indicate that California tiger salamander breeding has occurred in Lagunita. Starting in mid-May, Stanford will manage the water levels at Lagunita in a manner that mimics natural conditions (e.g., water levels will be gradually reduced to mimic natural drying, with Lagunita becoming dry by the end of June to early July). The newly created ponds in the foothills will be used as one index of natural conditions. Stanford anticipates implementing the following operations plan to accomplish this:

1. During years where rains have allowed the accumulated storm water runoff in Lagunita of 3 feet on the staff plate, elevation 122' above Mean Sea Level (MSL) on January 15, Stanford will operate the Lagunita diversion at San Francisquito Creek, or otherwise convey water (i.e., well water or reclaimed water, but Stanford will not use treated domestic, potable water for this use) to Lagunita, at a rate adequate to maintain the water level in Lagunita at an elevation of 124 +/- 1 foot, which places the water surface near the toe of the berm on the northeast side. (Note that late season storm events may cause the reservoir level to temporarily rise above the managed level of 124 feet.) At the managed elevation of 124 feet, the water covers a surface area of approximately 16 acres, 8 acres of which are at a depth of 0 to 2 feet and another 8 acres are at a depth between 2 and 4 feet; a few hundred square feet near the drain will have a depth greater than 4 feet. In years where there is normal or above rain fall, the water level in Lagunita will generally stabilize at 126 foot above MSL. At this level the reservoir covers approximately 20 acres, of which 4 acres are 0 to 2 feet deep, 8 acres are 2 to 4 feet deep, and approximately 8 acres are more than 4 feet deep. The diversion of creek water to Lagunita will be implemented only if: 1) the Lagunita diversion facilities are safe and operational, 2) there is sufficient water available in San Francisquito Creek at the point of diversion and water diversions to Lagunita are not in significant conflict with other environmental considerations, 3) there are not overriding public safety and health concerns raised by governmental agencies associated with water in Lagunita, and 4) Lagunita is considered critically important to the local persistence of the California tiger salamander. The diversion of creek water to Lagunita will continue only as long as these conditions remain met, or until the following two conditions are triggered.
2. On April 1 of each year, the flow of San Francisquito Creek and status of California tiger salamanders in and around Lagunita will be assessed, and Stanford will exercise professional judgment whether to continue, reduce, or cease diversions to Lagunita. If California tiger salamanders are present and creek water is available (relative to the operating parameters of the diversion system and potentially competing environmental concerns), the diversion rate will not be reduced from what is necessary to maintain the 124+/-1-foot level unless it is deemed appropriate for California tiger salamander management. A constant inflow of relatively cool creek water can act to retard California tiger salamanders larval development. It is likely that in some years it will be desirable for the salamanders to lower the water level in mid-spring to 122 ft +/- 1 ft above MSL. This lower level would result in slightly warmer water in Lagunita, which would still cover approximately 8 acres with several feet of water. This controlled lowering mimics the drying of natural bodies of water occupied by California tiger salamanders. While not expected, overriding public safety and health concerns raised by governmental agencies associated with water in Lagunita could require the cessation of diversion.
3. In the late spring/early summer, Stanford will cease diversions from San Francisquito Creek to Lagunita, and the water level at Lagunita will be allowed to drop naturally through percolation, evaporation, and transpiration. The diversions may be extended if California tiger salamanders development is not sufficiently advanced, and there is adequate water in San Francisquito Creek.

The berm that surrounds Lagunita is maintained with a Bermuda grass cover that is irrigated, fertilized, and mowed so that it maintains a pleasant visual quality throughout the year. In addition, Stanford is required by the California Division of Safety of Dams to control ground squirrel activity on the berm to ensure structural integrity. Ground squirrel abatement takes place as needed using County-approved control methods such as trapping and poison baiting. In the early fall, when Lagunita is dry, the reservoir bottom is mowed for fire control. These activities are all annual maintenance necessities and are Covered Activities, except for the use of poison.

The drain system requires routine maintenance and periodic upgrades. The two drain structures and associated pipes occupy approximately 0.1 percent of Lagunita's surface area. Additionally, the earthen berm occasionally needs minor repair (filling of potholes and removal of dead trees). The berm may need some significant work during the life of the HCP. The amount of permanent land conversion associated with significant berm work would be mitigated in accordance with Section 4.4 of the HCP.

Several maintenance changes have occurred at Lagunita in the last decade in response to the increased concern over California tiger salamanders. Stanford stopped discing the lake bottom in the early fall for fire control because the discing could have adversely affected California tiger salamanders and garter snakes. Instead, Stanford began mowing the reservoir bottom, which has fewer effects on the tiger salamanders and garter snakes. In addition, as discussed in Section 3.6.2 below, two recreational uses of Lagunita were discontinued. Stanford recently modified its diversion facilities to improve their efficiency at various flow levels, which has assisted Stanford in ensuring the availability of water for Lagunita.

3.1.3.1 Potential Effects of Water Reservoirs on the Covered Species

Operation and maintenance of Felt Reservoir will not affect California tiger salamander or steelhead because they are not located at the Reservoir. If the HCP's Conservation Program is successful, the population of California red-legged frogs and garter snakes will increase, and their range will likewise increase and could expand to Felt Reservoir during the life of the HCP. If these species become present at Felt Reservoir, dredging of accumulated sediment with heavy equipment could adversely affect them. Western pond turtles are periodically found in Felt Reservoir. Sediment removal would not affect any turtles that were present because they would follow the water ponding and move away from the dry mud that would be removed. If garter snakes are foraging in the vegetation that grows as the water recedes, the operation of heavy equipment could result in take.

Given the rate of water withdrawal, size of the reservoir, and the screening of the pipe intakes, western pond turtles are not impinged on the water intake screen and could not enter the pipe system. The substantial changes in water level during the year, however, are likely not optimal for turtle growth and survival, and western pond turtles left at Felt Reservoir therefore have a poor chance of long-term survival.

Lagunita provides breeding habitat for California tiger salamanders and the surrounding areas, including the berm, serve as upland habitat. Stanford manages Lagunita primarily for the benefit of California tiger salamanders. The operation of Lagunita likely has few, if any, significant adverse effects on California tiger salamanders because the management regime was specifically designed to benefit California tiger salamanders. However, the routine maintenance of Lagunita could result in the direct take of a small number of California tiger salamanders, or indirect take through habitat modification. Virtually all maintenance activities occur during the dry season and invasive practices, such as drain replacement or repair, are very limited in their extent and time frame.

Garter snakes are also present at Lagunita and vicinity. Operation of the reservoir provides a significant benefit to the species, but mowing in and around Lagunita could adversely affect garter snakes. Since the mid-1990s mowing has been conducted during periods when most, if not all, salamanders and snakes are inactive (during the hottest part of the mid-afternoon) and the mowers are set to cut vegetation no closer than 8 inches from the ground. It is unclear whether the snakes do better, worse, or are indifferent to mowed versus unmowed vegetation.

Maintenance and operation of Lagunita do not affect western pond turtles, California red-legged frogs, or steelhead because none of these species inhabit the seasonal reservoir, and it does not provide suitable habitat for them. However, turtle species other than western pond turtles are occasionally released at Lagunita without Stanford's authorization. In spring 2008, for example, a red-eared slider was repeatedly seen in Lagunita. It is therefore possible that in the future a western pond turtle could be released, without Stanford's authorization, into the reservoir. Lagunita is a seasonally filled reservoir and therefore does not provide suitable habitat for western pond turtles, and any western pond turtle that is subject to an unauthorized release at Lagunita would therefore have a very poor chance of survival.

3.1.4 Distribution System

Underground pipes, water lines that span the creeks on the underside of bridges, and above-ground filters, valves, and pump stations are located in virtually all areas of Stanford University. These were constructed in order to meet the demands of the University and surrounding communities. Maintenance and the upgrading of these facilities occur on a regular basis. New utilities are commonly constructed, in response to changes in the University's needs and to comply with public safety codes. Maintenance of existing lines (mainly excavation and flushing of lines) and the construction of new lines are typically limited to 3- to 6-foot-wide utility corridors, and excavation work typically occurs only in the dry months. However, emergency repairs may be required any time of the year.

Some of the existing pipelines are located very close to the creeks, and there are a number of creek-spanning pipes. Utility work in areas adjacent to the creeks often requires Stanford to remove a substantial amount of vegetation, install coffer dams, temporarily direct the flow of water with a bypass pipe, and temporarily dewater a small portion of the creek. Riparian vegetation is replanted following construction, and erosion protection measures are installed as needed to prevent sediment from entering the creek.

Pipe repairs are performed as needed; however, despite its age, the pipe system is in good shape. Pipe replacements are also performed on an as-needed basis, and much of the system will need to be replaced over the next few decades. Pipe replacement work is performed during the summer low-flow periods, and work areas are contained to avoid/minimize impacts to the creek and its banks.

An in-line booster pump station is located on a pipeline approximately 2 miles downstream from Searsville Dam. The pump station boosts the water pressure, and also conveys water through a filter, in order to reduce sediments and silts before the water is delivered to customers downstream. The filters automatically operate a backwash cycle, which occurs frequently (i.e., daily, and sometimes hourly) during the pump station's operation, as the filters accumulate sediment. The backwash water is laden with the sediment from Searsville Reservoir, and is discharged to a perforated pipe within the bank above San Francisquito Creek. The presence, maintenance, and operation of the booster pump station and associated pipeline system from Searsville are not Covered Activities.

3.1.4.1 Potential Effects of the Maintenance and Installation of the Distribution System on the Covered Species

The presence of underground pipes, water lines that span the creeks on the underside of bridges, and above-ground filter, valves, and pump stations do not affect the Covered Species. However, the installation and maintenance of underground pipes and creek-spanning water lines could adversely affect the Covered Species.

The installation of new pipes and maintenance of existing pipes would be done during the dry season. Maintenance would be performed on an as-needed basis, and new pipes installed, on average, every 3 to 5 years. Ground disturbance associated with the maintenance of existing pipes and the installation of new pipes in the Lagunita area and foothills could harm or kill salamanders. If an occupied burrow were destroyed, it would likely harm or kill a California tiger salamander. Since maintenance and installation activities that require ground disturbance would be done during the dry season when California tiger salamanders are in their burrows, California tiger salamanders should not become trapped in temporary trenches.

Ground disturbing activities associated with the installation and maintenance of pipes in the Lagunita area, foothills, and near San Francisquito and Los Trancos creeks would temporarily disturb small amounts of garter snake habitat and could disturb individual snakes by frightening a snake away from the construction area.

Maintenance and installation of pipes near Matadero and Deer creeks could affect California red-legged frogs and garter snakes. Maintenance and installation of underground pipes would result in a temporary loss of habitat because vegetation removal and trenching would occur along the utility corridor, which is approximately 10 feet wide, and a trench would need to be dug. Such maintenance could occur once every 10 years. These activities could also result in frogs or snakes being disturbed and frightened. Minor changes in the creek bank or topography of the riparian areas would not have any long-term effects.

Maintenance and installation activities near Matadero and Deer creeks would not affect western pond turtles or steelhead because these species do not inhabit the creeks or adjacent riparian areas.

The maintenance and installation of pipes near San Francisquito Creek could affect California red-legged frogs, garter snakes, and western pond turtles. The maintenance and installation of underground pipes near San Francisquito Creek would result in a temporary loss of habitat for these species because vegetation removal and trenching would occur along the utility corridor, which is approximately 10 feet wide. Such maintenance could occur every 5 to 10 years. These trenching and vegetation removal activities could also frighten any individuals of these species that were in the vicinity of the work. California red-legged frogs, garter snakes, and western pond turtles are not present on Los Trancos Creek and would therefore not be affected by waterline maintenance and installation along that creek.

