FINAL REPORT

HABITAT ENHANCEMENT AND CONSERVATION PLANNING ALONG THE MADERA AND FRIANT-KERN CANALS TO ACHIEVE SUSTAINABILITY OF VERNAL POOL COMMUNITIES

PREPARED FOR THE U.S. BUREAU OF RECLAMATION
SOUTH-CENTRAL CALIFORNIA AREA OFFICE
1243 N STREET, FRESNO, CA 93721

Prepared by:
Foung Vang, Scott Phillips, Brian Cypher, and Patrick Kelly

California State University Stanislaus
Endangered Species Recovery Program
One University Circle
Turlock, California 95382

December 27, 2012

HABITAT ENHANCEMENT AND CONSERVATION PLANNING ALONG THE MADERA AND FRIANT-KERN CANALS TO ACHIEVE SUSTAINABILITY OF VERNAL POOL COMMUNITIES

Patrick Kelly, Foung Vang, Scott Phillips, and Brian Cypher

California State University Stanislaus
Endangered Species Recovery Program
One University Circle
Turlock, California 95382

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Vernal pools are seasonal bodies of water characterized by topographic depressions underlain by impermeable soils that provide habitat for a variety of specialized organisms—including plants, freshwater crustaceans and invertebrates, and amphibians—that are adapted to these particularly ephemeral conditions (U.S. Fish and Wildlife Service 1996, 2004, 2005; Erikson and Belk 1999). Habitats and species associated with Vernal pools are highly threatened by habitat loss, fragmentation, and degradation by urban development, agricultural conversion, altered hydrology, non-native invasive species, inadequate regulatory mechanisms, exclusion of grazing in areas where grazing has been a historic land use, and inappropriate grazing regimes (U.S. Fish and Wildlife Service 1996, 2005). Holland (1998, 2005) estimated that almost 75% of vernal pool habitats in the Central Valley had been lost by 1997 and up to 78% had been lost by 2005.

The Central Valley Project (CVP) Madera and Friant-Kern canals (Figure 1) pass though regions of vernal pool habitat in the eastern Central Valley in Madera and Fresno counties. Madera canal has extensive areas of vernal pool habitat along its length and Friant-Kern Canal has habitat along its northern stretch between Friant Dam and central Tulare County. Many of the ephemeral pools harbor vernal pool branchiopods (some species are protected), and some pools are known also to contain the threatened California tiger salamander (*Ambystoma californiense*).

The distribution of sensitive resources along a linear feature, such as a canal, provides particular challenges to responsible agencies and other stakeholders. Vernal pool communities are characteristic of particular types of grassland ecosystems, which by definition are typically expansive. By contrast, canal rights-of-way are typically narrow transects that may or may not have any habitat values. Further, by their very nature, canal rights-of-way are highly subject to edge effects of adjacent land use.

Beginning in 2004, the California State University-Stanislaus Endangered Species Recovery Program (ESRP) began studies of vernal pool habitats and associated species in partnership with the U.S. Bureau of Reclamation South-Central Area Office. These studies were initiated by the Bureau to fulfill obligations in the 1991 Friant Biological Opinion (USFWS 1991), 2000 Biological Opinion on the Implementation of the Central Valley Project Improvement Act (CVPIA), Continued Operation and Maintenance of the Central Valley Project (CVP), and the 2001 Friant Biological Opinion.

Starting in 2004, vernal pools and vernal pool habitats were surveyed along both the Friant-Kern Canal and Madera Canal to provide critical baseline information on status species and update their critical needs, thus providing information for management of endangered and threaten species found on Bureau of Reclamation (Reclamation) land. Starting in 2006, surveys were conducted targeting California tiger salamander (*Ambystoma californiense*, CTS), which resulted in finding new CTS breeding pools found along the canal rights of way. California tiger salamander continued to be the focus in 2007.

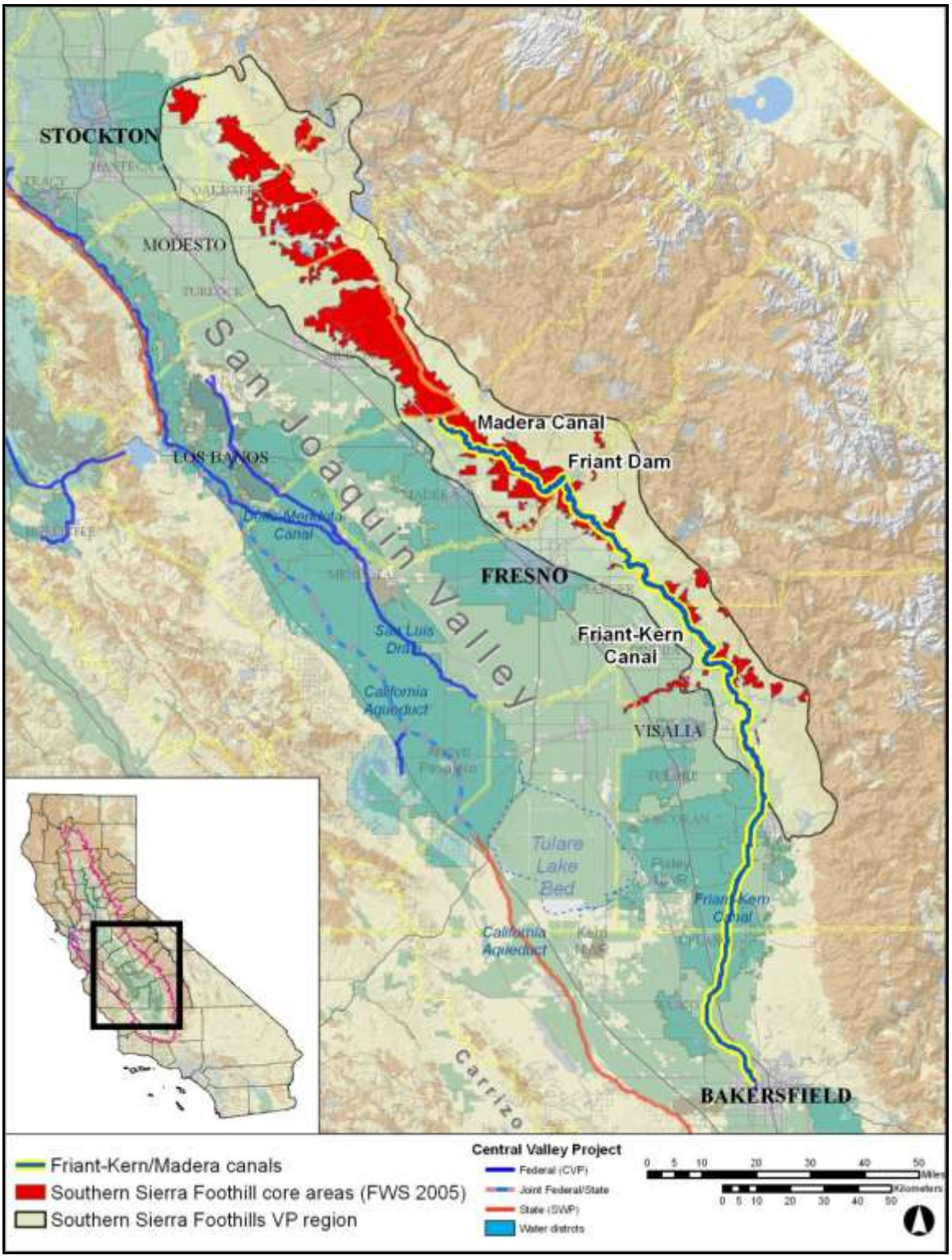

Figure 1. Friant-Kern and Madera canals in relation to the Southern Sierra Foothill vernal pool region and core areas identified in the Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005b).

Beginning in 2008, the primary focus was on California tiger salamander's usage of upland habitat along the canal rights of way and assessment of the canal habitat. The surveys in 2008 consisted of placing pitfalls and flashings adjacent to vernal pools, which had records of CTS, to capture any CTS that were using the canal rights-of-way to travel between vernal pools and their burrows. Lands along both canals, near these vernal pools, were also assessed for habitat integrity and suitability for CTS. In addition to field-based monitoring and habitat assessment, we used field-collected information and additional data sources to conduct a geographical analysis of habitat conditions for vernal pools and associated species on lands in the region of the Madera canal and northern Friant-Kern Canal. The results of these surveys and assessments will be discussed in this report.

STUDY AREA

The study area is located on sections of the Friant-Kern Canal and Madera Canal spanning both Madera County and Fresno County (Figure 1). The Madera Canal and northern section of the Friant-Kern Canal fall within the Southern Sierra Foothill vernal pool region (Keeler-Wolf et al. 1998) and Southern Sierra Foothill *core* areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005b, Figure 1, Figure 20).

PROJECT TASKS

The objectives of this project included direct monitoring of CTS and a field assessment of habitat conditions along the Friant-Kern and Madera canal rights of way; a geographical analysis of habitat conditions of the region using available data sources combined with right of way habitat assessments; and conservation planning and outreach to adjacent landowners willing to enhance habitat conditions (where appropriate) and with public agencies and other stakeholders to implement long-term conservation measures.

METHODS

FIELD MONITORING AND HABITAT ASSESSMENT

California Tiger Salamander Surveys

As part of a continuing effort to assess and monitor California tiger salamanders (CTS) along the canal rights of way, we conducted focused surveys for CTS along the Madera and Friant-Kern canals. Information on CTS presence and abundance was collected using pitfall arrays (Figure 2). Pitfall arrays were installed near 12 vernal pools (Figure 3, Table 1) where CTS larvae had been previously recorded. Six pools were located along the Madera Canal (Figure 4, Figure 5) and six were located along the Friant-Kern Canal (Figure 6). The pitfall arrays were installed on the canal right of way between the canal levee road and fence-line at least 3 meters from the nearest vernal pool.

Figure 2. Pitfall array with flashing in "Z" formation, buckets and stakes.

Pitfall arrays consisted of 4 plastic buckets that measured 10 inches deep with an opening diameter of 6 inches, which were buried at the end of each of the 3 metal flashings (120 inches long and 12 inches tall). Flashing was kept upright in a "Z" formation by burying 4 inches of it into the ground and with support of 6 12-inch wooden stakes (Figure 2). The flashing served to direct CTS into the pitfalls. Each pitfall contained a wet non-cellular (not impregnated with antibiotics) sponge to keep the CTS moist. A 2-inch gap between the pitfall bucket lid and bucket opening was created by placing the corners of 3 wooden, 2-by-12-inch stakes half way across the bucket opening, creating the gap through which salamanders would fall into the pitfall bucket.

During the CTS pitfall surveys from 2008 to 2010 there was a total of 5 researchers that participated and a total of 102 days used for opening, checking and closing the pitfall arrays.

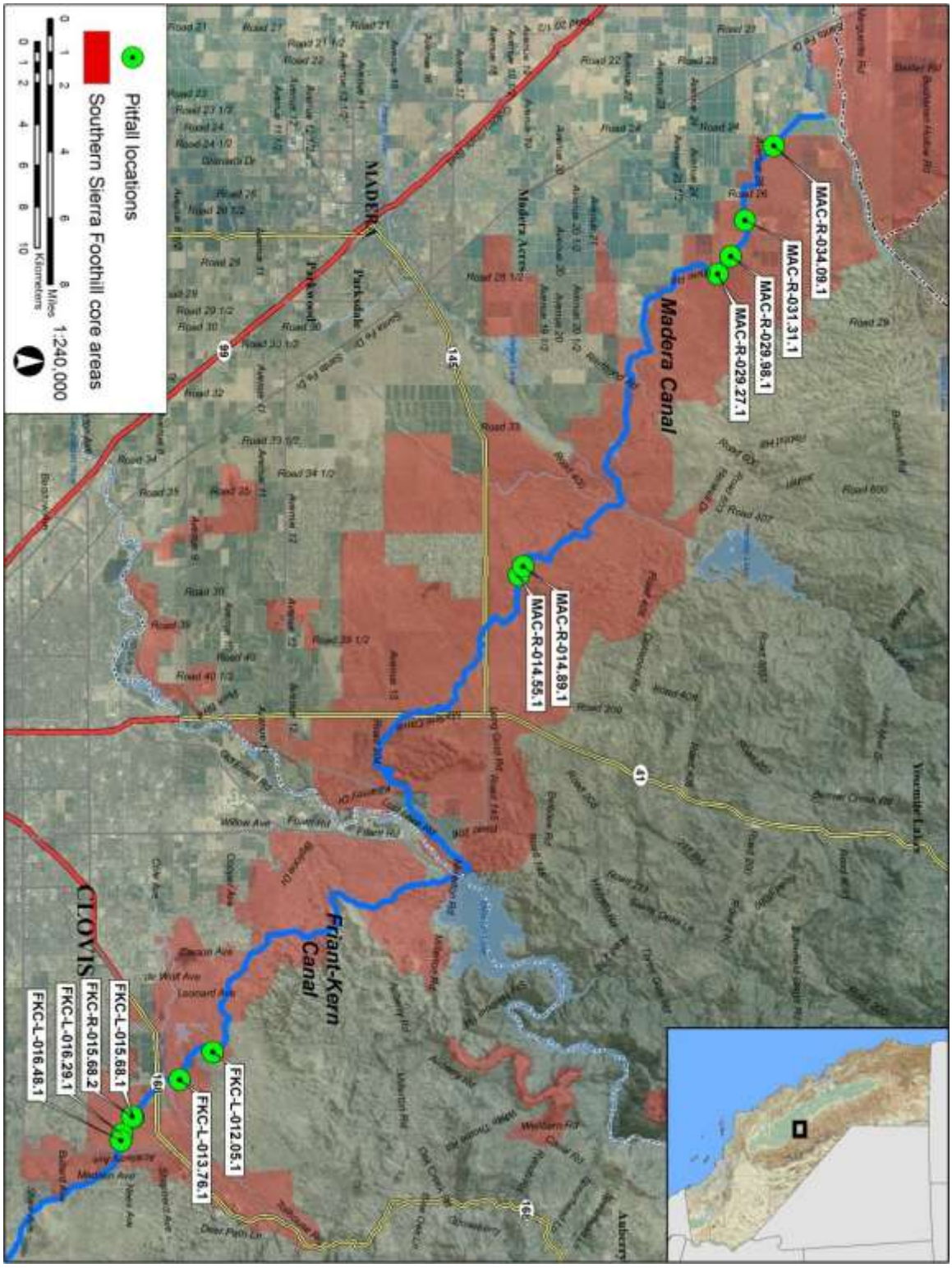

Figure 3. Twelve pitfall array locations along Friant-Kern and Madera canals.