The maintenance and installation of water lines spanning San Francisquito and Los Trancos creeks (along the underside of bridges) generally would not affect the creek. Although these water lines are attached to the underside of bridges and are usually maintained from the bridge itself, it is possible that if major work in the future were required under the bridge, a coffer dam could be necessary, which would temporarily affect steelhead habitat and disturb individual steelhead. Use of a coffer dam for such work would likely occur one or two times in the life of the HCP. The installation and maintenance of pipes in the adjacent riparian areas would not adversely affect steelhead, and minor changes in the creek bank or topography of the riparian areas as a result of underground pipe maintenance and installation activities would not have any long-term effects.

3.1.5 Wells

Stanford maintains five groundwater wells. These wells primarily serve as a backup supply of potable water, but also are used to supplement the supply of irrigation water in the summer and fall. Well water is also occasionally used to maintain the water level in Lagunita. Operation and maintenance activities include mechanical and electrical work on the pumps, motors, valves, and control systems, as well as periodic refurbishment of the wells.

Due to the cost of operating the wells, Stanford minimizes the amount of time that they are in use. Stanford's wells are relatively deep (for the area), averaging 300 to 600 feet below the surface. Several thick clay layers, mostly laterally continuous and ranging from 20 to 80 feet thick, form aquitards above and between the coarse water-bearing units.

3.1.5.1 Potential Effects of the Wells on the Covered Species

All groundwater wells take water from at least 100 feet below the surface and they are not hydraulically connected to the creeks. They do not, therefore, affect the creek flow conditions and do not affect steelhead at all.

Maintenance activities at the surface portions of the wells could impact California tiger salamanders, garter snakes or western pond turtles. Such impacts would be confined to disturbing an individual of the Covered Species which might be hiding around the structure. The wells are located out of the current range of the California red-legged frog, and well maintenance will therefore not affect California red-legged frogs. Western pond turtles are only occasionally found in the area where the wells are located. California tiger salamanders and garter snakes are found in the general vicinity of the wells.

3.1.6 Non-operating Lagunita Diversion

The Lagunita diversion facility consists of a dam on San Francisquito Creek, a water-directing gate, and a flume that parallels the creek and extends to Lagunita. The existing facility was constructed in the late 1800s, but the CDFG installed a fish ladder on the structure in the mid-1950s, which has been modified several times since. The gate to the flume was closed in the 1980s following partial collapse of the flume, and the facility has not been used to divert water since 1985.

Maintenance activities on the dam and fish ladder consist of physical hand clearing of branches and debris from the ladder and occasional repairs of the ladder and the dam itself. Approximately 10 to 20 times per year during the rainy season, the ladder is cleared, usually after creek flows have subsided. Creek flow is usually not disturbed for this work; however, on average five times each year, the creek flow is deflected from the ladder, using a sheet of plywood, so that large debris can be removed from the ladder without water pressure behind it. This work is usually completed within an hour. On average once a decade, the creek flow is diverted using a coffer dam so that erosion under the dam can be repaired, the concrete repaired as necessary, and/or the ladder repaired.

3.1.6.1 Potential Effects of the Non-operating Lagunita Diversion

This diversion facility does not affect California tiger salamanders, garter snakes, western pond turtles or red-legged frogs because these species are not present at this site. California red-legged frogs have been reported in the vicinity of the structure, but none have been verified to be present in several decades. Western pond turtles have also historically been found in the area of the structure, but no western pond turtles have been observed at the structure for more than a decade.

Steelhead are found in the creek at the non-operating diversion structure, including the large pool downstream. Maintenance activities associated with the existing facility could have short-term adverse impacts on steelhead if a coffer dam were required to conduct maintenance of the structure or repair erosion downstream.

Dispersing steelhead routinely pass the structure. However, even with the fish ladder, the facility does not meet NOAA's current fish passage guidelines, and NOAA Fisheries believes that the presence of the in-stream facilities could impede steelhead recovery in the watershed. NOAA Fisheries has therefore asked Stanford to remove the barrier to improve juvenile and adult steelhead passage.

In 2006, Stanford studied potential steelhead passage improvements, and concluded that removing the existing fishway, concrete weir, and apron between the abutments and restoring the channel to a more natural configuration would best improve fish passage for adult and juvenile steelhead, and that this approach is preferred by fisheries agencies and environmental professionals. The estimated costs to design, permit, and perform the necessary construction to remove the facilities and restore the channel is $386,000 (in 2006 dollars). Stanford proposes to remove this facility to restore more natural adult and juvenile fish passage. Stanford will initiate the removal project within 3 years of NOAA Fisheries' approval of this HCP, and anticipates that it will take 2-4 years to prepare final plans; perform the necessary studies and environmental reviews; and secure the applicable federal, state, and local permits. The effects of removing the non-operating Lagunita Diversion are anticipated to be similar to the creek maintenance activities described in Section 3.2.1. If a coffer dam were used for removal of the non-operating diversion facility, the coffer dam and dewatering would temporarily affect steelhead habitat and disturb individual steelhead. The removal project is expected to provide long-term benefits to both upstream and downstream migrating steelhead by eliminating a long-standing fish passage impediment.

3.2 CREEK MAINTENANCE ACTIVITIES

Stanford conducts both routine and emergency creek maintenance work in and around all of the creeks on its property (including Deer, Matadero, Los Trancos, San Francisquito, Corte Madera, Bear, and Sausal). Routine maintenance consists of debris removal, including compliance with requests from the Santa Clara Valley Water District to remove downed trees and other debris from the creeks. This work is typically conducted during periods of low flow, but if an emergency arises, work in a creek can occur at any time of the year. Tree snags and other debris are removed only if they are disrupting the free flow of water or are causing undo erosion.

Debris removal and bank stabilization regularly occurs in the more urbanized areas of campus, such as areas near the Oak Creek Apartments and the Children's Health Council along San Francisquito Creek, near the Ladera Tennis Club along Los Trancos Creek, and near the Stanford Research Park along Matadero Creek.

Recent bank stabilization efforts at Stanford have involved sinking pillars into the existing bank, with little structural work done on the surface. In a number of locations, however, gabions, rip-rap, and concrete aprons are present. These older types of bank stabilization methods have a tendency to fail, and future repair work is therefore anticipated. During the life of the HCP, bank stabilization would only occur when needed. Stanford would conduct this bank stabilization using bioengineered structures and would not use gabions. Timing or need for bank stabilization is not known, but based on past experiences, Stanford anticipates constructing up to 10 bank stabilization structures during the life of the HCP, with each structure up to 200 feet in length, with no more than 50 percent of each structure consisting of hardscape materials such as rip-rap and concrete.

Stanford participates in an annual inter-agency maintenance effort that is coordinated by the San Francisquito Creek Joint Powers Authority (JPA) prior to the winter rainy season. The purpose of this effort is to remove obstructions that could cause flooding or bank erosion. An annual creek walk of San Francisquito Creek is organized by the JPA in September from the Oak Creek Apartments to El Camino Real during which the JPA, Santa Clara Valley Water District, Menlo Park, Palo Alto, and East Palo Alto survey conditions and agree on needed maintenance activities. Trash such as yard waste and other bulky items that are illegally dumped, large vegetation in the channel, fallen trees, and debris jams that extend into the center of the channel are identified during this annual creek maintenance walk. Any obstructions on sections of San Francisquito Creek that are maintained by Stanford are cut and collected using chainsaws and other hand tools, and removed from the creek channel by hand or by a truck-mounted crane where access is possible from the top of the bank. Fallen trees or other debris are usually removed during periods of low or no water flow. Fallen trees or debris jams that are too large to be removed by hand are occasionally encountered in the creeks. These require the use of large equipment and work crews. Due to accessibility, safety, and environmental concerns, heavy equipment remains at the top of the creek bank or on a side bench, if available, but are never used in an active channel. The heavy equipment is used to pull large pieces of debris out of the creek channel. In most reaches of Stanford's creeks fallen trees and other woody debris are left in place. However, fallen trees or other natural material are removed when there is a risk of flooding or at the request of a public safety agency.

In addition to Stanford's creek maintenance activities, public agencies with maintenance easements over Stanford's lands perform flood control and maintenance. Stanford does not have control over the public agencies' flood control activities, and these activities are therefore not included in the HCP.

San Francisquito Creek runs through the Stanford golf course, and creek-related activities associated with the golf course are described in Section 3.6.1, below.

Tributaries and drainage channels upstream from Searsville Reservoir on Stanford lands require annual maintenance in order to prevent flooding of adjacent roads and residential properties. These maintenance activities include periodic excavation of the existing channels, maintenance of constructed berms, vegetation removal, and bank stabilization.

During the life of the HCP, Stanford may restore the Corte Madera Creek channel and drainage areas upstream of Searsville Reservoir to prevent flooding of adjacent roads and properties. To address siltation that has caused Corte Madera Creek to become braided and result in upstream flooding, Stanford restored a 400-foot channel segment in 1997 through excavation of the primary old channel with heavy equipment, placement of boulders to stabilize the side of the channel, placement of excavated sediment as a berm alongside the channel, and placement of riparian plantings for bank stabilization. In the future, approximately once per decade, these maintenance activities may need to be redone and extended downstream to prevent upstream flooding. The work area is expected to be 2,000 feet long from the Stanford boundary to Searsville Reservoir and no more than 50 feet wide. The future activity would employ similar methods to those used in 1997 and described above. Placement of boulders would only be required in the first 400 feet of the creek, in the same location as the 1997 restoration. Any amount of permanent land conversion associated with this project would be mitigated in accordance with Section 4.4 of the HCP.

3.2.1 Potential Effects of the Creek Maintenance Activities on the Covered Species

Creek maintenance activities will not affect California tiger salamanders because the creeks at Stanford do not support this species. The hand removal of debris and fallen trees in areas deemed at risk of flooding can cause short-term impacts, but few long-term effects on western pond turtles, California red-legged frogs, garter snakes, and steelhead because very few of these species inhabit downstream reaches that would be affected by the removal. For example, the loss of large woody debris from the creeks may reduce channel complexity and the diversity of microhabitats that provide a positive benefit for steelhead. In the rare case where the use of heavy equipment is required, this could have a short-term effect on western pond turtles, California red-legged frogs, garter snakes, and steelhead. Again, as these activities are concentrated in the downstream, more urban portions of Stanford's creeks, impacts to the Covered Species will be limited to altering steelhead habitat and temporarily disturbing any steelhead in the vicinity of the work.

Bank stabilization efforts, even with comparatively little surface work, often require diverting a portion of the creek – via coffer dams and a bypass pipe. Such work has the potential to adversely affect steelhead through dewatering, fish relocation, and modification of the streambank. Bank stabilization work would frighten any individual western pond turtles, California red-legged frogs, or garter snakes that would be in the vicinity of the work. Tiger salamanders would not be affected by bank stabilization efforts because these areas are not occupied by California tiger salamanders. Further modification of the Corte Madera Creek channel would result in the loss of potential California red-legged frog, garter snake, and western pond turtle habitat.

3.3 FIELD ACADEMIC ACTIVITIES

3.3.1 Jasper Ridge Biological Preserve

Scientists have conducted research at the Jasper Ridge Biological Preserve continuously since 1891, long before it was formally designated a biological field station. This extensive research includes long term studies that are landmarks in ecology and population biology. Jasper Ridge Biological Preserve has a long policy of biological non-intervention, and the vast majority of work conducted at the Preserve does not involve the broad manipulation of natural resources.

Because many of its ecosystems are so well documented and understood, the Preserve provides unique opportunities for scholars to seek answers to questions involving long-term monitoring and observations that could not be performed elsewhere. In addition, the careful management of the Preserve's ecosystems, with a prohibition on large-scale manipulative studies, allows scientists to quantify changes observed in similar ecosystems that are subject to a range of human activities. In addition to facilitating first rate research, this highly accessible field station provides rich undergraduate and graduate educational experiences and plays an active role in educating the general public.