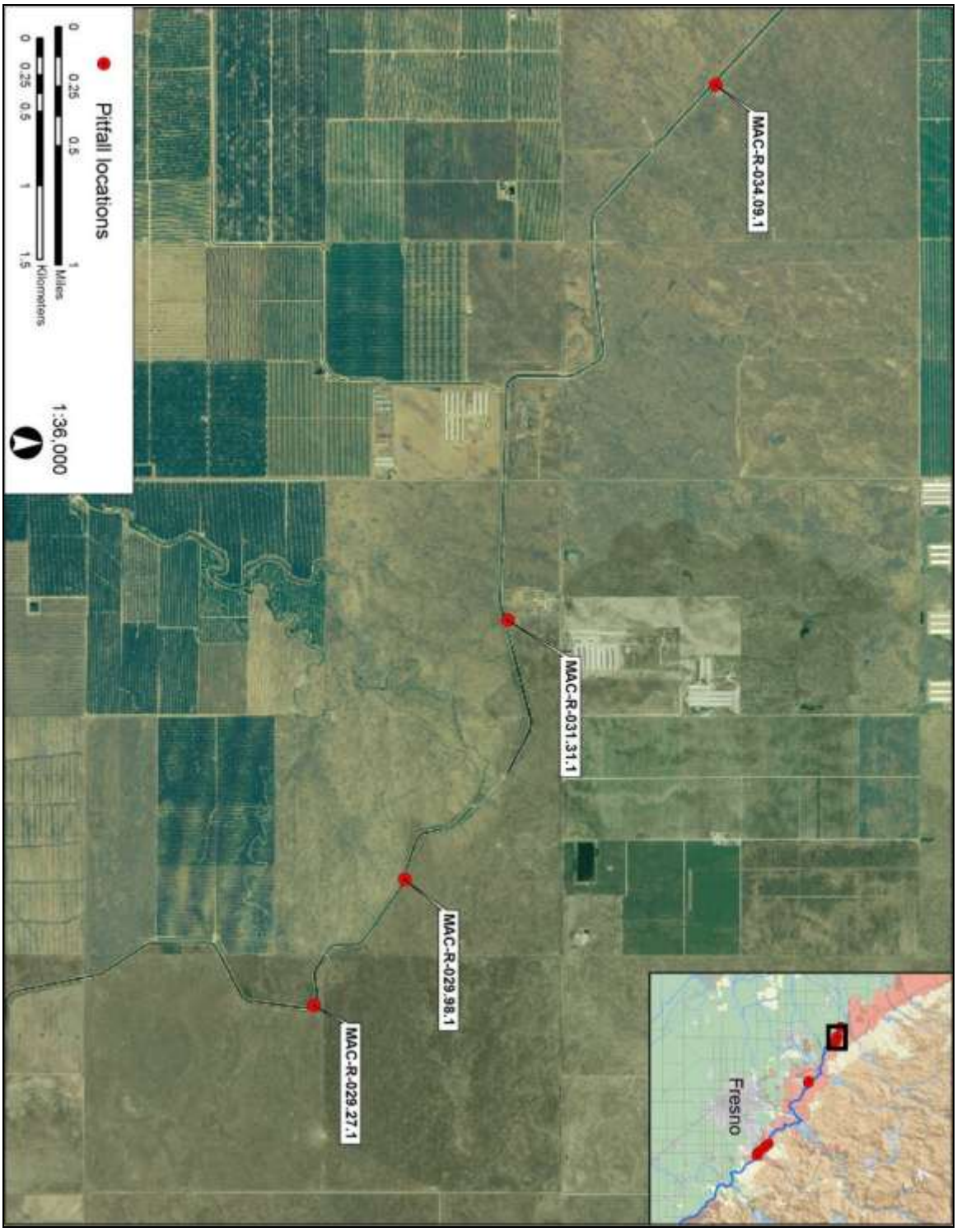

Figure 4. Northern pitfall array locations along the Madera Canal.

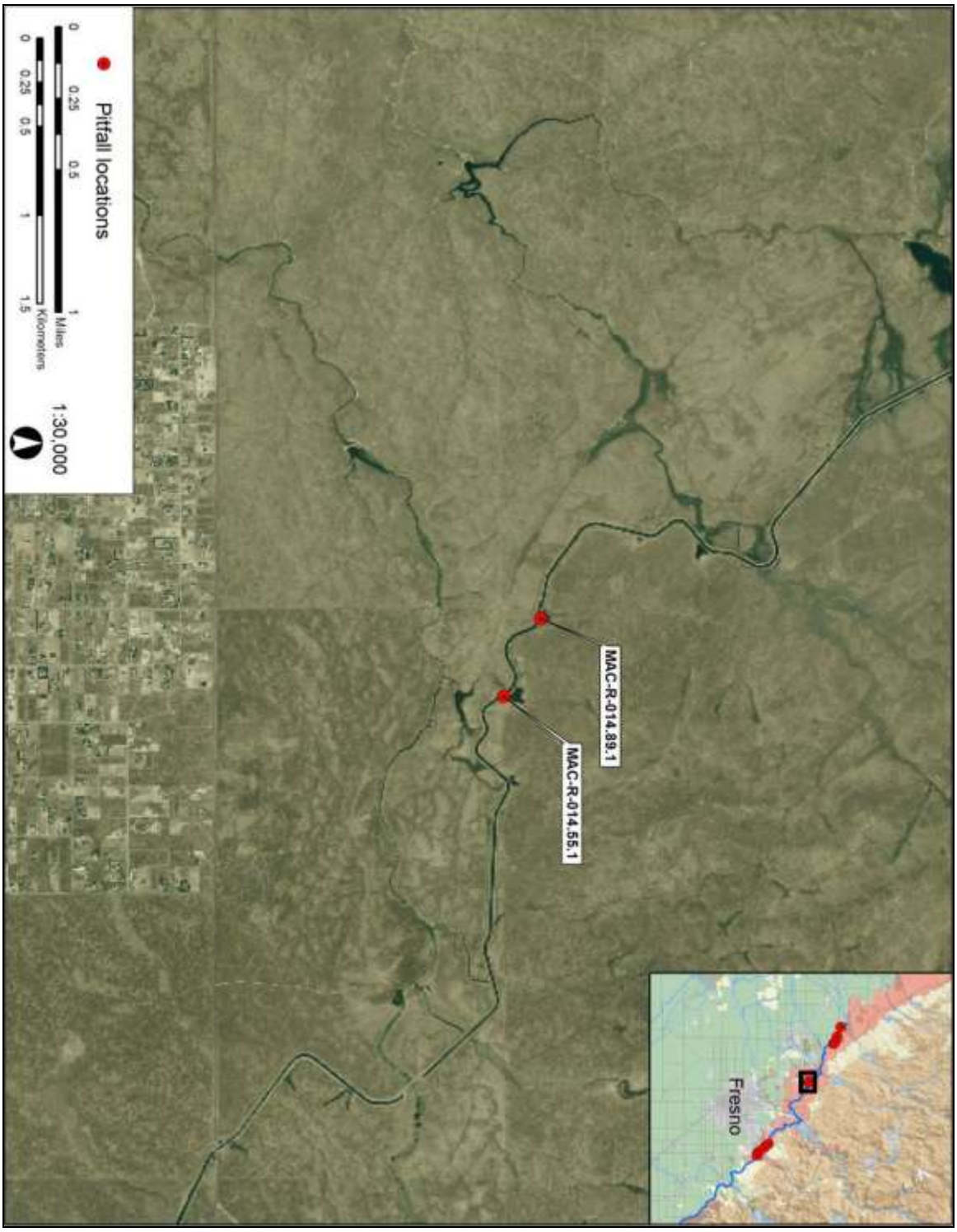

Figure 5. Central pitfall array locations along the Madera Canal.

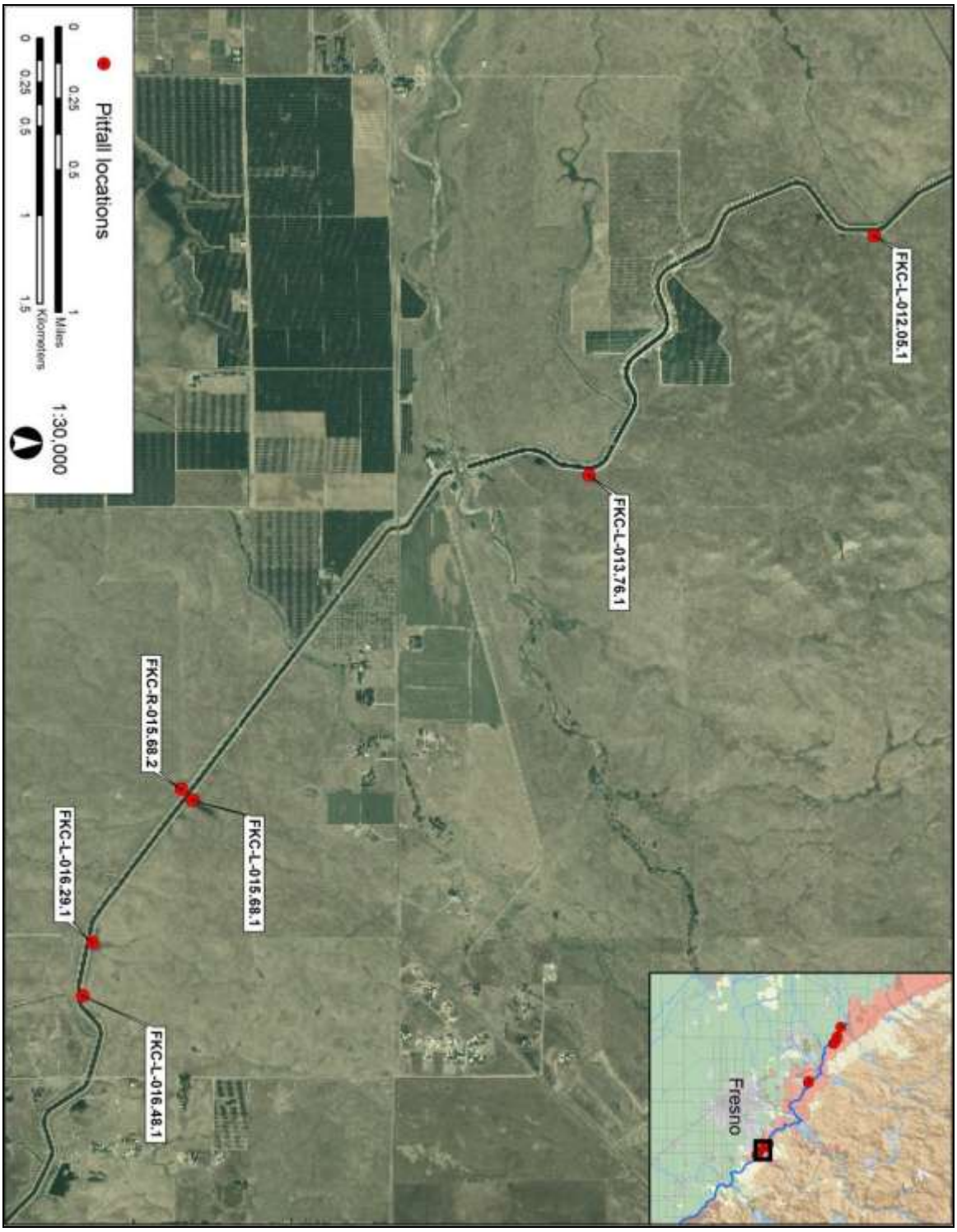

Figure 6. Southernmost pitfall array locations along the Friant-Kern Canal.

Table 1. Number of pitfall arrays by vernal pool location.

Pitfall array location (Figure 3)	Number of pitfall arrays
MAC-R-034.09.1	2
MAC-R-031.31.1	1
MAC-R-029.98.1	1
MAC-R-029.27.1	2
MAC-R-014.89.1	2
MAC-R-014.55.1	2
FKC-L-016.48.1	1
FKC-L-016.29.1	2
FKC-L-015.68.1	2
FKC-R-015.68.2	2
FKC-L-013.76.1	2
FKC-L-012.05.1	1

Because CTS migrate (at night) during times of rainfall, pitfalls were opened when weather forecasts predicted >=50% chance of rain through the night. All captured CTS were processed (data was collected from each) and released into a nearby small mammal burrow or vernal pool. Data collected for each animal included weight, snout to tail length, snout to vent length, sex, and digital photographs (Figure 7).

Figure 7. Measurement of a captured California tiger salamander.

Habitat Assessment

We visually surveyed both the canal right-of-way and adjacent, privately-owned rangelands along the Madera and Friant-Kern canals and assessed habitat quality at sites along each canal. At each assessment site, we recorded the survey site location, filled out a form with habitat indicators, and took digital photographs. Habitat

conditions at each location were assigned a number ranking from 1 to 10 (low to high). Habitat quality was assessed using a combination of recorded habitat type, level of site disturbance, size (area) of contiguous habitat, the type (and size) of vernal pools present, the type of vegetation in and surrounding vegetation, known occurrence of CTS and fairy shrimp, observed invasive species, the number of small mammal burrows, and the density and size of vernal pools (Appendix A). These habitat requirements have been noted as essential for the survival of CTS (USFWS 2005b, Trenham 2000, 2001, 2005, and Searcy 2007). Additionally, Holland's attribute classes (Holland 1998), which grouped habitat by vernal pool density, was also recorded and assessed as part of the ranking process.

GEOGRAPHICAL ANALYSIS

The *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005b) identifies recovery actions based on recovery *core* areas (Figure 1) that are assigned to *zone* rankings based on rarity of species, unique conditions, biodiversity, and levels of threats to remaining habitat. Core areas are nested within recovery regions, or broad, discrete geographic *regions* based primarily on endemic species and secondarily on physiogeographic characteristics (Figure 1, Keeler-Wolf et al. 1998).

We conducted a geographical analysis of habitat characteristics in relation to vernal pool recovery *core* areas (by *zone*) within the Southern Sierra Foothill vernal pool *region* south of the Chowchilla River (northern extent of the Madera Canal, Figure 20). Our objective in this approach was to link discrete geographic regions identified in the plan to habitat conditions measured from canal rights of way and other available geospatial information. Habitat characteristics were derived from field-collected habitat assessment information and available geospatial data on land use, vernal pool density, vernal pool conservation zones, classified wetlands, and species occurrence records (Figure 8).

We put together a set of habitat quality indicators (for CTS and vernal pool communities) based on density of sensitive species occurrences, distance from CTS occurrence records, vernal pool complexes, and soil taxonomy. Field-based habitat rankings were used to verify habitat quality indicators based on notes and photographs taken from canal rights of way. Habitat quality indicators were screened by land use status (urban, permanent crops, grain or field crops, and rangeland/oak woodland).

We put together a second set of geographic information based on geographically-based conservation priorities identified on the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005b) and areas of critical habitats in the region (Figure 9).

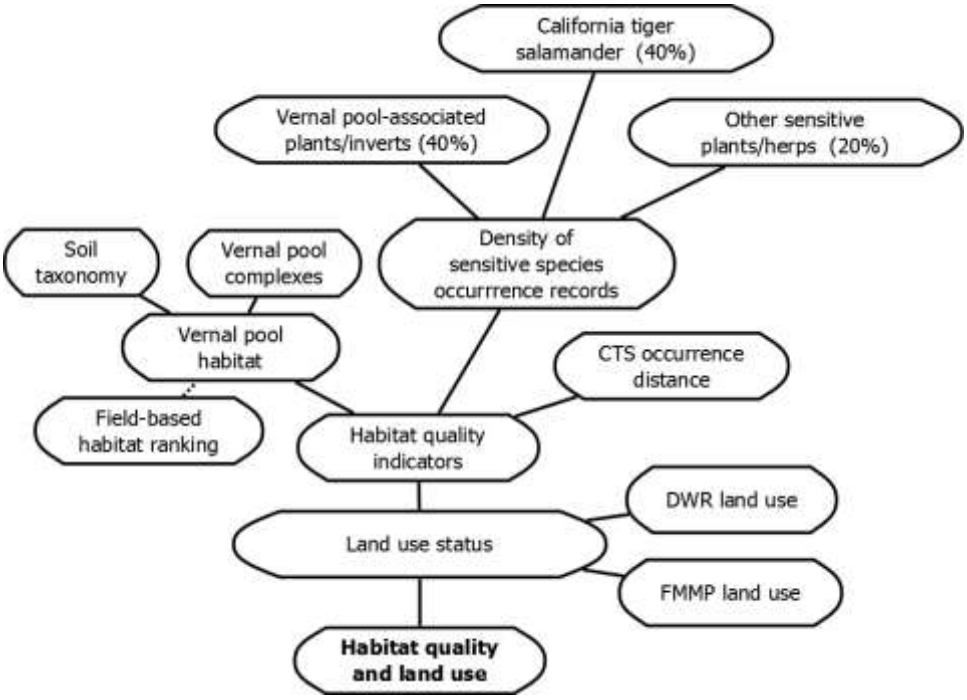

Figure 8. Sub-model of geographical analysis of land conservation priority using indicators of habitat quality and land use,

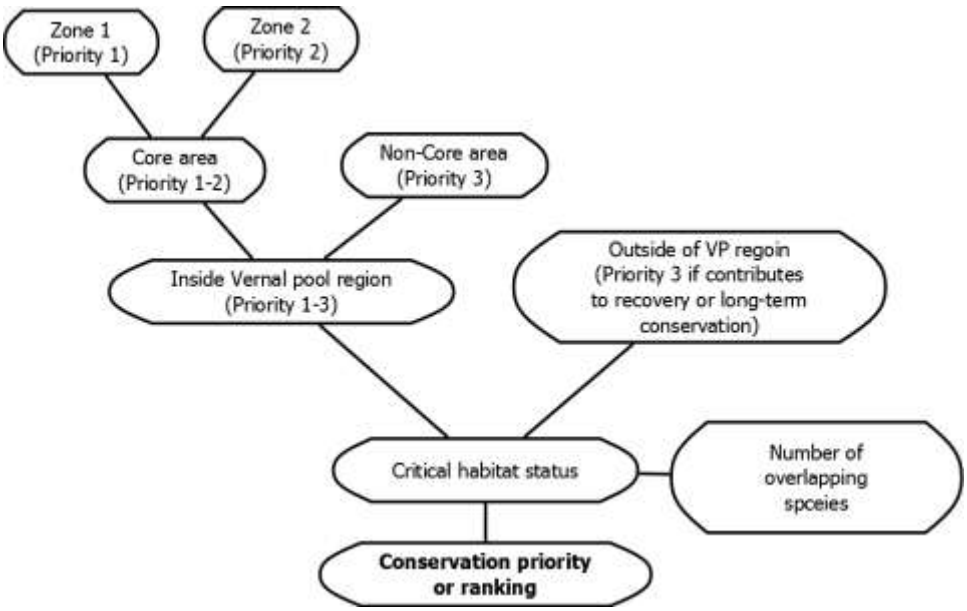

Figure 9. Sub-model of geographical analysis of land conservation priority using critical habitat status and recovery implementation tasks associated with discrete geographic regions.

Habitat Quality Indicators

Vernal Pool Habitat

Vernal pool complexes

Vernal pool complexes were mapped using geographic data of vernal pool complexes greater than 40 acres mapped in 2005 (Holland 1998, 2005). Extant vernal pool complexes in 2005 were classified into four classes based on vernal pool density, habitat quality, and disturbances (Table 2). We used spatial information on land use (see section Land use status below) to identify areas of disturbance to vernal pool complexes (i.e., dryland farming or land uses other than cattle grazing) and used field-based habitat assessments to verify vernal pool classes near canal rights of way.

Table 2. Vernal pool classification based on Holland (1998).

Vernal pool class	Description (adapted from Holland 1998)
Vernal pool class 1	**High density**. Pools are all sizes and numerous. Pools are distributed over the entire delineated vernal pool complex. Also includes large, isolated playa-like pools (Holland code 3).
Vernal pool class 2	**Medium density**. Pools are larger, more numerous, and more pervasively scattered, although still patchy within the delineated vernal pool complex (Holland code 2).
Vernal pool class 3	**Low density**. Pools are small, widely and patchily scattered. At least 2 and usually 5 or more pools within the delineated vernal pool complex (Holland code 1).
Vernal pool – disturbed	**Disturbed by cultivation**. Pools of class 1-3 with obvious signs of disturbance or lands with pools present and persistent in spite of cultivation (Holland codes 4, 8, 9, 10).

Soil taxonomy

Smith and Verrill (1998) identify a hierarchical framework of relationships between geomorphological characteristics, soil series, and soil taxonomic classes for areas associated with vernal pool formation in the Central Valley of California. Using the Soil Survey Geographic (SSURGO) Database (http://soils.usda.gov/) we created a layer of soil mapping units for the study area along with an associated table of mapping unit *components* (with percentage of each map unit) which include taxonomic information (*Great Group*). Using *Table 1* from Smith and Verrill, we created a list of soil taxa (*Great Group*) identified with Central Valley vernal pool regions. We joined the list of soil taxa with our component table and calculated the percentage of each map unit associated with a component of one of the identified taxa (Figure 11). We used this to identify regions not explicitly mapped as vernal pool complexes by Holland (1998, 2005) but with a greater likelihood of vernal pool presence.

We combined information for vernal pool complexes (based on Holland 2005) and soil taxonomy to create a composite vernal pool habitat quality surface with values ranging from 0-100, with 100 being highest quality vernal pool habitat (Table 3, Figure 12). High-density vernal pool complexes (Vernal pool class1, Table 2) were assigned a score of 100, medium density complexes (class 2) were assigned a score of 90, low-density

complexes (class 3) were assigned a score of 80, and disturbed complexes (class 4) were assigned a score of 70. Remaining areas outside of mapped vernal pool complexes were assigned a score of 0-60 based on the percentage of soil map units with soil taxa (Great Group) identified by Smith and Verrill (1998) as associated with vernal pool formation in the Central Valley of California (Figure 11).

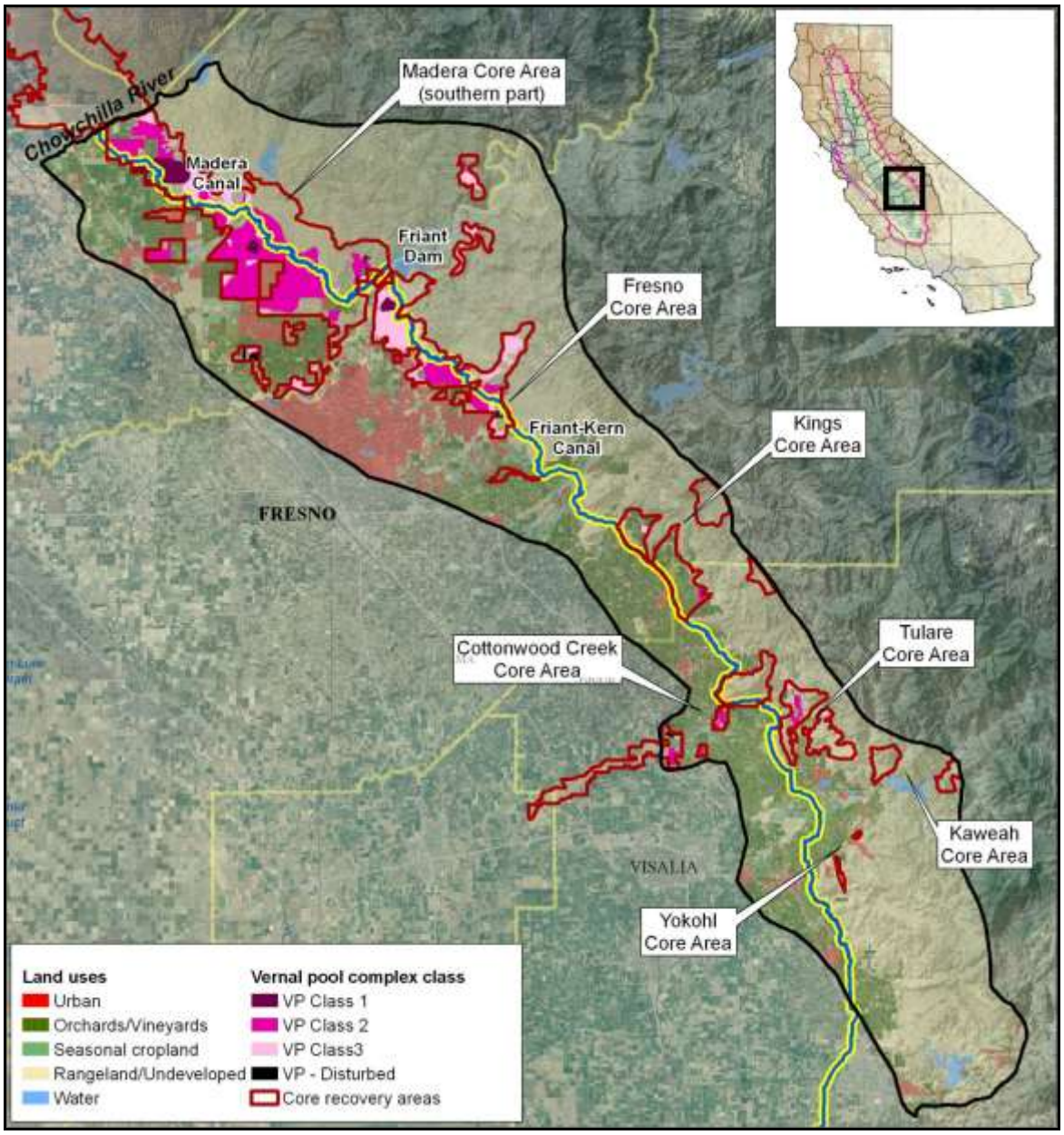

Figure 10. Vernal pool classes based on Holland (2005) with disturbance classes based on land uses (Figure 20).