Jasper Ridge maintains a series of trails that facilitate research and teaching. These trails are packed dirt and generally no more than 5 feet wide. Monitoring facilities, such as weather stations, motion-detecting camera stations, and automated sound recording devices, are used throughout the Preserve, and require routine servicing, such as cleaning, vegetation trimming, etc.

The collection of biotic specimens and the sampling of water, soils, and rocks is frequently part of the teaching and research that occurs at Jasper Ridge. This collection is strictly controlled by Stanford.

Access to biologically sensitive parts of Jasper Ridge, particularly areas where individuals of the Covered Species may reside, is carefully controlled.

3.3.2 Creeks

Researchers at Stanford conduct field activities in the creeks on an annual basis. Much of the research involves monitoring California red-legged frogs, steelhead, and other native fishes that live in the creeks. These efforts also monitor the changes in abundance of non-native species such as bullfrog, mitten crab, and crayfish. Geology and engineering researchers also utilize the creeks on a regular basis to perform research and to support teaching. Like research at Jasper Ridge, research in the creeks is primarily observational and typically non-manipulative. Some collection of specimens, both physical and biotic, does occur.[4] Access to creeks is strictly controlled by Stanford, and is limited to trained researchers; introductory classes and large numbers of students are prohibited from the vast majority of creeks. Monitoring devices are occasionally placed in the creeks or in the riparian zone.

3.3.3 Foothills and Alluvial Plain

Faculty and students from many academic departments routinely use undeveloped portions of the Stanford foothills and alluvial plain.[5] The activities conducted by these academic groups range from field studies in geology, archaeology, and engineering, to more humanities-oriented exercises in photography and cinematography. The field studies generally do not involve manipulations of biotic variables or significant earth moving. Study test pits and trenches are, however, used annually in the geology, geophysics, and earth systems courses. These range from simple soil borings to hand excavation of a trench up to 10 feet by 2 feet that remain open for up to a week. There are a number of academic facilities situated in the relatively undeveloped portions of the Stanford foothills and alluvial plain, including student observatory, solar observatory, radio telescopes, independent research institutions, and several plant growth facilities. These facilities require ongoing maintenance and are frequently upgraded (and occasionally expanded). Rodent and vegetation control is conducted at the facilities. Buildings in the main campus are discussed in Section 3.5.5.

Some collection of specimens, both physical and biotic does occur. Access to the foothills for academic purposes is controlled by Stanford, and is limited to approved researchers and classes. The biotically sensitive portions of this area are held off-limits to general studies. Monitoring devices are occasionally placed in the foothills.

There are more than 60 prehistoric archaeological sites and a number of historic period archaeological sites on Stanford's lands. Prehistoric sites include prehistoric Ohlone-Costanoan villages, cemeteries, stone tool raw material quarries, bedrock milling stations and petrogylphs. Historic archaeological discoveries at Stanford include Mexican rancho sites, gold rush towns, American ranches, Japanese and Chinese labor camps, 1906 earthquake rubble dumps, and trash pits associated with early campus housing. Stanford employs a university archaeologist to oversee the protection of the cultural resources, and to facilitate research and teaching activities at these sites. Research focusing on these resources occasionally involves extensive digs and vegetation clearing. These digs are not located within the creeks, but several of the digs have been in locations adjacent to the creeks. Archaeological teaching and research activities are dictated by the size and composition of the archaeological resource. A large-scale archaeological dig might last up to 15 months and consist of a main pit 450 square feet by 6 feet deep, with smaller associated pits. It is roughly estimated that

Stanford could undertake up to five large-scale digs near the creeks during the life of the HCP. In addition, it is estimated that Stanford will conduct smaller investigations (e.g., a set of 10 pits, each 18 square feet, 3 feet deep) every few years. Pits are refilled at the end of the archaeological dig.

Additionally, researchers from the University engage in restoration biology throughout the lower foothills. In 2000, the University began funding this restoration work, and the goal is to find cost-effective ways to improve the existing non-native-species-dominated communities. This goal serves the University's desire to conserve its natural resources and the desire to improve the academic value of the lower foothills.

3.3.4 Lagunita

Lagunita is occasionally used by classes and researchers as an outdoor laboratory and study site. Generally, these academic activities are non-invasive and involve walking around Lagunita, making observations, taking water samples, and sometimes using small boats or rafts to collect information.

3.3.5 Potential Effects of the Field Academic Activities on the Covered Species

Academic activities could have direct and indirect effects on the Covered Species, but most of the impacts of Stanford's academic activities would be exceedingly minor and of short duration. Most of the academic activities that could cause take involve students or researchers walking through an area where the Covered Species were found. It is unlikely that an individual of a Covered Species would be stepped on or otherwise directly encountered during such activities. Individuals of the Covered Species found in the immediate vicinity of these academic activities could be disturbed by academic activities and alter their behavior. Additionally, if the number of person-visits to an area occupied by a Covered Species were too high, there could be some habitat degradation, or the behavior of Covered Species could be altered.

More invasive academic pursuits, including such tasks as archaeological digs, digging of geological test pits, and conducting

[4] This collection does not include Covered Species unless permits are obtained from the appropriate agencies.
[5] The main academic campus is located on an alluvial plain.

habitat restoration projects, also could have short-term adverse effects on the Covered Species, including short-term habitat degradation. Individuals could become trapped in open pits. Continuous visits (i.e., an on-going archaeological dig) could disturb individuals and/or cause Covered Species to leave the area. It should be noted that many of the research activities (e.g., water quality testing, soil characterizations, population studies) would result in information that provides substantial positive benefits to the Covered Species.

The maintenance of facilities, mainly dirt trails and monitoring stations, associated with field academic activities would have only a minor potential to impact Covered Species. As this work typically would occur during daylight hours and during the dry season, any potential impacts would be short-term and minor.

3.4 UTILITY INSTALLATION AND MAINTENANCE

A large number of above- and below-ground power, communication, steam, chilled water, water, sewer, and drainage (e.g., flow-filtering manholes and detention basins) utilities, and related facilities exist at Stanford.[6] There also is an extensive steam and chilled water system on the main campus. Storm drains are located throughout campus and drain into either San Francisquito Creek or Matadero Creek. A majority of these facilities are located in the main campus. However, essentially all parts of the campus are served, and hence crossed, by utility lines. In addition, existing utilities will have to be improved, and new utilities will be installed during the life of the HCP. Stanford may need to construct additional utility facilities and lines to fully utilize existing utility facilities. Other improvements also might be needed to accommodate new technologies. For ease of operation, and to reduce the potential environmental effects, most new utilities are installed in existing utility corridors.

Many of the existing utilities, including major domestic water supply facilities and power supply utilities, are located in areas that are occupied by the Covered Species. Domestic water system utilities also are located adjacent to, through, and under creeks. Maintenance of existing and new utilities, including utilities located in habitat areas, includes vegetation control around the utility lines and replacement of utilities and associated infrastructure such as power poles. Utilities located in undeveloped areas are generally accessed by designated access roads or by driving through open grasslands. Underground work is typically limited to a defined utility corridor. When work is done away from existing roads, the surface is usually replanted with a mix of native grasses and forbs (for maintenance considerations, shrubs and trees are not typically planted on top of or below utility lines).

[6] Some of the utilities such as PG&E and SFPUC facilities are not owned by Stanford. These facilities and the maintenance, repair, and other activities associated with these facilities may be covered under this HCP through Certificates of Inclusion, which are described in Chapter 6.

3.4.1 Potential Effects of Utilities on the Covered Species

Maintenance and improvements to existing infrastructure are typically confined to the existing footprint of the structure, and, as such, these activities usually have a minimal and temporary effect on the Covered Species. However, some of the maintenance actions, including ground disturbing activities, new utility installations, and utility line maintenance or replacement, and work in, under, or adjacent to creeks (e.g., pipeline repair, temporary use of coffer dams, etc.) can result in the take of Covered Species.

Ground disturbance associated with the maintenance or replacement of existing utilities could adversely affect tiger salamanders, red-legged frogs, and garter snakes. These species could become trapped in open trenches or holes if construction sites were not properly fenced or covered. Pond turtles and steelhead are much less likely to be impacted by ground disturbance activities.

The installation of new infrastructure also could adversely affect the Covered Species, and the magnitude and duration of the effects depend upon the type of infrastructure that was installed and the location of the new infrastructure. Installation activities near or across the creeks would have greater effects on the Covered Species located in the creeks, and could result in take; whereas, the installation of new utilities in the developed portions of the campus would likely not affect the Covered Species. The installation of new utilities in the foothills also could impact California tiger salamanders and garter snakes, but would not have an effect on the other Covered Species. The amount of any permanent land conversion associated with new infrastructure would be mitigated in accordance with Section 4.4 of the HCP.

3.5 GENERAL INFRASTRUCTURE

Urban infrastructure exists in areas that are occupied by or provide habitat for the Covered Species. This infrastructure includes private roads, unpaved service roads, private bridges, fences, detention basins, buildings, and private residences. Operation of the University, and much of the surrounding community, depends upon the operation of this infrastructure. Therefore, it is mandatory that these uses be maintained. Also, the addition of new structures at existing facilities or operational changes may be necessary.

3.5.1 Roads and Bridges

There is a broad network of Stanford-controlled roads that provide access to all of Stanford. These private roads range from paved four-lane roads in the main campus, to narrow dirt or gravel service roads in the undeveloped portions of the University.[7] These roads are maintained regularly, both for public safety and in an effort to reduce environmental impacts.

[7] Golf cart paths are not part of the Stanford roadway network, and are therefore included in the Golf Course Covered Activities.

The type and frequency of road maintenance depends upon the route; heavily traveled paved roads generally require more frequent maintenance than rural service roads. As part of Stanford's road maintenance activities, roads are occasionally rerouted. Resurfacing, vegetation control, and other similar maintenance activities are conducted during daylight hours, and during periods of no rain. Roads are occasionally re-aligned, most often in response to public safety concerns or in an effort to reduce environmental impacts.

New roads are occasionally required for public safety or as land uses change. New roads that were not associated with replacement and restoration of an existing road in a more sensitive location would result in a net loss of habitat. The amount of permanent land conversion associated with a new road would be mitigated in accordance with Section 4.4 of the HCP. In addition to Stanford's system of private roads, several public roads cross Stanford (e.g., Junipero Serra Boulevard, Sand Hill Road, and Stanford Avenue). Activities by Stanford on the public roads located on Stanford's lands are Covered Activities. Stanford sometimes encroaches into these roadways to maintain utilities or construct salamander tunnels, and these activities are covered by the HCP.

Several private bridges are included in the Stanford roadway system. These bridges are used by authorized University personnel, although several also are used by the public at the golf course and along Piers Lane. These are maintained and improved on an as-needed basis. Maintenance is generally restricted to resurfacing the structure or to trimming overhanging vegetation, but occasionally more significant structural work is required, including replacing spans or supports or the entire bridge. In some situations, a small portion of the creek, typically less than 200 feet, is temporarily contained in a pipe as the creek channel up and downstream of the bridge is spanned with coffer dams. Major bridge work is fairly infrequent, and it is expected that during the 50-year span of the HCP, coffer dams and bypass pipes will only be needed on three or four occasions. In addition, it is possible during the life of the HCP that Stanford would need to construct new bridges. It is anticipated that any new bridges would span the creeks, with no permanent structures within the creek channel, and that no more than six bridges over creeks where Covered Species are located would be constructed. Construction of new bridges could require temporary falsework in the creek, vegetation removal, and dewatering with coffer dams and bypass pipes.

3.5.1.1 Potential Effects of Roads and Bridges on the Covered Species

Roadway maintenance could disturb habitat for all Covered Species. Indirect take caused by reduced vegetation or minor maintenance-related runoff would also be very limited, and would consist of few individuals of the Covered Species relocating themselves away from inhospitable areas. Likewise, maintenance workers and equipment could temporarily disturb habitat.

Repair or maintenance of existing bridges or bridge construction could also adversely affect steelhead and California red-legged frogs in the creek. These activities could require the use of falsework and coffer dams, resulting in adverse affects to juvenile steelhead and red-legged frog tadpoles and metamorphs. If an area were de-watered, the relocation of these animals could result in mortalities and increased competition for resources at the relocation site. Maintenance workers and equipment on the creek bank may also disturb red-legged frogs, garter snakes, and western pond turtles.

No disturbance of California tiger salamanders is anticipated during bridge maintenance because tiger salamanders are not found near the creeks at Stanford. Many California tiger salamanders are killed by traffic on roads at Stanford. However, most of the mortalities occur on Junipero Serra Boulevard, a Santa Clara County road that traverses the campus near Lagunita.

3.5.2 Fences

Fences are widespread in the undeveloped portions of campus. Many of the fences are used to control public access, while others define leaseholds. The agricultural tenants also operate a series of fences. In addition, fences are a necessary component of conservation planning at Stanford and are used to protect valuable habitat.

Fences at Stanford are inspected and repaired on a continuous basis. Vandalism, fallen trees, auto accidents, and simple aging all take their toll on the fences. Fence repair work is usually quite simple. A work crew drives as close as possible to the damaged fence and repairs the fence by hand, though power augers are occasionally used for post-hole digging. In addition, Stanford commonly moves existing fences, removes unused fences, and installs new fences. In the case of new fences, shrubby vegetation is sometimes cleared from the fence route.

3.5.2.1 Potential Effects of Fences on the Covered Species

The installation and maintenance of fences at Stanford is a fairly low impact endeavor. It is possible that individual California tiger salamanders, California red-legged frogs, and garter snakes could be disturbed by replacing a fence post or by workcrews accessing the site. The fences do not act as barriers to migration of Covered Species.

3.5.3 Detention Basins

Stanford recently constructed stormwater detention basins within the central campus to intercept increased runoff that may be caused by future campus development. The basins are earthen (unlined), and include subdrains and pipe systems to convey accumulated runoff to the regional storm drain system. The currently existing detention basins in the San Francisquito Creek watershed are just over 1 acre in size and located along Sand Hill Road near Stock Farm Road. Additional detention facilities (basins and/or buried pipe systems) are planned along Sand Hill Road, both north and south of the existing basins, for future development in the west region of campus. The detention basins located in the Matadero Creek watershed are approximately 3 acres in size and are located along El Camino Real near Serra Street. This detention system is designed to accommodate 100-year storm events (i.e., storms of a sufficient magnitude that they have no more than a 1 percent chance of occurring in any given year). The new detention basins will detain the increased runoff and keep it from entering San Francisquito Creek or Matadero Creek until well after the peak creek flow has receded. In the event of a 100-year storm, the basins are designed to drain within approximately 2 days (48 hours). During storm events of lesser magnitude, the basins would hold water for a shorter period of time. The purpose of the basins is to reduce peak flows by detaining a portion of the runoff for a short period of time. The basins do not provide long-term water storage.

3.5.3.1 Potential Effects of the Detention Basins on the Covered Species

While detention basins are temporarily collecting storm water, individual California tiger salamanders may be attracted to them and interrupt their migration to suitable breeding locations. However, while the basins located near Sand Hill Road are within migration distance of the California tiger salamanders, there are significant barriers located between Lagunita and the basins and CTS surveys have not found them in the basins. While California tiger salamanders are not expected to be present, there is a remote possibility that an individual could be found at the detention basin as the population expands. There are no garter snakes, red-legged frogs, or western pond turtles at the detention basins.

3.5.4 Isolated Private Residences

There are a number of modest private residences near Los Trancos Creek and San Francisquito Creek. These residences are not part of defined residential neighborhoods, and are generally associated with the agricultural and equestrian uses (one exception is a residence that houses University personnel involved in the operation of rural University facilities and lands). These houses and their associated yards are subject to normal residential activities including building maintenance, repair and modification, vehicle storage, etc.

3.5.4.1 Potential Effects of Isolated Private Residences on the Covered Species

The limited number of these isolated residences and their location away from the most biologically sensitive areas makes it unlikely that they have an effect on the Covered Species. However, maintenance and ongoing use of residences could result in limited take of California red-legged frogs, western pond turtles, and California tiger salamanders. Such take would likely be in the form of an individual of a Covered Species straying from appropriate habitat into an area of human activity, and subsequently being harmed or trapped. Garter snakes have not been recorded from near the isolated private residences, but it is plausible that a garter snake could enter into a developed area.

3.5.5 Academic Buildings

Stanford's central campus includes approximately 13 million square feet of academic, academic support and housing structures, including student residences, libraries, laboratories, and lecture halls. The central campus also includes faculty/staff housing. These buildings and their associated landscaping are continuously maintained, frequently modified, and occasionally demolished. New buildings are constantly being constructed, and are discussed under "Future Development." Academic buildings located out of the main campus were discussed under "Academic Activities."

3.5.5.1 Potential Effects of Academic Building Maintenance on the Covered Species

Covered Species that enter into the built portions of campus will likely die, due to the number of hazards in the urban environment. Maintenance and modification of these buildings could potentially harm a Covered Species, particularly California tiger salamanders that are occasionally found near buildings adjacent to Lagunita. Additionally, garter snakes are occasionally observed in and around the buildings adjacent to

Lagunita. These snakes leave the area as soon as they are encountered by people.

3.6 RECREATION AND ATHLETICS

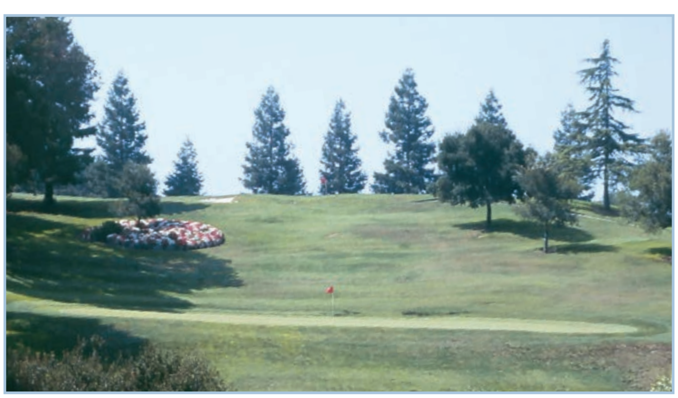
3.6.1 Stanford Golf Course, Practice Facility, and Driving Range

Stanford University operates an 18-hole golf course north and south of Junipero Serra Boulevard, to the southeast of Sand Hill and Alpine roads (Figure 3-2). There are no pooled water hazards associated with the course; however, San Francisquito Creek flows through the course. There are several cart bridges over the creek and a network of golf cart paths that allow players to access the course.

Golf course maintenance practices are focused on mowing and fertilizing the greens, fairways, and roughs; maintaining the paved golf cart paths; and, in areas that golf play crosses San Francisquito Creek, trimming riparian vegetation on a regular basis. Stanford utilizes an integrated pest management approach for golf course maintenance. Pesticides for weed and insect control are only used as a last resort and in accordance with all State and local pest control regulations. The Stanford golf course has been designated as a "Clean Bay Business" certified by the City of Palo Alto for hazardous materials handling and storage efforts. The pesticide use decreased approximately 75 percent since the mid-1990s. Pests are now spot-treated, as opposed to the previous method of broadcasting those treatments. The "roughs" have been naturalized to provide understory vegetation for wildlife. Pesticide use will continue to be used in this way, but pesticide use is not a Covered Activity

There is also an approximately 25-acre golf practice facility located adjacent to the main golf course and Sand Hill Road. This facility is operated and managed in a manner similar to the main golf course.

In addition to the 18-hole course, there is a driving range on approximately 13 acres of modified grassland next to Lagunita on its northwest side. The driving range has its own parking lot, service building, strip of tee boxes, putting green, and chipping mound at the northwest end. The range also includes lighting to allow nighttime operation, target greens, and distance markers. Operating hours are from 8:30 a.m. to 10:00 p.m. on weekdays and from 7:00 a.m. to 10:00 p.m. on weekends. The range closes early on rainy nights.



Driving range balls are collected from noon to closing, depending upon the need. Ball collection is done mechanically using a tractor-driven collecting device. A fence is located at the south end of the range to keep balls on the irrigated part of the turf, which makes ball collection easier.

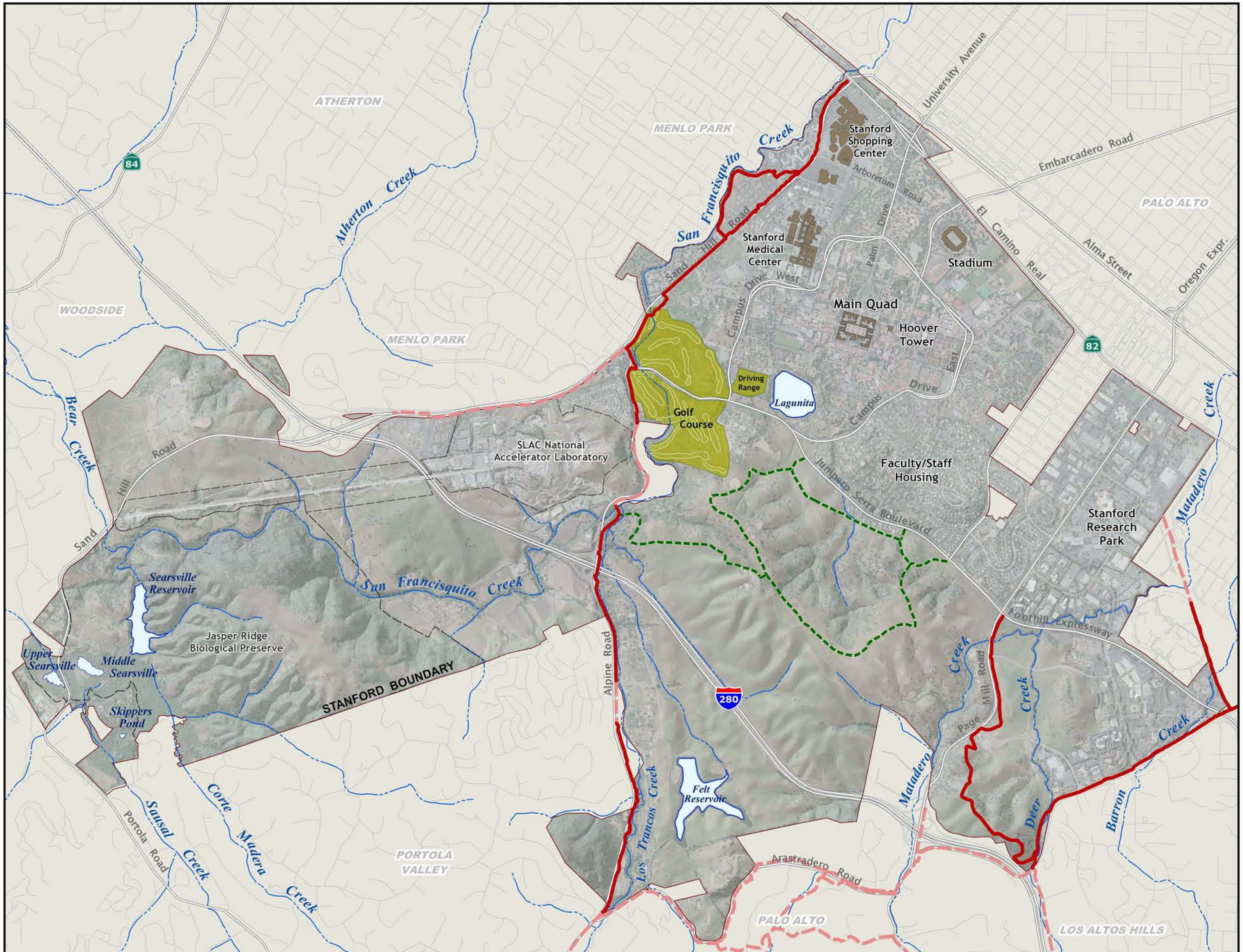
The golf course, practice facility, and driving range are periodically redesigned. These changes typically involve moving tees or green locations. These moves are located within the existing footprint of the highly modified landscape.