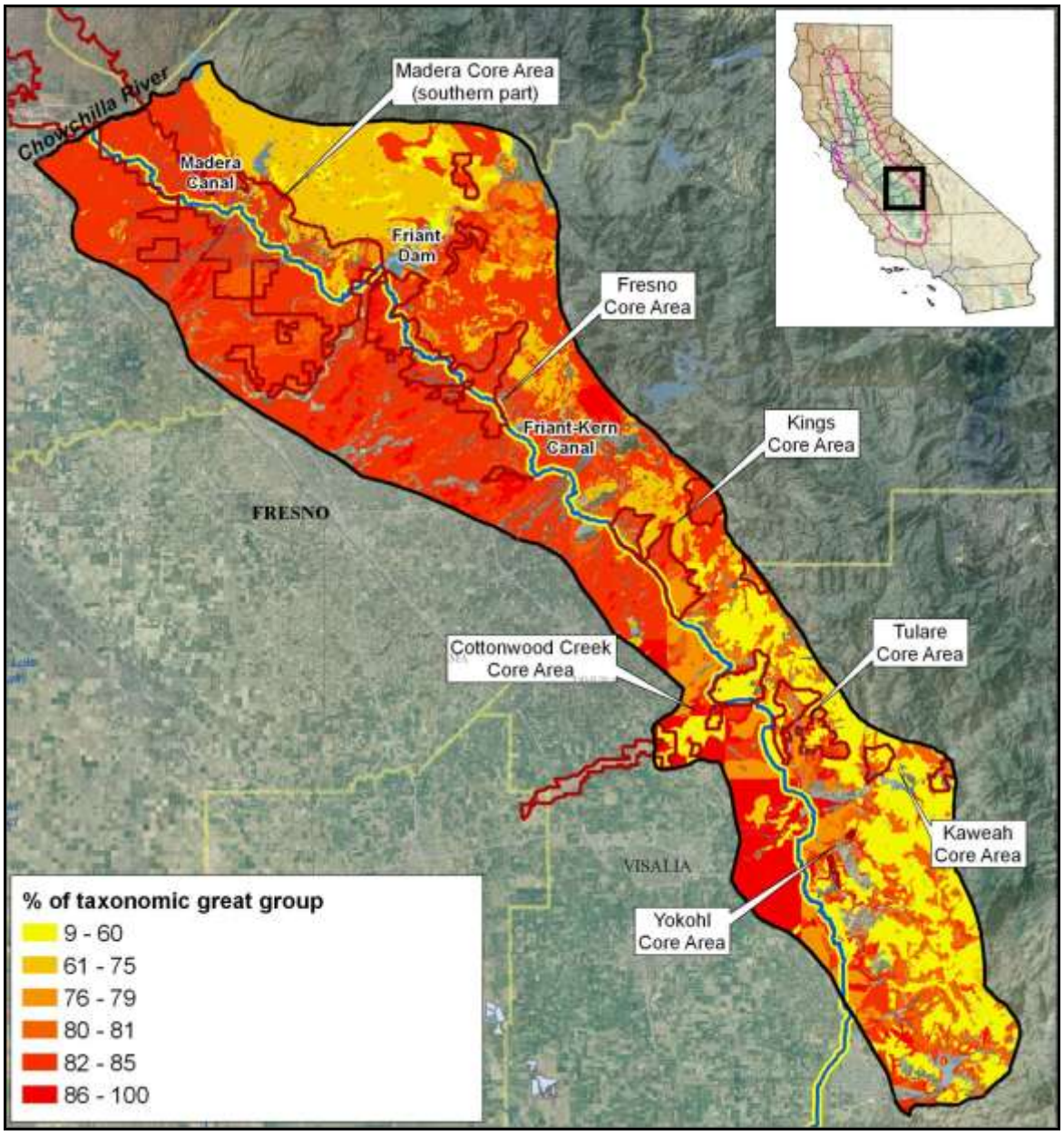

Figure 11. Percentage of soil map units with soil taxa (Great Group) identified by Smith and Verrill (1998) as associated with vernal pool formation in the Central Valley of California.

Table 3. Vernal pool habitat quality scores.

Vernal pool class or soil taxonomy	Vernal pool habitat quality score
Vernal pool class 1	100
Vernal pool class 2	90
Vernal pool class 3	80
Vernal pool – disturbed	70.
Outside of mapped vernal pool complexes	60 * percent of identified *Great Group* taxa

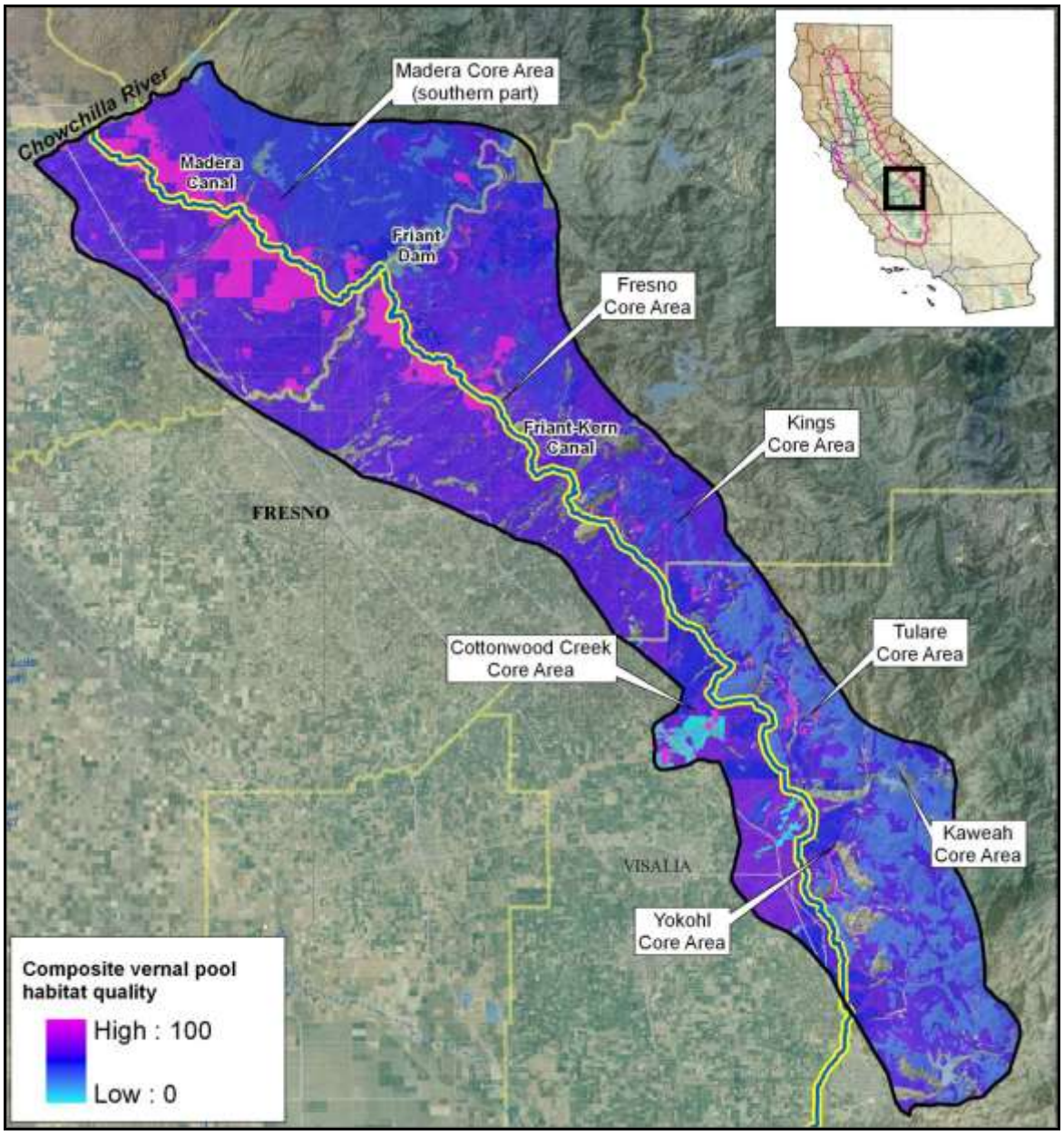

Figure 12. Surface of composite vernal pool habitat quality based on mapped vernal pool complexes (Figure 10) and soil taxonomy (Figure 11).

Species occurrence record density

We obtained occurrence records for CTS and vernal pool-associated species and communities from the California Natural Diversity Database (CNDDB, Table 4). The CNDDB records included those collected along Reclamation rights of way during field monitoring for this project and previous focused surveys of vernal pools along Reclamation canal rights of way. Vernal pool associated species in the region included plants featured in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005b), vernal pool invertebrates, vernal pool communities, and records for CTS. We also included records for other special-status herptiles

encountered during focused surveys of canal rights of way (western pond turtle and western spadefoot) and two regionally-important rare plants present in foothill grasslands (Hartweg's golden sunburst and San Joaquin adobe sunburst) that, while not directly tied to pools, would add to the conservation value of a region when present.

Table 4. Selected species occurrence records in the Southern Sierra Foothill region.

Category		Species	Common name	Federal/ California status[1]	No. Occ.
Vernal pool-associated species and communities	Vernal pool invertebrates	*Branchinecta lynchi*	vernal pool fairy shrimp	T/-	83
		Branchinecta mesovallensis	midvalley fairy shrimp	-/-	3
		Lepidurus packardi	vernal pool tadpole shrimp	E/-	7
		Linderiella occidentalis	California linderiella	-/-	69
	Vernal pool plants	*Atriplex persistens*	vernal pool smallscale	-/-	1
		Castilleja campestris ssp. succulenta	succulent owl's-clover	T/E	21
		Chamaesyce hooveri	Hoover's spurge	T/-	5
		Eryngium spinosepalum	spiny-sepaled button-celery	-/-	21
		Gratiola heterosepala	Boggs Lake hedge-hyssop	-/E	6
		Orcuttia inaequalis	San Joaquin Valley Orcutt grass	T/E	9
		Orcuttia pilosa	hairy Orcutt grass	E/E	9
	Vernal pool communities		Northern Basalt Flow Vernal Pool	-/-	4
			Northern Claypan Vernal Pool	-/-	3
			Northern Hardpan Vernal Pool	-/-	16
California tiger salamander		*Ambystoma californiense*	California tiger salamander	T/T	96
Other sensitive plants and herptiles	Other herptiles	*Emys marmorata*	western pond turtle	-/-	14
		Spea hammondii	western spadefoot	-/-	48
	Other plants	*Pseudobahia bahiifolia*	Hartweg's golden sunburst	E/E	4
		Pseudobahia peirsonii	San Joaquin adobe sunburst	T/E	21

1. E = Endangered, T = Threatened

Because survey efforts were limited almost exclusively to canal rights of way, we used the locations of known occurrence records along the rights of way (and elsewhere if available) to calculate a surface of occurrence record density across the study area, such that lands near concentrations of occurrence records would be ranked as higher value for species presence than lands farther from such concentrations. While extrapolating density from known records, particularly those collected along a linear right of way, cannot substitute for a region-wide survey for species, it provided some estimate for occurrence potential on lands that could not be surveyed due to lack of access. We calculated the density (occurrence per km^2) for each category of species occurrence records (vernal-pool associated [Figure 13], CTS [Figure 14], and other regionally-important sensitive plants and herptiles [Figure 15]).

For each species category, we normalized density on a scale from 0-100 with 100 being areas with highest density and 0 being the lowest. We used a weighted model to combine normalized species density for each category with vernal pool-associated species weighted

at 40%, CTS weighted at 40%, and other herptile and plant species weighted at 20% – or half that of target species and communities. Output from the model was used to create a surface of estimated habitat quality based on species density ranked from 0-100 with 100 being areas of highest weighted normalized occurrence record density (Figure 16).

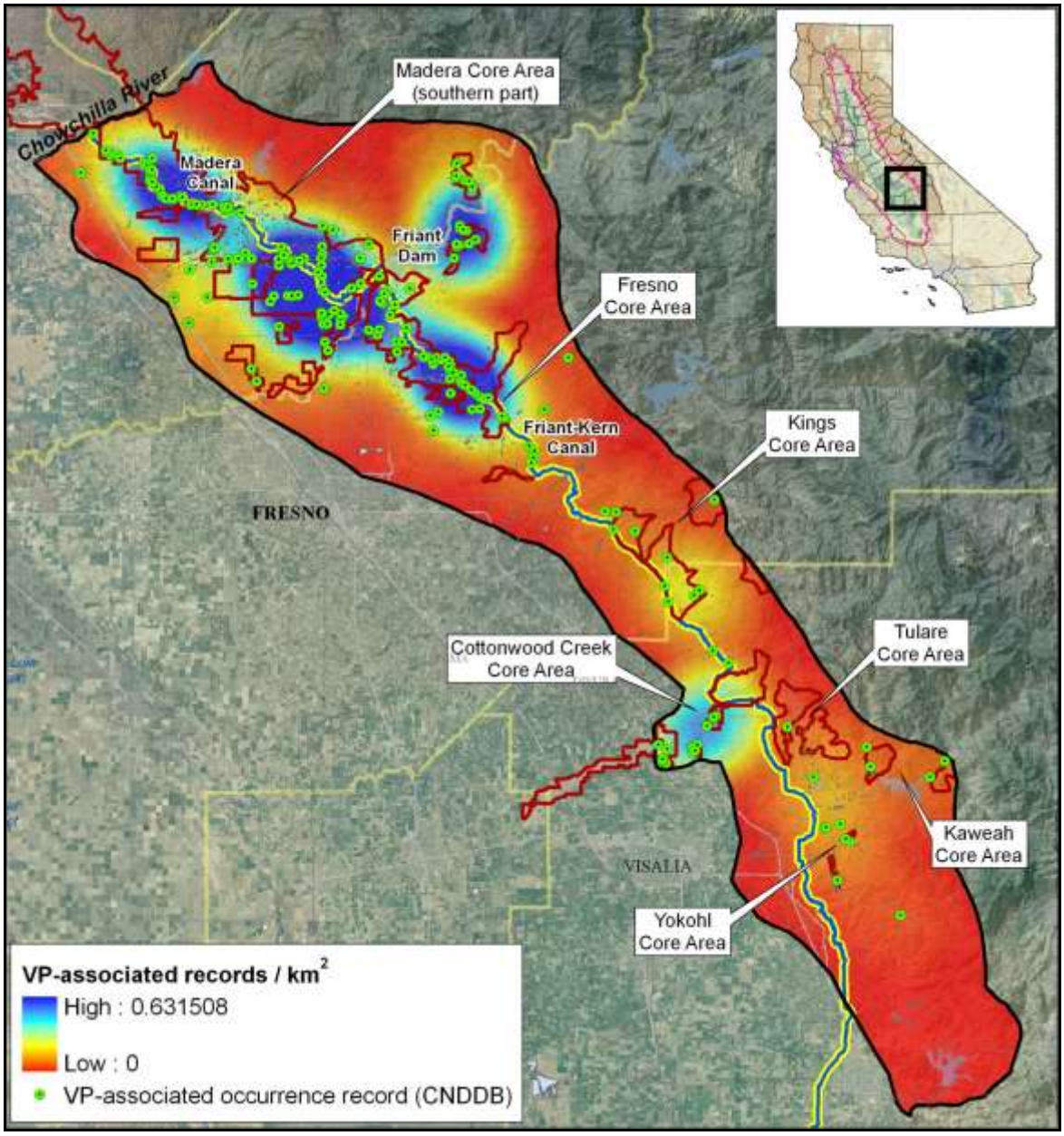

Figure 13. Density of vernal pool-associated plant and invertebrate occurrence records (record per km^2).