3.6.1.1 Potential Effects of the Golf Course, Practice Facility, and Driving Range on the Covered Species

Operation and management of the golf course, practice facility, and driving range may adversely affect California tiger salamanders and garter snakes. California tiger salamanders and garter snakes do not utilize the fairway and green portions of the golf course, practice facility, or the driving range for upland habitat, because it is manicured lawn and burrows are not present. California tiger salamanders and garter snakes will traverse the open areas, the fairways, and the greens, but they seem to avoid them as exceedingly few California tiger salamanders and no garter snakes have been observed in such areas during the last 15 years of monitoring at Stanford. Undeveloped portions of the golf course and driving range that are not surrounded by manicured fairways are occupied by California tiger salamanders and garter snakes. California tiger salamanders and garter snakes could also be impacted through mowing of turf, fairways, and greens, and the maintenance of vegetation in the areas adjacent to fairways and greens.

Ball retrieval at the driving range during rainy nights has the potential to harm or kill California tiger salamanders and garter snakes. However, the driving range typically closes on rainy nights due to lack of use and the balls are generally not retrieved during the rain.

The operation and maintenance of the Stanford golf course, practice facility, and driving range may affect western pond turtles and steelhead, through mowing turf, fairways, and greens; maintaining vegetation in the areas immediately adjacent to fairways and greens; maintaining cart bridges; and trimming riparian vegetation where the course plays across the creek. This trimming could disturb steelhead and western pond turtles, and result in the loss of habitat. The reduction in riparian vegetation at the golf course likely does not cause a significant or long-lived increase in water temperature in San Francisquito



Stanford University Habitat Conservation Plan

Recreational Uses

Sources:
Public Trails:
Santa Clara Co. Trails Master Plan Update, Nov. 14, 1995
San Mateo Co. Trails Plan, Draft Program EIR, Oct. 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles
0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 3-2

Creek. California red-legged frogs have not been observed at the golf course or areas downstream for several decades.

Maintenance of the cart bridges could affect the western pond turtles, garter snakes, and steelhead, particularly if major work were required. While even major work is typically conducted outside of the creek banks (using cranes), it is possible that under some circumstances the creek would need to be diverted around the repair site using coffer dams and by-pass pipes. Such extensive work would affect steelhead and possibly western pond turtles and garter snakes.

3.6.2 Lagunita and Felt Reservoir-Related Recreation

Since 2001, Stanford has not used Lagunita for scheduled recreational purposes. In the past, however, numerous community and University activities occurred at Lagunita. During non-drought years, the Stanford Windsurfing Club used Lagunita for windsurfing courses. To support this activity, the Windsurfing Club would bring in storage containers that contained sail boards and small boats. Students could use the sailboards and boats on their own or take lessons throughout the spring quarter during the hours of 9 a.m. to 6 p.m. To facilitate recreational activities, emergent aquatic vegetation was mechanically cleared from part of Lagunita during the late spring and several tons of sand was imported to create a swimming beach. During those periods of formal recreational use, Lagunita was monitored by Stanford for several health-related parameters (Coliform bacteria levels, etc.). Despite the regular outbreaks of "swimmer's itch", a generally harmless condition caused by a trematode parasite, Lagunita was a very popular recreational facility.

Formerly, Lagunita was the site of the annual Big Game Bonfire and a mud volleyball fund-raising event. These two popular, traditional events probably had an adverse effect on the California tiger salamanders at Lagunita and were therefore cancelled in the early 1990s.

A partially developed trail system encircles Lagunita. This trail is open and receives heavy public use, including many dogs.

Felt Reservoir is used on a regular basis for equestrian uses and sailing courses. Felt Reservoir is located in an area that is subject to an equestrian lease; however, the reservoir is not open to the public.

3.6.2.1 Potential Effects of Reservoir-Related Recreation on the Covered Species

Currently, of the Covered Species, only western pond turtles are occasionally found at Felt Reservoir. However, California red-legged frogs and garter snakes could be found at the reservoir in the future. Sailing courses could result in short-term avoidance behavior by these species. Equestrian uses also could result in short-term avoidance behavior but horses could kill or injure adult and juvenile individuals of these Covered Species if they did not move off an equestrian trail adjacent to the reservoir.

The past use of Lagunita for recreational purposes may have adversely affected California tiger salamanders and garter snakes. However, historically the recreational uses prompted the University to fill Lagunita, and likely facilitated California tiger salamander and garter snake breeding at Lagunita and persistence at Stanford. People using the trail around Lagunita may disturb California tiger salamanders and garter snakes. However, it is unlikely that the trail is used on rainy nights when California tiger salamanders are generally migrating.

3.6.3 Recreational Routes

The Santa Clara County Countywide Trails Master Plan identifies several trails through Stanford, and several public trails currently exist (Figure 3-2). The Los Trancos Creek and Adobe Creek trails have been in place for several years, and a portion of the San Francisquito Creek trail was included in the streamside open space plan approved by the City of Palo Alto. Stanford's 2000 General Use Permit requires implementation of the Santa Clara Countywide Trails Master Plan though the construction, operation, and dedication of two trails that are located roughly along San Francisquito/Los Trancos creeks and Matadero Creek.

Stanford also maintains recreational routes in the "Dish" area of the foothills between Junipero Serra Boulevard and I-280. Recreational use to the area began in the mid-1980s, and Stanford posted a clear set of rules and regulations governing the uses of the trail. Prior to 2000, Stanford did not have the resources to enforce the rules and regulation. As a result more than 13 miles of unauthorized footpaths and an array of structures were built (e.g., tree houses, labyrinths, fire rings, and tunnels). There was 24-hour-a-day access, and numerous dogs were not contained on leashes. In 2000, Stanford initiated a foothills management program, and now pedestrian traffic is only allowed on designated trails. Non-designated trails have been closed off and are being restored, dogs are no longer permitted, and there are frequent security patrols. These measures will reduce human impacts on the flora and fauna of the foothills. The recreational routes are part of the University's paved service roads. Maintenance of these roads and potential impacts on Covered Species are discussed in Section 3.5.1.

3.6.3.1 Potential Effects of Recreational Routes on the Covered Species

Recreational use of the foothills by pedestrians is now regulated by the University, and members of the public rarely stray from designated paths and are not allowed on-site after dark. Dogs are not allowed in the Dish area of the foothills. Use and maintenance of these recreational routes could disturb California tiger salamanders and garter snakes.

Recreational use of future trails associated with the 2000 General Use Permit along San Francisquito, Los Trancos, and Matadero creeks could affect California red-legged frogs, steelhead, garter snakes, and western pond turtles by bringing humans in proximity to the creeks, but use of the trails will be subject to rules and regulations prohibiting entry into the creeks and unauthorized disturbance of riparian vegetation. In addition, the improvement, operation, and ongoing maintenance of the existing trails could affect these Covered Species through bank stabilization activities.

3.7 GROUNDS AND VEGETATION

3.7.1 Fire Control and Public Safety

Stanford engages in several fire control and public safety activities, including the maintenance of fire breaks and vegetation control. Various techniques are used to control weeds so that they do not become fire hazards in the summer and fall months. The primary techniques are flail mowing, discing, and herbicides. Flail mowing is used for weed suppression in open fields with tall grasses. The mower is attached to a tractor and can cut grass down to ground level. Flail mowing of approximately 70 acres is typically done one to three times during the summer in open space areas. Discing and mowing are used to create fire breaks in grassland areas. Discing is typically used along roads and pathways in the foothills and along Junipero Serra Boulevard. The amount of discing that is typically conducted in sensitive California tiger salamanders areas south of Junipero Serra Boulevard is estimated to be 4,500 feet by 20 feet wide, or a total of about 2 acres.

3.7.1.1 Potential Effects of Fire Control Activities on the Covered Species

All of the vegetation control methods used for fire control can result in adverse effects to California tiger salamanders, garter snakes, or California red-legged frogs. Mowing is currently used to manage vegetation and improve areas for California tiger salamanders. Discing during the dry season is unlikely to adversely affect Covered Species, because the depth of the discing is fairly shallow (approximately 6 inches) and the rodent burrows supporting California tiger salamanders (and possibly California red-legged frogs) tend to be much deeper. Discing could harm any garter snakes present on the surface.

Herbicides could affect the Covered Species by either directly entering occupied burrows or through runoff into the creeks. However, herbicides are generally used as a last resort and on a spot-treatment basis, reducing the likelihood of contaminated runoff or ground saturation. Herbicide use is not a Covered Activity.

3.7.2 Grounds Maintenance

The Stanford Grounds Department maintains the landscaping throughout the campus, including planting and pest control (i.e., weeds and animal pests). The following is the list of activities that Stanford carries out that could affect the Covered Species.

General Maintenance. The Stanford Grounds Department manages formal landscaped areas, including lawns, planters, and road medians. These areas are re-planted, trimmed, irrigated, fertilized, and mowed as needed. Maintenance activities also require substantial infrastructure, including irrigation boxes (e.g., housing valves, timers, etc.). Herbicides are typically used only in the formal landscaped areas and along roads for weed control.

Animal Pest Control. In some locations on campus, burrowing mammals, including ground squirrels, gophers, and moles, need to be controlled for safety reasons and because they destroy the landscaping. Underground poison bait stations and traps are used to control ground squirrels. The bait stations are placed near parking areas and in open fields. Moles and gophers are controlled using traps and poison bait placed in their tunnels. Rats and mice also are controlled via various methods throughout the developed part of campus. Pesticide use is not a Covered Activity, although the other animal pest control methods are Covered Activities.

Temporary Stockpiling/Staging. Stanford periodically has a need for temporary stockpiling of dirt, compost materials, or construction materials on its lands.

Weed Control. Various techniques are used to control weed growth throughout the campus, including mulch cover (wood chips), flail mowing, discing, and herbicides. Wood chips from oak, eucalyptus, and other hardwood trees, are placed along pathways and roads, and around trees and buildings to suppress weed growth, retain water, and suppress fire, and flail mowing is used for weed suppression in open fields with tall grasses. The discing of broad areas was commonly used to control weeds until the early 1990s, but was discontinued in most of the environmentally sensitive areas in favor of the more environmentally sound mowing.

3.7.2.1 Potential Effects of Grounds Maintenance Activities on the Covered Species

Grounds maintenance and vegetation control activities at Stanford have been modified as a result of the implementation of the California Tiger Salamander Management Agreement in June 1998 to avoid and/or minimize the potential effects of the above described activities on California tiger salamanders. Under most circumstances, activities conducted by the Grounds Department would not result in direct take of the Covered Species.

General Maintenance. Since these activities occur primarily in the built portion of campus or in association with a facility, they would not have direct effects on California red-legged frogs, western pond turtles, or steelhead. However, stray California tiger salamanders and garter snakes are found scattered throughout campus and garter snakes and California tiger salamanders could get trapped in irrigation boxes, and landscaping activities could harm individuals.

Animal Pest Control. Control of burrowing mammals can indirectly affect California tiger salamanders by reducing the number of burrows available. It also is possible that the indiscriminate use of rodenticides can cause toxins to enter the local food chain, and affect the Covered Species (primarily California tiger salamanders), and it is also possible that California tiger salamanders can be directly harmed by traps. These pest control efforts do not impact garter snakes, western pond turtles, or steelhead.

Temporary Stockpiling/Staging. The placement of stockpiled materials could affect the terrestrial Covered Species. Individuals of these Covered Species could take refuge in stockpiled materials, resulting in possible take when the materials were moved.

Weed Control. The use of wood chips is unlikely to affect the Covered Species. Mowing also is not likely to directly affect the Covered Species because the timing and location of mowing (open grasslands, daytime, and in dry weather) does not coincide with periods when any of the Covered Species would be present. Biocides would be used according to industry standards and applied by well-trained crews, and their use is not a Covered Activity.

3.8 AGRICULTURAL AND EQUESTRIAN LEASEHOLDS

3.8.1 Intensive Agriculture

Intensive agriculture has been conducted at Stanford for more than a century. Currently, seasonal crops, a vineyard, and a plant production/wholesale nursery are located on Stanford property (Figure 3-3). Stanford has historically played a limited role in the day-to-day operation of its agricultural lessees. Each lessee is responsible for the construction and maintenance of all roads, buildings, and other improvements on the leasehold.

Ranch/Farm. A farm with 260 acres of crops is located in San Mateo County, on the alluvial plain adjacent to San Francisquito Creek. The farm produces a wide variety of organic and non-organic seasonal crops, some of which are sold at an on-site, road-side market. The working ranch/farm requires a number of facilities (storage sheds, maintenance yards, worker housing, etc.), which are scattered throughout the leasehold.

Nursery. An approximately 50-acre nursery lease is located in Santa Clara County. This lease contains a plant growing facility and conducts wholesale selling of trees, shrubs, flowers, and ground cover. The lease is bordered on one side by Los Trancos Creek. As a nursery operation, the lessee is continuously replanting plants and trees into larger containers and storing them on site until sale. Potting materials are brought on-site from other facilities. The materials used are horse stables sweepings (pine chips and manure), redwood shavings, sand, and topsoil. The products are mixed on-site and put into the containers with the plant. Synthetic fertilizer is top-dressed in the containers at the time of planting. There are several buildings on-site that house the office and storage facilities. There also is an extensive irrigation system.

The animal waste and composting material used for planting are not generated on site. They are imported to the site on an as-needed basis. Stockpiled sweeping/compost piles are stored at several locations; one is located approximately 300 feet away from Los Trancos Creek. The piles that contain animal waste are covered and surrounded by a berm to prevent water runoff from entering the stockpile area.

Vineyard. In the late 1990s, an approximately 10-acre vineyard was planted on Stanford lands in San Mateo County, at the site of a former Christmas tree farm. This site abuts an extensive riparian forest associated with Sausal Creek and several unnamed seasonal tributaries.

3.8.1.1 Potential Effects of Agricultural Uses on the Covered Species

Under existing water quality regulations, run-off cannot impair water quality in the creeks. Intensive agricultural uses that are adjacent to or near creeks can result in waterway contamination from pesticides and fertilizers used during farming, and the erosion of loose soils could increase the amount of sedimentation in creeks. Additionally, it is probable that individuals of Covered Species, primarily red-legged frogs and western pond turtles, occasionally wander into areas of intensive agriculture and are subsequently harmed or killed.

Ranch/Farm. Existing water quality regulations prohibit run-off to the creeks that would adversely affect water quality.

Ground disturbing activities associated with normal farming activities could harm western pond turtle and California red-legged frogs that stray out of the riparian habitat and into farmed areas. California tiger salamanders and garter snakes have not been found in farmed areas, or in areas immediately adjacent to farmed areas.

Nursery. Existing water quality regulations prohibit run-off to the creeks that would adversely affect water quality and therefore do not adversely affect steelhead. California red-legged frogs could be killed or harmed if they dispersed into nursery operations. California tiger salamanders, garter snakes, and western pond turtles are not located near the nursery area and it does not provide potential habitat.

Vineyard. Covered Species have not been recorded from the immediate vicinity of the vineyard. It is therefore unlikely that operation of the vineyard would have a direct effect on the Covered Species. Existing water quality regulations prohibit run-off to the creeks that would adversely affect water quality.

3.8.2 Equestrian

Approximately 1,200 acres of Stanford's lands are leased or licensed for equestrian-related activities, including facility-intensive horse boarding and training, and less intensive open pasture and trails (Figure 3-3). A number of boarding and training facilities are situated adjacent to riparian areas known to support the Covered Species. Likewise, many of the access roads for the equestrian facilities are located adjacent to creek banks. Manure and other refuse is collected from the equestrian facilities on a regular basis, stored on-site in piles, and removed for disposal every few days. The refuse piles are covered during the rainy season and are located a minimum of 150 feet from the top of any creek bank.

Horse pastures at Stanford are typically fairly flat, although there are a number located on steep hillsides. Grazing intensity varies, but in many years grazing is insufficient and supplemental feed must be provided.

Pastured horses have limited direct access to Deer and Matadero creeks. Equestrian trails are located throughout the undeveloped portions of Stanford. Trails cross creeks via unimproved crossings only in one location in the San Francisquito watershed and at several locations in the Matadero/Deer watershed. These crossings tend to be sites where erosion and horse waste impact water quality. During the last decade, Stanford has eliminated several unimproved creek crossings by constructing a new bridge at Webb Ranch, replacing an existing but decrepit bridge at Glen Oaks, and realigning the horse trail at Webb Ranch and Jasper Ridge Biological Preserve away from the San Francisquito Creek bank.

Horse washing facilities are present in all of the equestrian operations. The horse washing facilities are located more than 150 feet from the top of any creek bank.

3.8.2.1 Potential Effects of Equestrian Uses on the Covered Species

Equestrian-related activities could adversely affect steelhead, California red-legged frogs and western pond turtles by contaminating water sources with animal waste. These impacts are particularly problematic in locations that have stables and paddocks adjacent to the top of creek banks, grazing on steep slopes, and horses that have direct access to creeks (in some pastures and where trails cross creeks). In addition, horses could trample Covered Species, especially in locations that the horses cross the creeks.

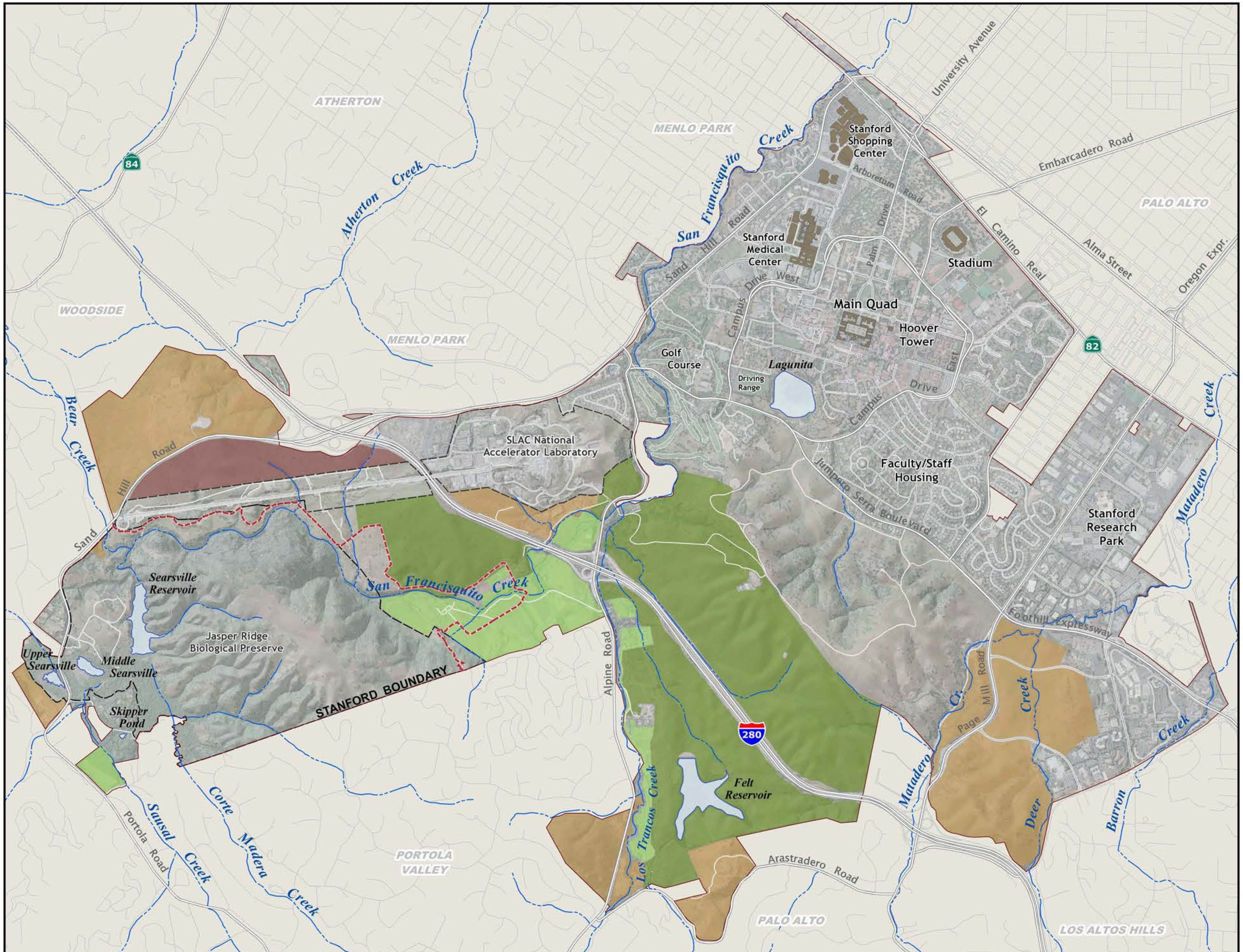
3.8.3 Grazing

Stanford maintains grazing leases on approximately 1,000 acres in the foothills (Figure 3-3). Grazing reduces the fuel load and is important for fire hazard reduction. Cattle in individual leaseholds typically free range over several hundred acres. Water troughs and salt licks are scattered throughout the cattle grazing areas and cattle have direct access to several of the minor seasonal creeks. Major creeks are fenced to prevent access by cattle.

3.8.3.1 Potential Effects of Grazing on the Covered Species

Managed grazing generally benefits grassland ecosystems. At Stanford, cattle have not grazed in most of the foothill areas that are occupied by California tiger salamanders and garter snakes since the mid-1980s. The foothill areas that are currently grazed are generally too far from Lagunita to provide upland habitat for California tiger salamanders that breed in Lagunita and garter snakes have not been observed in these areas. Some grazing activity is located adjacent to riparian areas and could result in impacts such as erosion of loose soils that could increase the amount of sedimentation in the creeks, or trampling of dispersing California red-legged frogs.

Stanford University Habitat Conservation Plan



Leaseholds: Agricultural & Equestrian

- Agriculture
- Equestrian
- Licensed equestrian trail
- Grazing
- Vacant

hectare

100

25

4

acres

Sources:
Leases: Stanford Management Co. & SU/PO, 2006
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1

Miles

N

Stanford University Planning Office
Date Printed: December 2011

Figure 3-3

3.9 COMMERCIAL AND INSTITUTIONAL LEASEHOLDS

3.9.1 SLAC National Accelerator Laboratory

The Stanford Linear Accelerator Center (SLAC) was founded in 1962 and the construction of the 2-mile-long accelerator was completed 4 years later in 1966 (Figure 3-4). A decade after SLAC was founded, the Stanford Synchrotron Radiation Laboratory (SSRL) was established as a National Users' Facility. Construction of the SSRL began in 1983 and was completed in 1989. SSRL became part of SLAC in 1992, and in 1994, the PEP II project was initiated, to build the Asymmetric B Factory. The facility was renamed the SLAC National Accelerator Laboratory in 2009.