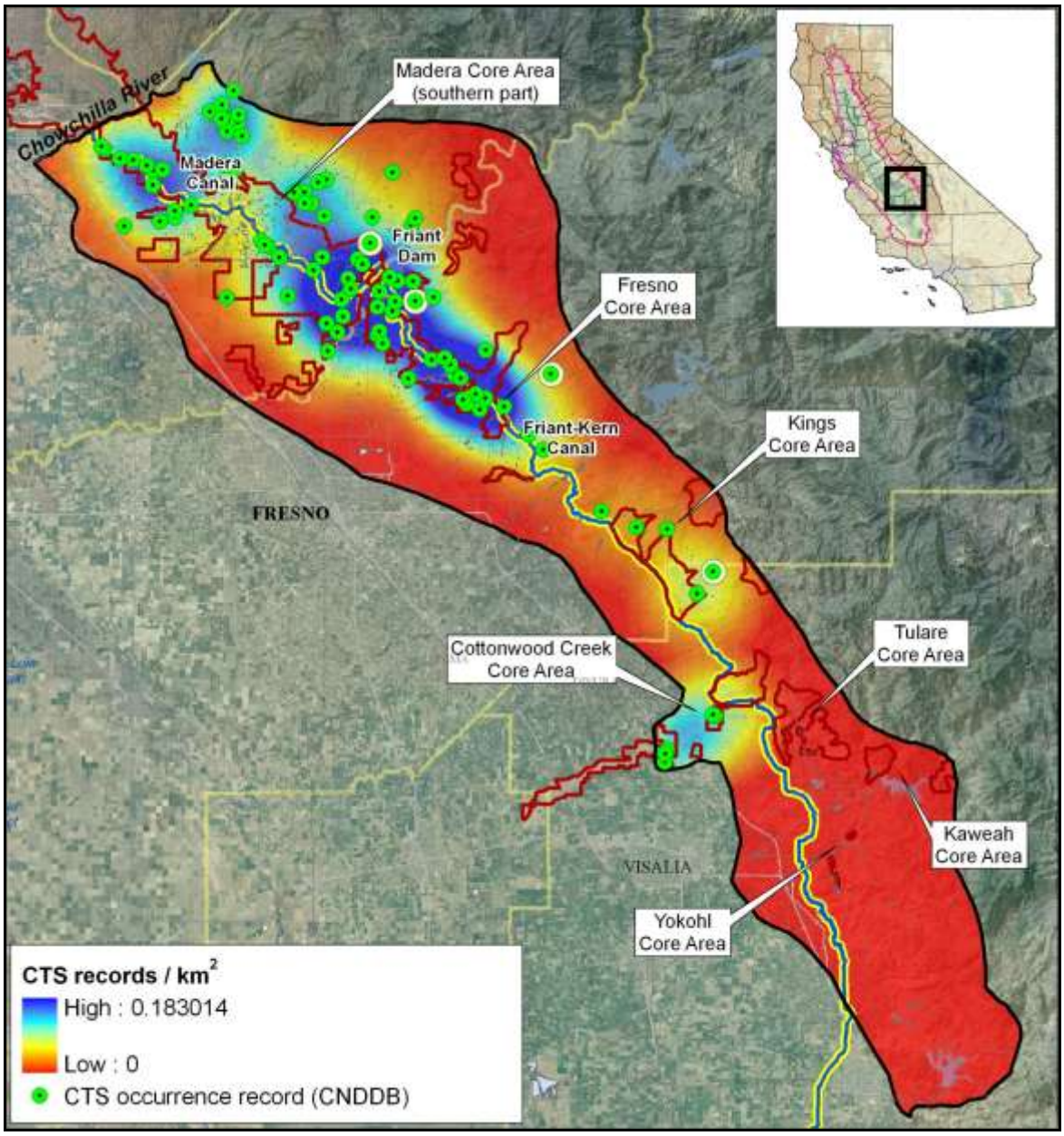

Figure 14. Density of California tiger salamander occurrence records (record per km^2).

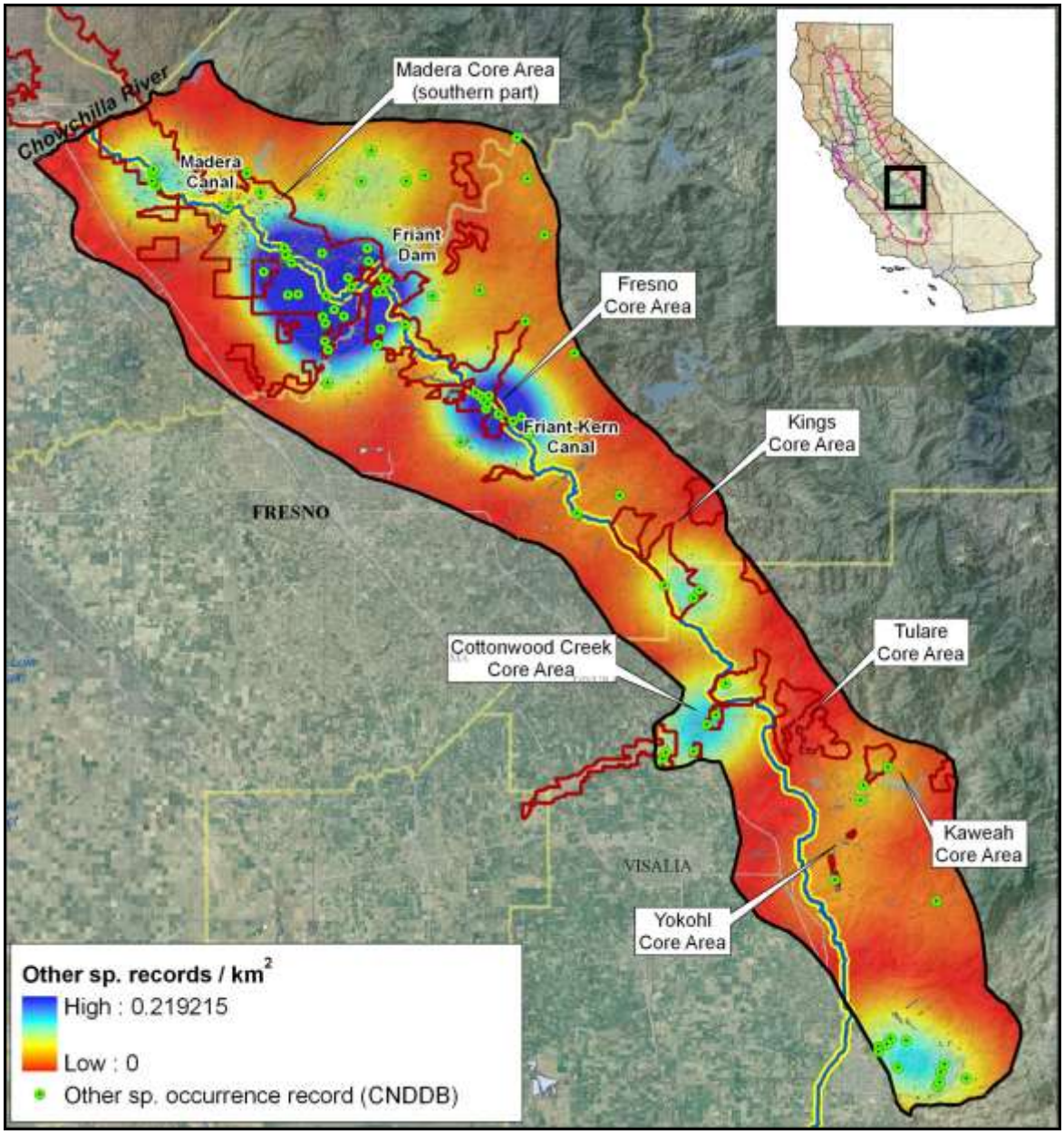

Figure 15. Density of other regionally-important rare plants and herptile occurrence records (record per km^2).

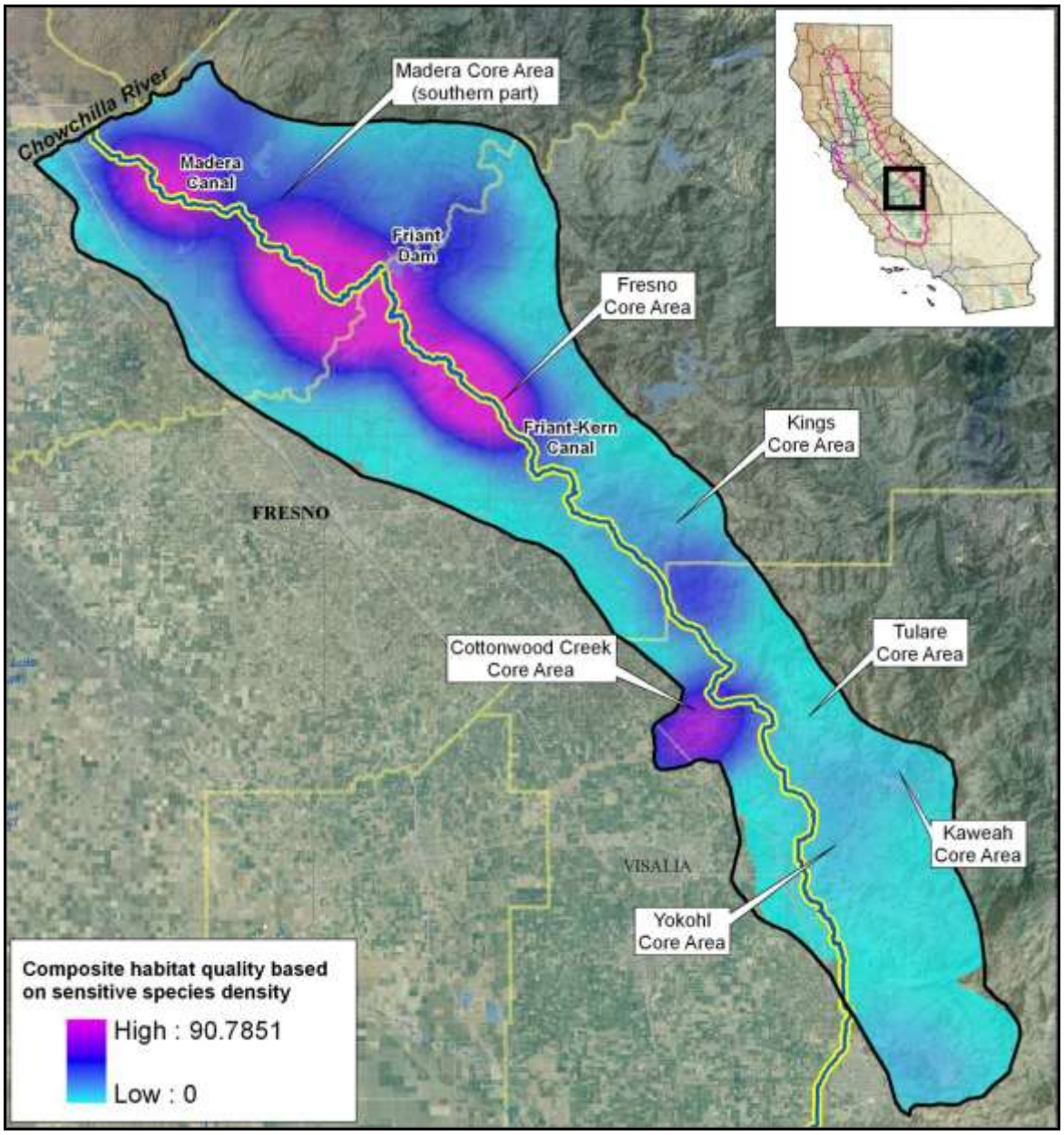

Figure 16. Composite habitat quality based on species density ranked from 0-100 with 40% based on density of vernal pool-associated species and communities, 40% based on density of California tiger salamander records, and 20% based on density of other regionally-important rare plants and herptiles.

In addition to presence of species, we created surfaces of the minimum distance from a CTS occurrence record (Figure 17). This allowed us to measure, in addition to presence (or density), the proximity of CTS occurrences for a given location.