SLAC is a national research laboratory, probing the structure of matter at the atomic scale, and at much smaller scales with electron and positron beams. The laboratory is operated by Stanford University under a contract from the United States Department of Energy (DOE) and the site is ground leased by Stanford to the DOE. As the property owner, Stanford would continue to perform some activities at the SLAC site, such as landscaping, grounds maintenance, and drainage management.

3.9.1.1 Potential Effects of SLAC Activities on the Covered Species

SLAC is a federal facility and federal activities at the SLAC site, including the modification or expansion of any SLAC facilities, are not covered by this HCP. However, outdoor activities carried out by Stanford at SLAC, such as landscaping, grounds maintenance, and drainage management, are covered by the HCP. Potential conflicts between federally listed species and new or ongoing uses at SLAC would be addressed through a "Section 7" consultation between the DOE and the Service. If the SLAC lease, or a portion of the leased property, reverts to Stanford during the life of this HCP, it will automatically be subject to the HCP, and any subsequent land uses and activities will be carried out in accordance with the terms of the Stanford HCP. The SLAC site is in a generally developed area. However, landscaping and similar outdoor maintenance activities could adversely affect individual California red-legged frogs, garter snakes, and western pond turtles that happen to enter the area from adjacent riparian areas.

3.9.2 Independent Research Institutions

A small number of sites located in the "Lathrop" district of the University, in Santa Clara County, south of Junipero Serra Boulevard, are leased to independent research institutions. These sites are within or adjacent to California tiger salamander upland habitat and include improvements typically associated with academic facilities: buildings, roads, paths, parking lots, lighting, etc. Although many of these sites incorporate non-irrigated native plant landscaping, they also include managed landscapes primarily intended for human uses, and include irrigated non-native plants, furnishings, paving, and recreational facilities.

3.9.2.1 Potential Effects of the Independent Research Institutions on the Covered Species

Maintenance and operation of independent research institutions located in the undeveloped portions of campus can result in the take of Covered Species. California tiger salamanders and garter snakes are more vulnerable to impacts from these institutions because they are located in areas that provide upland habitat for these two species. Maintenance of the facilities involves landscaping and utility work, both of which often involve earth moving and vegetation modification. Rodent control also is a necessary part of the management for these institutions, but is limited to the immediate proximity of the buildings. Digging, vegetation removal, and rodent control can take California tiger salamanders. Likewise, unless adequately fenced or covered, short-term trenches can act as traps for dispersing California tiger salamanders, and inappropriately placed structures can act as barriers.

3.9.3 Commercial Leases

There are many urban leases on Stanford lands, primarily in Palo Alto and Menlo Park (Figure 3-4). These leases include the Stanford Research Park, Stanford University Medical Center, Stanford Shopping Center, commercial housing, and other commercial uses. These leases are all located in developed urban areas.

3.9.3.1 Potential Effects of the Commercial Leases on the Covered Species

These leases are for fully developed properties. The ongoing use, maintenance, and re-development of these properties would not have direct effects on the Covered Species. However, stray California tiger salamanders, garter snakes, and California red-legged frogs are occasionally found scattered throughout campus and could be affected by urban activities at these fully developed properties.

3.10 FUTURE CAMPUS DEVELOPMENT

Under the HCP, the future development of Stanford land is a Covered Activity. Potential future development includes new academic, academic support, residential, athletic, and commercial facilities. As discussed in more detail below, the County of Santa Clara granted Stanford a General Use Permit (GUP) that allows Stanford to develop certain lands that are located in unincorporated Santa Clara County. Stanford does not have any specific plans to develop additional land that supports Covered Species, beyond the development permitted by the GUP.

However, the Covered Activities include additional future development that could occur during the life of the HCP. This additional development also will require discretionary permits from state and local agencies, which in turn could trigger compliance with state and local regulations, including environmental review under the California Environmental Quality Act (CEQA).

Future development in areas that are already developed, and which do not provide habitat for or support the Covered Species, would not have direct effects on the Covered Species. However, stray California tiger salamanders, garter snakes, and California red-legged frogs are occasionally found scattered throughout campus and could be harmed by future development even in the developed areas.

3.10.1 Development Associated with Santa Clara County 2000 GUP

The development permitted by the GUP is currently anticipated to be completed in approximately 10 years. Most of the development permitted by the GUP will be infill development. However, development could conceivably occur in areas that provide habitat for the Covered Species, primarily California tiger salamander and garter snake habitat. Under the GUP, Stanford could develop land that is occupied by the Covered Species or that provides potential habitat for the Covered Species. For the purposes of analysis, this HCP anticipates that development under the 2000 GUP could result in the removal of 30 acres of habitat.

The remainder of the allowed academic, academic support, and residential development allowed under the GUP will occur in already developed portions of the campus, which do not provide habitat for, or support, the Covered Species. This infill development generally would not adversely affect the Covered Species; however, stray California tiger salamanders, garter snakes and California red-legged frogs occasionally migrate into these developed areas. Therefore, future in-fill development in the central campus is a Covered Activity.

3.10.1.1 Potential Effects of Development under 2000 GUP on the Covered Species

All of the potential environmental impacts of the GUP were addressed in an Environmental Impact Report (EIR) certified by the County of Santa Clara in December 2000. The EIR contains a detailed analysis of the impacts of the GUP on various resources including biological resources. In summary, the EIR found that the academic and residential development permitted under the GUP would result in a minimal amount of take of California red-legged frogs and steelhead, primarily by way of habitat modification. The approved development would result in a loss of California tiger salamander habitat, as well as potential loss of individuals due to direct mortality or reduction of reproductive success (i.e., inability of adults to reach breeding sites, inability of juveniles to disperse to upland habitat).

The EIR imposed several Conditions of Approval to reduce the impacts on these Covered Species to less than significant. One of these Conditions recognized the potential future Stanford HCP, and this HCP will fulfill GUP Condition J.9 as soon as it is approved by the Service:

> *"Condition J.9. If the CTS is listed as threatened or endangered under the federal Endangered Species Act or any successor statute with the purpose of protecting endangered or threatened species, an appropriate permit will be obtained from the USFWS . The conditions of the GUP that address California tiger salamanders shall be superseded by any subsequent Habitat Conservation Plan (HCP) approved by the USFWS, so long as the HCP provides at least as much habitat value and protection for CTS as these Conditions of Approval." (page 24)*

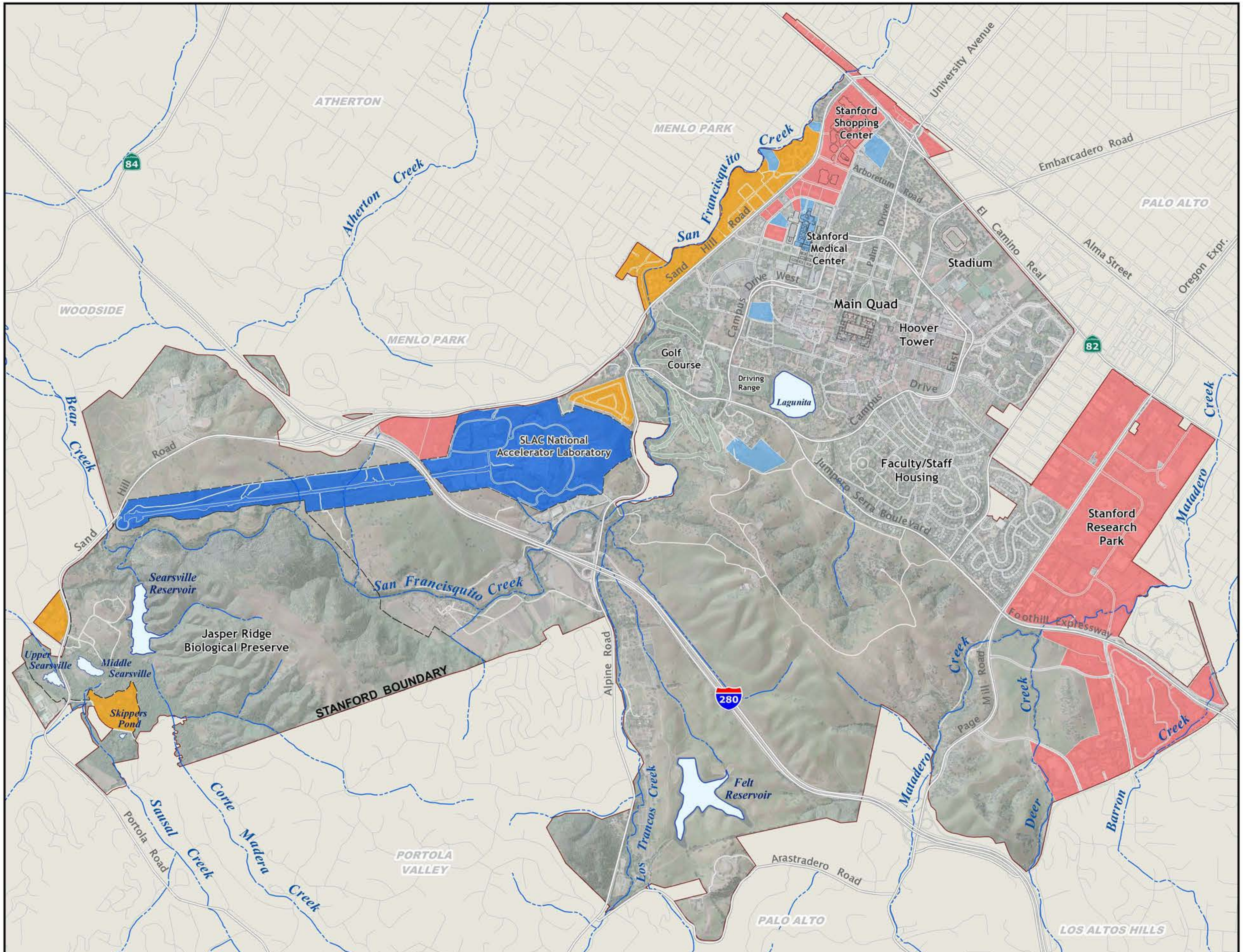
At the time of the HCP drafting, none of the academic or residential GUP projects with the potential to impact the California tiger salamander had been proposed or constructed. However, several conditions of approval had been fulfilled, including the construction of eight new breeding ponds south of Junipero Serra Boulevard (JSB) and three amphibian tunnels across JSB.

Future development was also addressed through the California Tiger Salamander Management Agreement, approved by the CDFG, the Service, and Santa Clara County in June 1998. This agreement was entered into before California tiger salamanders were protected under the ESA, and does not provide incidental take authorization. However, the Management Agreement provides conservation guidelines that have been incorporated into the HCP's Conservation Program (Section 4.0). The HCP will supersede the California Tiger Salamander Management Agreement.

3.10.2 Development Beyond the Santa Clara County 2000 GUP

The GUP will expire when development covered by the permit has been completed. Prior to its expiration, Stanford will determine its needs for housing, educational facilities, recreational facilities, etc., for the next planning horizon. Future development up to at least 2025 will be guided by Stanford's Community Plan and the existence of the Academic Growth Boundary that was established in 2000. The Academic Growth Boundary restricts virtually all academic growth in unincorporated Santa Clara County to the currently developed portions of campus (primarily north of Junipero Serra Boulevard).

The land use designation for San Mateo County lands are open space/institutional/future study area. The underlying zoning designation is RE/S11, residential estate. This zoning allows housing on a 1-5 acre minimum lot determined by slope. Higher density residential development, non-profit facilities, and farming may also be permitted with a conditional use permit.



Stanford University Habitat Conservation Plan

Leaseholds: Commercial & Institutional

Commercial

Institutional/ Professional

Residential

SLAC

hectare

100

25

4

acres

Sources:
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Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 3-4

Planning for the future development of Stanford's lands outside of Santa Clara County, and in Santa Clara County beyond the GUP, was estimated based on current planning principles of density and building efficiency. These assumptions present a reasonable forecast of future development during the 50-year life of the HCP; however, actual development could vary from these predictions. Specific future building projects have not been identified at this time, and the forecast is based on the distribution of potential building sites within currently undeveloped land.