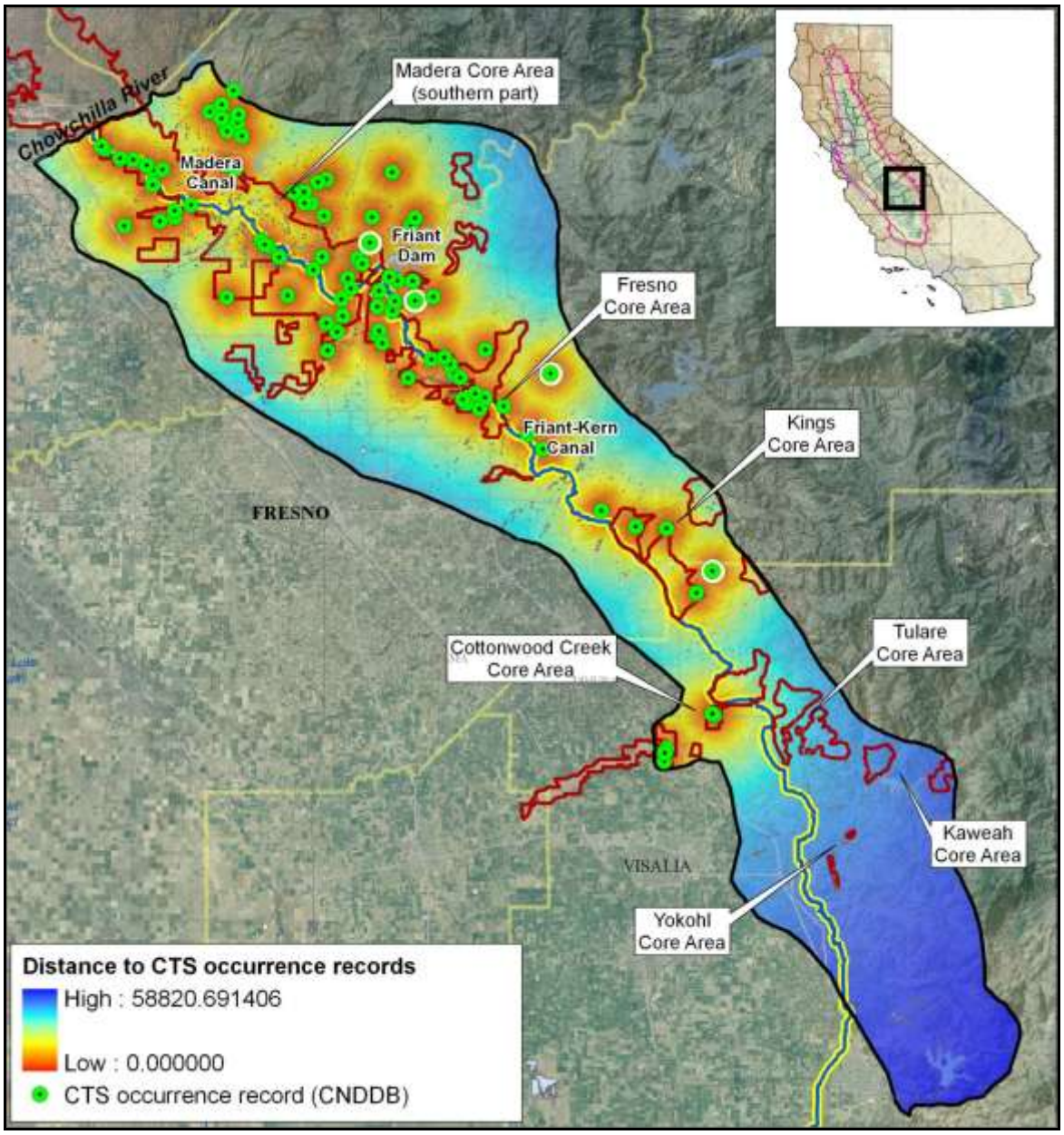

Figure 17. California tiger salamander occurrence records and a surface of the minimum distance to a record (in meters).

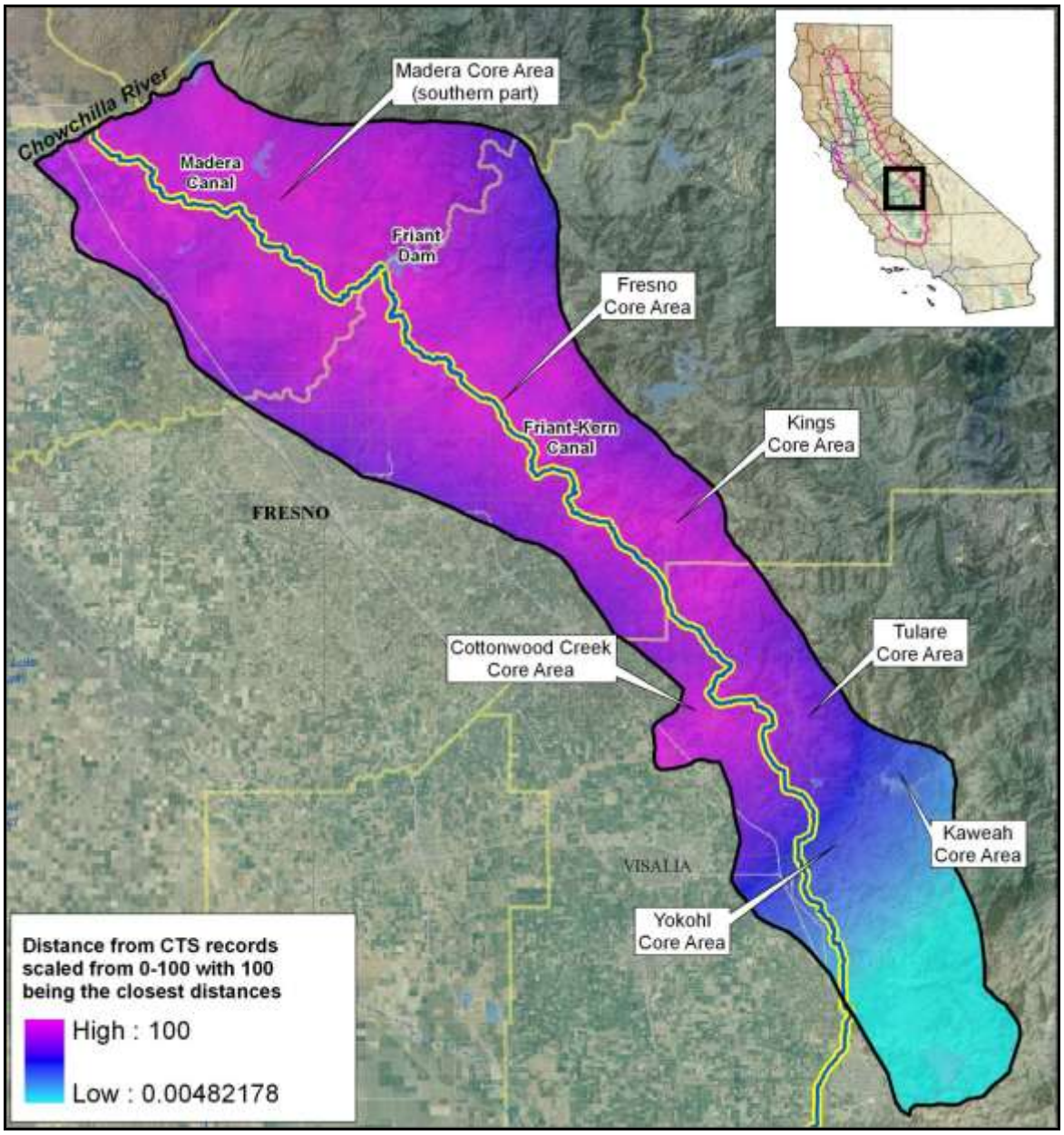

Figure 18. Distance from California tiger salamander records scaled from 0-100 with 100 being the regions closest to an occurrence record.

Combining Factors for Habitat Quality Model

We combined the three factors of habitat quality (vernal pool habitat quality, combined species record density, and distance from CTS records) by multiplying each surface (scaled 0-100) by 0.33 and adding their values – or essentially generating the average of the three factors scaled from 0-100 with 100 representing the highest quality (Figure 19).

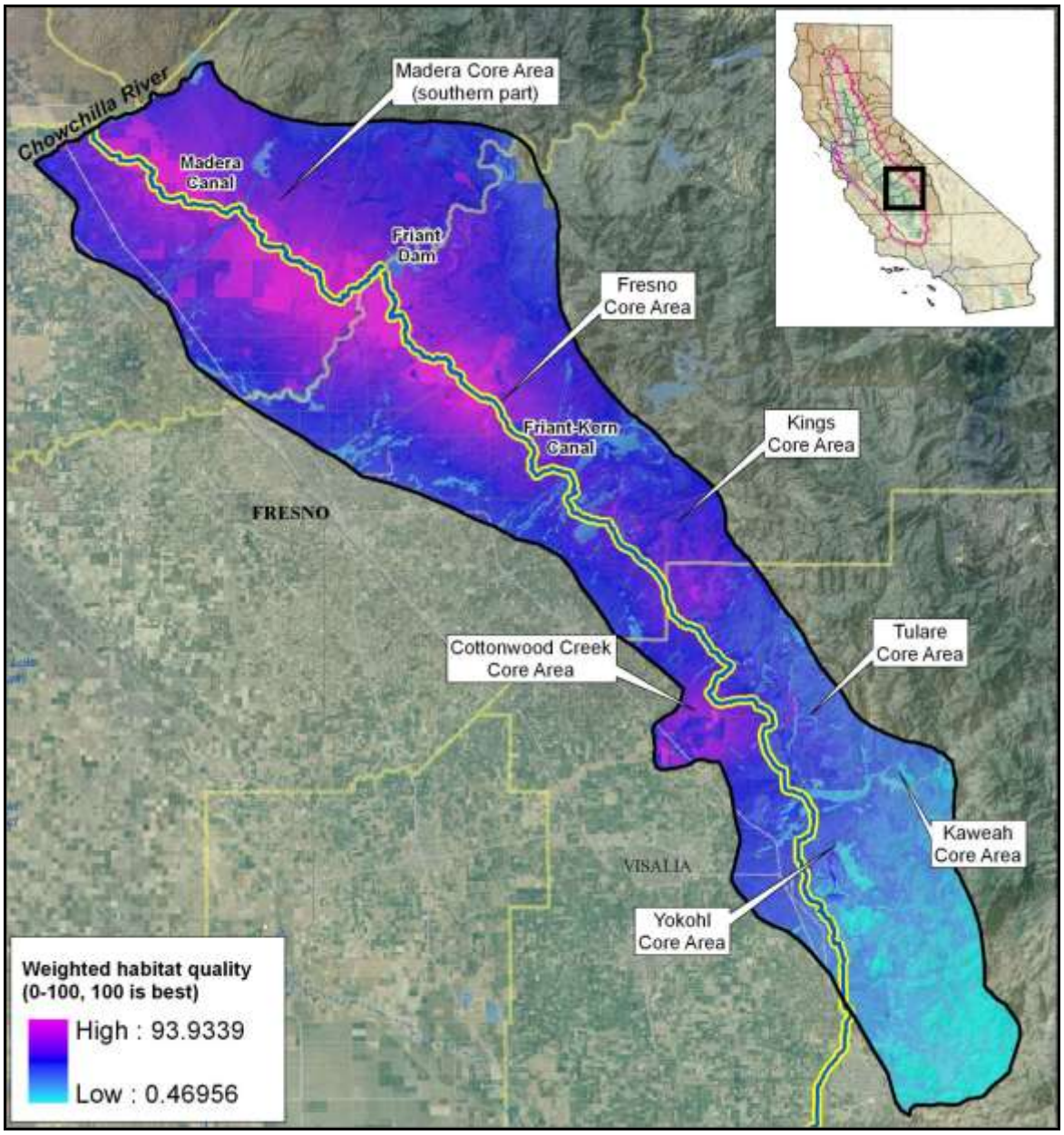

Figure 19. Surface of composite habitat quality based on vernal pool habitat quality, density of sensitive species occurrence records, and distances from California tiger salamander occurrence records.

Land use status

We mapped land uses by combining spatial data from the California Department of Water Resources Land Use Survey data (2010) and the California Department of Conservation Farmland Mapping and Monitoring Program (2008), aerial photography, and field observations during habitat assessments. We used a GIS model to create a composite land use dataset of developed land use classes (urban and farmland) and non-developed rangeland or oak woodland (Figure 20).