In accordance with current planning principles of density and building efficiency, as well as economic and research uncertainties, the HCP forecasts that Stanford could develop 1-3 acres per year of land that provides habitat for, or is occupied by, the Covered Species. Development at this rate would result in a total development of 50-150 acres over the 50-year life of the HCP. This development likely would not occur in regular increments annually, but would more likely occur as a 30-acre project every decade, or a 15-acre project every 5 years, at a maximum.[8] It could also occur as small operational projects that result in permanent conversion of habitat.

3.10.2.1 Potential Effects of Future Development on the Covered Species

The future development beyond the GUP could remove approximately 50 to 150 acres of land that is either occupied by the Covered Species or that provides habitat for the Covered Species. This represents 2 percent to 4 percent of the Covered Species' habitat, and would not affect the persistence of any of the Covered Species. However, reducing the amount of available habitat could reduce the future maximum size of the species' populations. Construction activities could result in the take of Covered Species. Species that became trapped in a construction area could be killed or harmed by construction related equipment, and future development could result in new barriers to migration. This would result in the loss of individuals due to direct mortality or reduction of reproductive success if adults were unable to reach breeding sites or juveniles are unable to disperse to upland sites.

3.11 HABITAT MANAGEMENT, MONITORING, AND ENHANCEMENT

Chapter 4 of the HCP describes the Conservation Program that Stanford will adopt in order to contribute to the recovery of the Covered Species, and to minimize the effects of the Covered Activities and mitigate for the unavoidable adverse effects of the Covered Activities on the Covered Species. Under the Conservation Program, Stanford will actively manage, monitor, and enhance some of its land for the Covered Species and will undertake numerous activities to reduce the potential effects of the Covered Activities on the Covered Species. These management, monitoring, and enhancement activities include the preservation of areas that are important for the long-term survival and persistence of the Covered Species, surveys for Covered Species and invasive species, water quality monitoring, revegetation, vegetation management, erecting fences if needed to protect the Covered Species, construction of new wetlands suitable for California tiger salamander reproduction, and employing adaptive management to modify or introduce new management techniques. Many of these activities will occur in the most biologically sensitive areas, where the Covered Species are located.

Specific management and monitoring activities that could affect Covered Species include the activities described below.

Surveys. Surveys will be conducted for Covered and non-native species. Methods include day and night visual surveys, snorkeling, dip netting, trapping, and electrofishing.[9]

Pond construction. Pond construction includes grading activities to create the pond, planting of native materials and/or hydroseeding, and inoculating the new wetlands with appropriate species of aquatic invertebrates.

Creation of cover piles. This includes use of logs or rocks inserted into the ground. These attract ground squirrels and are useful in enhancing California tiger salamander upland habitat.

Modification of creek banks. A number of management and monitoring activities could affect the creek bank, including bank stabilization, erosion control, removal of barriers in the creek, restoration planting, and removal of non-native plants.

Relocation of "salvaged" individual Covered Species. The Conservation Program includes the relocation of individuals found in harm's way (e.g., in urbanized areas or in side pools or ponds that were isolated and/or drying prematurely) to safer locations within protected areas.

Control of non-native species. The Conservation Program includes ongoing surveys for non-native species, and the removal of non-native animal species will occur through hand capture, trapping, and electrofishing, as described in Section 4.3.1.2 San Francisquito/Los Trancos Easement Monitoring and Management Plan, Section 4.3.2.2 Matadero/Deer Easement Monitoring, Section 4.3.3.2 CTS Reserve Monitoring and Management Plan, and Section 4.6 HCP Monitoring Program. Control of non-native plant species includes mowing, hand removal, grazing, and the spot application of herbicide if hand removal is not effective or is not feasible because of the range of the infestation.

[8] Assuming a lower density campus development of 0.25 Ground Area Coverage and two-story buildings, 1-3 acres would support 20,000 to 60,000 gsf of academic development. Assuming a housing density of 4-5 single-family units per acre, 1-3 acres would support 4-15 housing units each year. Thus, during the life of the HCP, approximately 1,000,000 to 3,000,000 gsf of academic development, or 200-750 single-family housing units, or some combination of the two (e.g., 1,000,000 gsf of academic development and 400-500 housing units) could occur.

[9] Electrofishing is a NOAA-approved method of temporarily immobilizing steelhead for monitoring or relocation purposes.

3.11.1 Potential Effects of Habitat Management, Monitoring, and Enhancement on the Covered Species

The management, monitoring, and enhancement activities associated with the Conservation Program will benefit the Covered Species. Although the long-term effect of these activities will be beneficial to the Covered Species and their habitat, the activities could result in the incidental take of the Covered Species.

Surveys. Day and night visual surveys, and snorkeling, will not impact California tiger salamanders. Use of these methods does have the potential to temporarily alter the behavior of steelhead, California red-legged frogs, garter snakes, and western pond turtles, because these species typically attempt to avoid humans by either finding cover or by leaving the immediate vicinity of the person conducting the survey. These effects are minor and generally limited in duration to the brief periods during which the observer is surveying a particular area. Dip netting, trapping, and electrofishing each have the potential to impact the Covered Species. However, if employed with caution, the level of take associated with each of these techniques is minor. Dip netting has the least potential to cause take, but it should be expected that such activities will cause the take of several larval California tiger salamanders and California red-legged frogs, and small steelhead. Dip netting will not affect western pond turtles or garter snakes.

The proposed survey trapping for larval California tiger salamanders involves the use of aquatic minnow traps and is live trapping. No individuals of any species are released until positive identification is made. Trapping is very unlikely to affect California red-legged frogs or western pond turtles because they are not located at Lagunita or the foothills ponds. Garter snakes could become trapped in the shallow traps. Research at Stanford in the 1990s found that steelhead survive being temporarily trapped quite well. Larval California tiger salamanders may exhibit some cannibalism while being held in traps, and invertebrate predators that find their way into traps have been observed to eat amphibian larvae. Being held in a live trap does pose a risk of take, but the potential for take is minimized by frequent checking of the traps and discontinuing the use of the traps if predation or some other factor, such as water quality, becomes a problem.

Electrofishing will not affect California tiger salamanders, and it is very unlikely to affect western pond turtles. While electrofishing will not be used in areas where California red-legged frogs or garter snakes are expected, there is a slight chance that California red-legged frogs will be encountered. If California red-legged frogs or garter snakes are unexpectedly encountered, electrofishing will stop, and the effects on these species will be limited to the very short time period during and just after they are discovered. The effects of electrofishing on California red-legged frogs are generally limited to harassment, and should not result in the death of California red-legged frogs. Inadvertent electrofishing is not anticipated to result in the death of a garter snake. Electrofishing will take a small number of steelhead. Take is generally limited to harassment (e.g., stunning the fish), but can cause death. Take will be minimized by following the NOAA Fisheries' "Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act, June 2000."

The spread of pathogens is always a risk when field workers go from one site to the next, particularly in aquatic systems. However, there is very little risk of this problem at Stanford because the equipment (e.g., waders, nets, etc.) used to monitor the Covered Species at Stanford are only used at Stanford or in the immediate vicinity of the University (and all off-campus sites are within the same watersheds which occur at Stanford). Additionally, equipment used in aquatic surveys is typically washed and dried after each use.

Pond construction. The creation of new, off-channel, wetlands will not affect steelhead. Construction of such wetlands could potentially affect western pond turtles, garter snakes, or California red-legged frogs, but preconstruction surveys and project siting considerations will essentially eliminate the chance of take of these species. A limited amount of take of California tiger salamanders, however, is likely when ponds are constructed for California tiger salamanders because the location of the new ponds will likely be in areas that are already occupied by California tiger salamanders and in areas where burrowing rodents are present. With preconstruction surveys and hand excavation of extensive burrow systems, take of California tiger salamanders during future pond construction will be minimized, and on the order of one or two salamanders per new pond. If the new ponds are located at the edge of occupied uplands, then the estimated number of California tiger salamanders impacted by construction activities is further reduced, but these more peripheral ponds will likely take longer to be used by California tiger salamanders.

It is possible that the wetlands could have hydrologic features which cause the wetland to act as population sinks for the Covered Species. As part of the long-term adaptive management program this possibility will be evaluated on a case-by-case basis, and any pond found to have significant negative effects on California tiger salamanders will be modified or eliminated.

Creation of cover piles. Construction of cover piles will not affect steelhead or western pond turtles. Construction of cover piles in or near riparian zones could potentially affect California red-legged frogs and garter snakes, but cover piles would only be constructed in locations noticeably lacking in cover that are very unlikely to support either species. The construction of cover piles in California tiger salamander-occupied uplands could affect California tiger salamanders. Preconstruction surveys, hand-excavation of extensive rodent burrows, and flexibility in where to exactly site the cover piles

(they will be sited to avoid locations where construction would cause take) reduce the chance of take.

It is possible that the cover piles could attract predators, competitors, non-native species, or other biological elements that cause take of the Covered Species. As part of the long-term adaptive management program, this possibility will be evaluated on a case-by-case basis, and any cover pile found to have significant negative effects will be removed.

Modification of creek banks and channel. Work on the creek banks or channel will not affect California tiger salamanders, but could affect California red-legged frogs, garter snakes, western pond turtles, and steelhead.

Relocation of "salvaged" individual Covered Species. Relocating individual Covered Species presents a risk that an individual will be harmed or killed. However, the relocation of individual Covered Species is only contemplated if that individual is already at risk of being harmed or killed, and the amount of take associated with moving it is less than leaving it in the original risk-causing situation. California tiger salamanders are the most likely of the Covered Species to benefit from relocations as they frequently encounter human-built structures, including roads, during their rainy season migrations. Numbers of California tiger salamanders potentially handled during each year varies considerably (largely dependent on weather), and ranges from several hundred individuals to be moved off of roads, to a few individuals inadvertently trapped in utility boxes or drains. The release sites are chosen carefully. For example, in the 1990s, most utility box rescues occurred in the dry season, and the rescued California tiger salamanders were released in relatively damp areas or at the entrance of rodent burrows. While such dry season relocations do present risk, leaving the individual California tiger salamanders trapped in utility boxes is virtually guaranteed to result in death of the individual. Additionally, the relocation of individual California tiger salamanders should not affect California tiger salamanders that already inhabit the release area.

During the last decade of active conservation work at Stanford, no California red-legged frogs or western pond turtles were found in situations that required relocation. In the future, as the population of these Covered Species increases, they could require relocation. Care will be taken to minimize the potential for take by handling the species as little as possible and choosing the release site carefully.

A few steelhead, particularly small parr and smolts, become trapped in naturally rapidly drying portions of the creek or in areas around structures each year. Relocating these individuals to the nearest appropriate habitat can cause take, but the alternative is dying by desiccation or predation.

Control of non-native species. Trapping of non-native animal species can cause the inadvertent take of the Covered Species if they are present. Non-native animal species control will not affect California tiger salamanders, garter snakes, and western pond turtles. Steelhead and California red-legged frogs, particularly California red-legged frog tadpoles, may be harassed by non-native species control activities. The proposed trapping involves the use of aquatic minnow traps and is live trapping. No individuals of any species are disposed of until positive identification is made. Being held in a live trap does increase the risk of being eaten or injured by aquatic predators, but this is minimized by frequently checking the traps and discontinuing the use of the traps if predation becomes a problem.

Control of non-native plant species will not affect steelhead or western pond turtles. California red-legged frogs and garter snakes could be affected by the removal of non-native plants in the riparian zone. Such impacts will be short term and non-lethal. Dry season mowing will not affect any of the Covered Species, including California tiger salamanders. Discing has the potential to kill California tiger salamanders, but discing is only allowed in areas where the expected density of California tiger salamanders and garter snakes is very low.