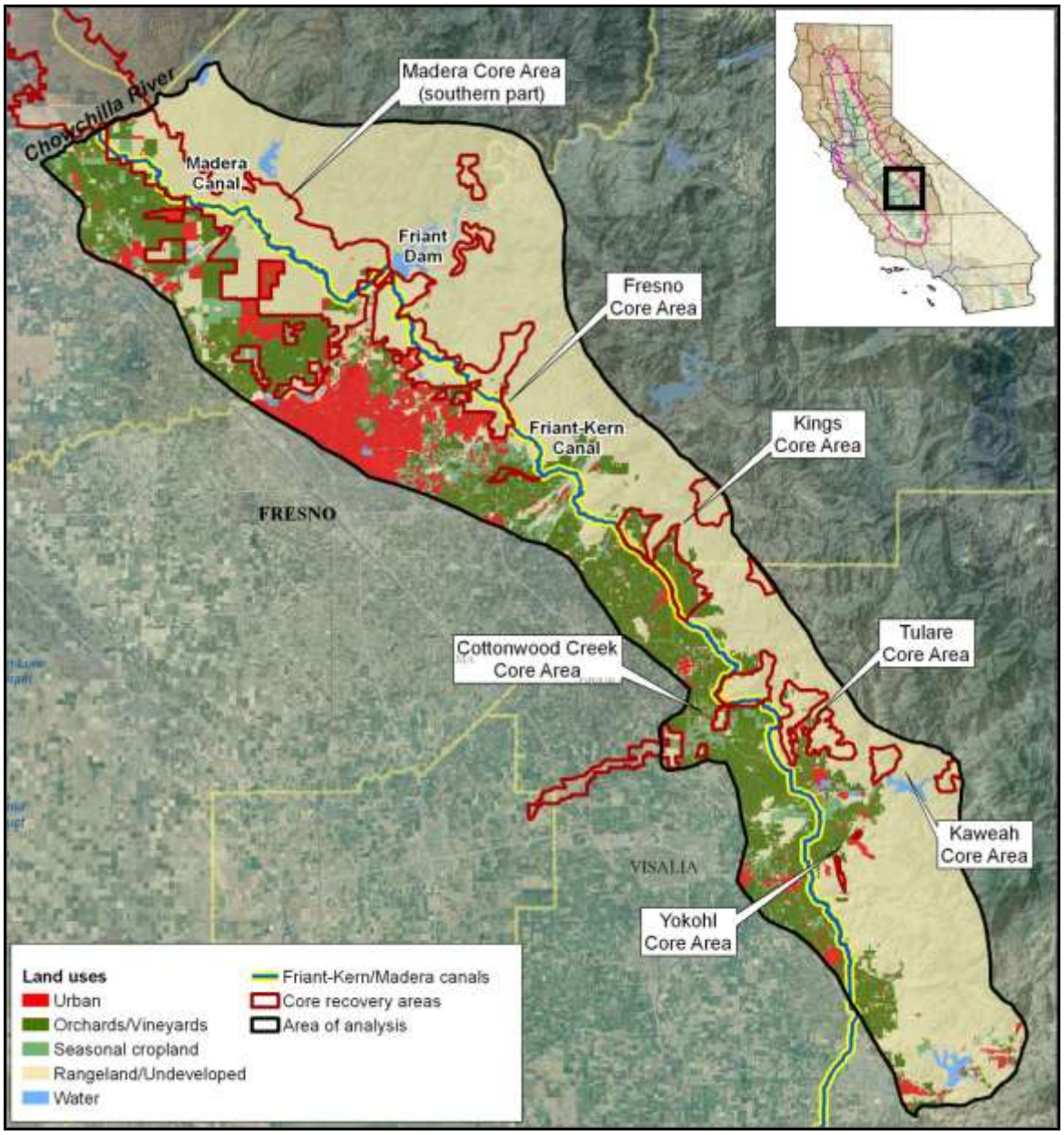

Figure 20. Land uses (California Dept. of Water Resources 2010 and California Dept. of Conservation 2008) and Southern Sierra Foothill vernal pool core recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*.

Land uses were used to screen out regions of developed land uses (e.g., urban or permanent crops) from habitat rankings (Figure 21). Land use categories were converted to a surface (30-m resolution) of numerical values (Table 5) that were multiplied to the surface of composite habitat quality (Figure 19). This process assigned areas of compatible land uses (rangeland/undeveloped) to 100% of their originally assigned habitat quality value and areas of incompatible land uses (developed, open water) to 0% of their original value (0). Areas with lower-intensity farming (non-permanent crops) were assigned to 50% of their original habitat quality value to reflect some reasonable potential for restoration.

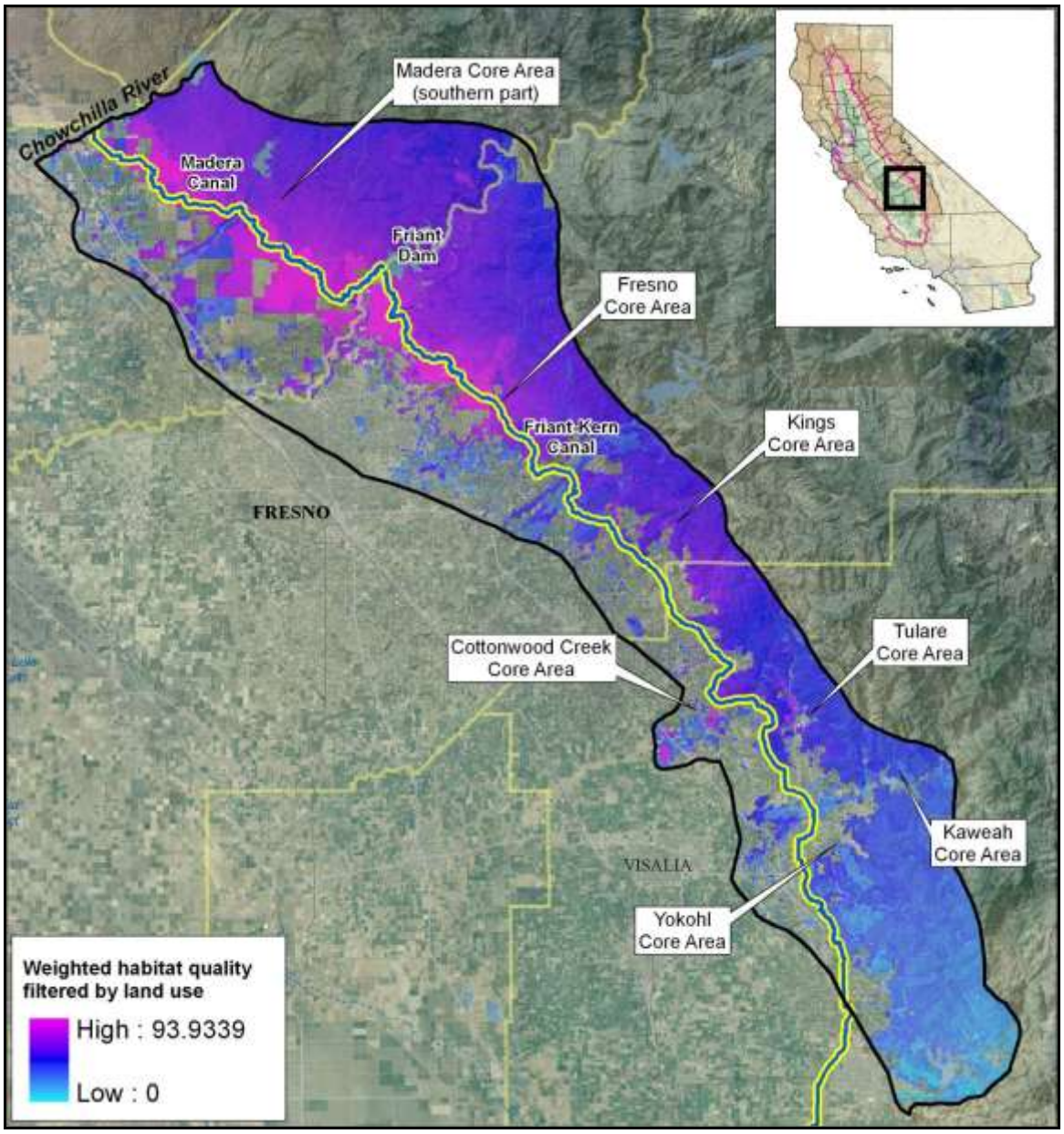

Figure 21. Habitat quality screened to exclude developed land uses.

Table 5. Land use categories as a multiplier to habitat quality

Land use class		Multiplier to habitat quality
Developed	Urban	0.0
	Orchards/Vineyards	0.0
Open Water	Water	0.0
Low-intensity farmland	Seasonal cropland	0.5
Undeveloped	Rangeland/Undeveloped	1.0

Conservation Priority or Ranking

We developed a recovery conservation priority layer to identify and add conservation priorities based on recovery regions and critical habitat status to our model of habitat quality. This served to essentially break ties between areas of equally good habitat. For example, lands with high quality habitat in a region identified as higher priority for recovery would be scored higher in our model than lands of equal habitat quality outside the region. We used recovery regions identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005a; Figure 1) and regions of critical habitat to create a surface of conservation priority based on recovery plan priorities and critical habitat status.

We obtained locations of critical habitat for CTS, vernal pool fairy shrimp, vernal pool tadpole shrimp, and five vernal pool-associated plants (Table 6) from the U.S. Fish and Wildlife Service environmental Conservation Online System (http://ecos.fws.gov). We converted the spatial locations to 30-m raster datasets, or grids, for each species with the value of 1 for cells with critical habitat and 0 for cells not critical habitat. We used a simple raster math expression to add the grids resulting in a new grid with areas of overlapping critical habitats with the number of overlapping critical habitat regions assigned to each cell (Figure 22).

Table 6. Species with critical habitat within the study area.

Type	Common name	Species	Federal status
California tiger salamander	California tiger Salamander	*Ambystoma californiense*	Threatened
Invertebrate	Vernal pool fairy shrimp	*Branchinecta lynchi*	Threatened
Invertebrate	Vernal pool tadpole shrimp	*Lepidurus packardi*	Endangered
Plant	Fleshy owl's-clover	*Castilleja campestris ssp. succulenta*	Threatened
Plant	Hoover's spurge	*Chamaesyce hooveri*	Threatened
Plant	San Joaquin Orcutt grass	*Orcuttia inaequalis*	Threatened
Plant	Hairy Orcutt grass	*Orcuttia pilosa*	Endangered
Plant	Greene's tuctoria	*Tuctoria greenei*	Endangered

Areas within the Southern Sierra Foothill vernal pool region (Figure 1, Priority 3) were assigned a base ranking of 10. Rankings for areas within a core area (Figure 1, Priority 1-2) were increased to 20. Rankings for areas within a Zone 1 (Madera Core Area) were increased to 30. In areas with critical habitat present, rankings for all classes were increased by 1 for each species with overlapping critical habitat, resulting in a ranking from 10 (within the Southern Sierra Foothill vernal pool region with no overlapping critical habitat) to 34 (areas within the Zone 1 Madera Core Area with overlapping critical habitat for four species; Figure 23, Table 7).

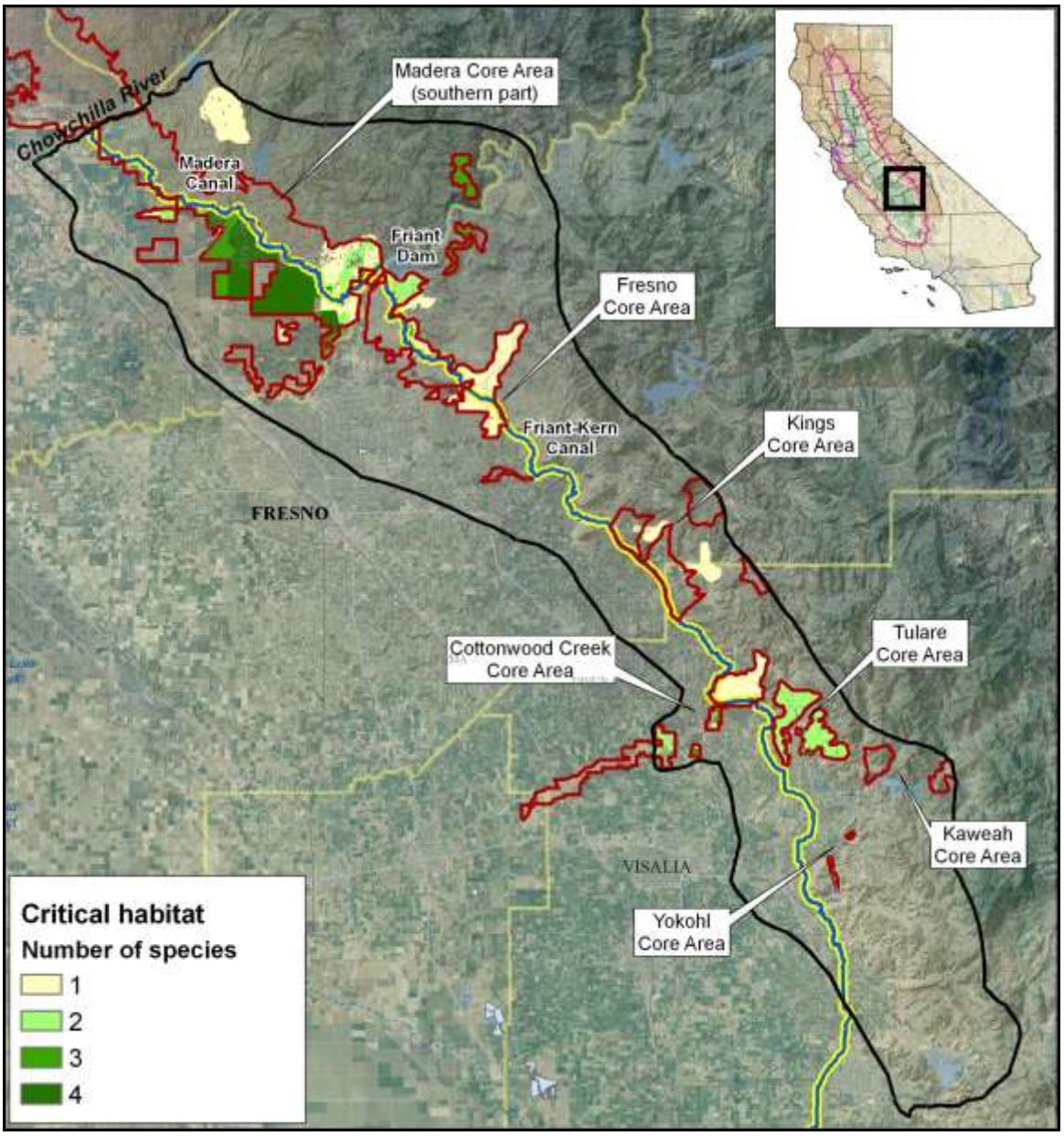

Figure 22. Critical habitats for eight species in the region (Table 6) summarized by the number of overlapping critical habitat regions.

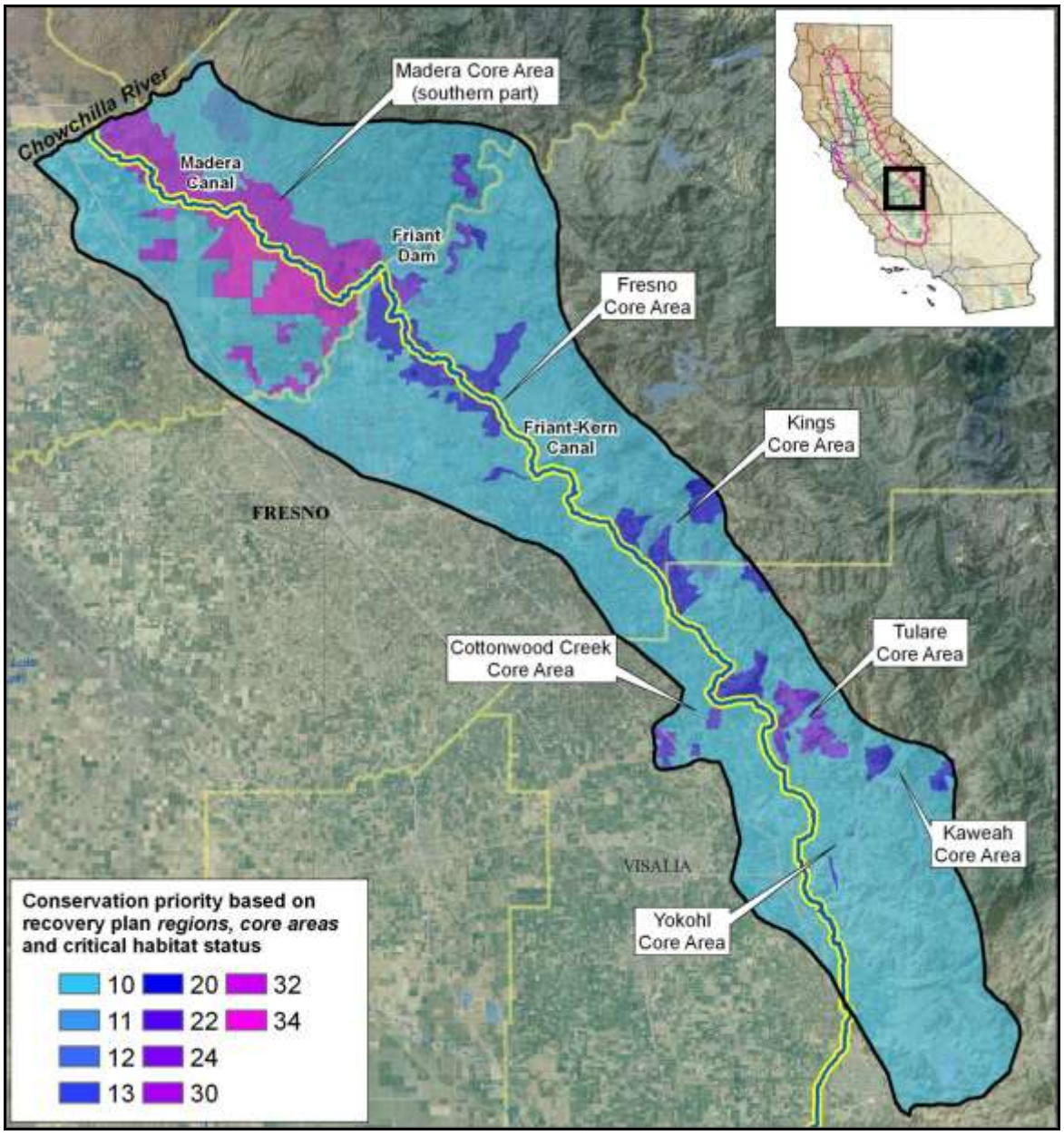

Figure 23. Ranked recovery conservation priority based on regions identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* and critical habitat status.

We added the values of the combined habitat quality indicator layer and conservation priority status layer to create a composite, additive layer of lands with highest habitat and conservation value. We then classified the composite layer into five classes from very low ranking to high ranking combined conservation value (Table 8).

Table 7. Conservation priority classes and additive value of each class to habitat quality model.

Conservation priority	Description	Additive value to model
10	In vernal pool region, no critical habitat	1
11	In vernal pool region, 1 critical habitat zone	2
12	In vernal pool region, 2 critical habitat zones	3
13	In vernal pool region, 3 critical habitat zones	4
20	In Zone 2 core area, no critical habitat	5
22	In Zone 2 core area, 2 critical habitat zones	6
24	In Zone 2 core area, 4 critical habitat zones	7
30	In Zone 1 core area, no critical habitat	8
32	In Zone 1 core area, 2 critical habitat zones	9
34	In Zone 1 core area, 4 critical habitat zones	10

Table 8. Classes of conservation rankings based on habitat quality added with recovery-based conservation priority.

Class	Composite value
Very low	1-25
Low	25-50
Medium	50-75
Moderately high	75-90
High	>90

Assessment of Threats

In addition to habitat quality and conservation priority, we generated a spatial surface of estimated landscape threat based on land uses identified in county general plans, farmland (or grazing) easement status, and housing unit density. We separately estimated threat based on planned land uses sub-divided by grazing and farmland easement status and threat based on housing unit density and created a composite threat surface based on the maximum (planned use or housing unit density) threat value per cell.

General plan information was derived from the California Resources Agency/University of California Davis (2004) and divided into classes of highly urbanized uses (*industrial, commercial, high-density residential*), *medium-density residential*, *low-density residential*, *very low-density residential*, *agricultural*, *open space/public lands*, and *other*. Lands identified for agricultural use were subdivided into grazing lands and non-grazing lands using farmland classes identified in the Farmland Mapping and Management Program (California Dept. of Conservation 2008). Lands used for grazing were considered as very low threat value where more intensive non-grazing lands (i.e., irrigated permanent or row crops) were considered higher threat.

In addition to planned land uses, we obtained information on land enrollment in the Williamson Act Program – a program that limits land use to agricultural or open space

uses in exchange for reduced property tax assessments[1]. We used a GIS layer of Williamson Act enrollment up to 2009 (California Dept. of Conservation 2010) to assign lands to 15 classes of planned uses and Williamson Act Program enrollment status and assigned and estimated threat value of 1-100 (100 being highest threat) to each class (Table 9).

Table 9. General plan and easement status-based threat classes.

Threat level	Threat class	Assigned threat value
High	Commercial, Industrial, High density residential	100
	Medium density residential	95
	Urban reserve	90
	Agricultural (non-grazing)	85
	Agricultural (non-grazing), Williamson Act easement	75
	Low density residential	55
Moderate	Low density residential, Williamson Act easement	25
	Other unspecified uses	25
	Very low density residential	25
Low	Other unspecified uses, Williamson Act easement	15
	Very low density residential, Williamson Act easement	15
	Agricultural (grazing)	5
	Open space/public lands	5
	Agricultural (grazing), Williamson Act easement	1
	Open space/public lands, Williamson Act easement	1

In addition to planned land uses we used housing unit density by census blocks from the 2010 census (U.S. Dept. of Commerce 2010) to supplement threats by planned land uses. We assumed that areas with higher current density of housing units would be under greater threat of future development. Cartographic (GIS) files of census blocks with counts of housing units were obtained and converted to an equal area map projection (from latitude/longitude) to calculate the area (acres) of each census block. Housing unit density was then calculated by dividing the number of housing units by the number of acres. We then calculated an estimated threat value of 0-100 with 0 being blocks with no housing units and 100 being blocks with 1 or greater housing unit per acre (100 * housing units per acre with a maximum of 100; Table 10). We combined this with the land use planning-based threat level to create a surface depicting the maximum threat value of each (Figure 24).

Table 10. Threat values and classes based on housing unit density.

Threat level	Threat class	Assigned threat value range
High	0.50 to 1.00 (or greater) housing units per acre	50-100
Moderate	0.25 to 0.50 housing units per acre	25-50
Low	0.00 to 0.25 housing units per acre	0-25

[1] Williamson Act Program - http://www.conservation.ca.gov/dlrp/lca

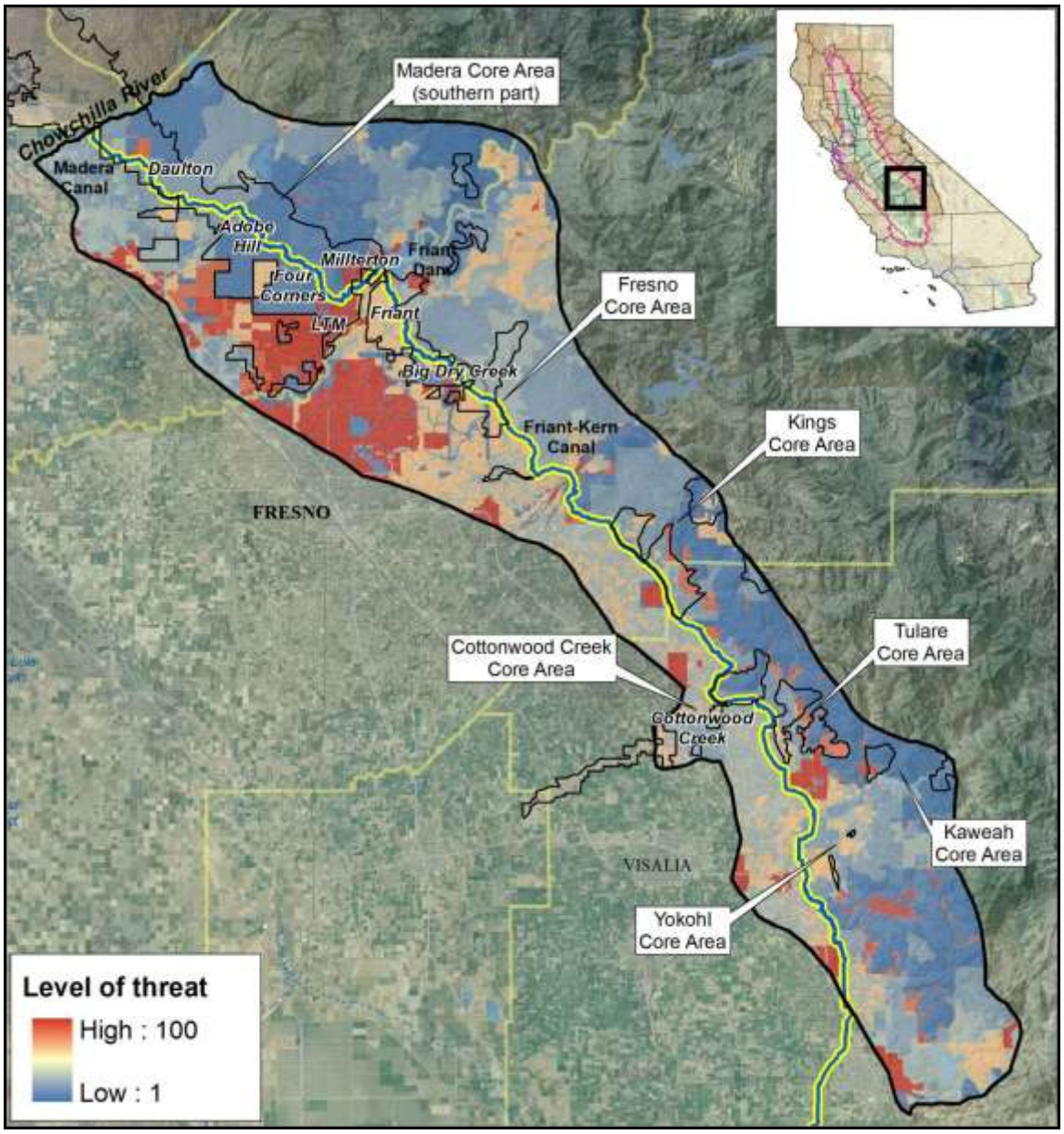

Figure 24. Composite land use planning and housing unit density threat.

Summarization of Habitat Quality/Conservation Priority with Threat Status

To summarize composite habitat quality/conservation priority with landscape threats, we generated a hexagonal surface of 260-hectare (approximately 1-mi^2) planning units using the Nature Conservancy Protected Area Tools for ArcGIS (Schill and Raber 2008). Within each planning unit (zone) we calculated zonal statistics (summarization of a surface for each zone) for the mean level of composite habitat quality/conservation priority and mean level of landscape threat. We subsequently assigned these planning areas into regions for analysis by assigning 70 planning units to the largest six regions

(Daulton, Adobe Hill, Four Corners, Millerton, Friant, Big Dry Creek) and 10 planning units to a smaller, geographically restricted region (Big Table Mountain).

LANDOWNER OUTREACH FOR MONITORING AND HABITAT ENHANCEMENT

Private Land Access

During the course of this project we continued work initiated in 2007 to extend surveys from canal rights of way to adjacent private lands to assess and monitor CTS populations in the region. We used a geographic information system of land parcels in the region of the Friant-Kern and Madera canals to identify assessor parcel numbers (APN) for lands in the Madera and Fresno core vernal pool regions and near the canal rights of way (within 1.5 miles). Parcels with potential CTS habitat were identified to develop a list of 250 APN. Land owner information for each APN was obtained using ParcelQuest web services (http://www.parcelquest.com/) to develop a landowner contact list. We contacted 67 private landowners of 247 parcels within 1.5 miles of the Friant-Kern and Madera canals to request access to lands for sensitive species surveys (Appendix B, Appendix C). We were not able to obtain sufficient contact information for three additional landowners to request access.

Outreach and Planning

San Joaquin Valley Upland Species Recovery Team

Due to overwhelmingly negative response to direct requests for private land access (see *results* and *discussion* sections), we began discussions with federal and state agency partners though the San Joaquin Valley Recovery Team (an advisory group of agency stakeholders to support U.S. Fish and Wildlife endangered species recovery in the San Joaquin Valley). Discussion among agency stakeholders identified a need for a multi-agency discussion forum to identify conservation issues and potential landowner incentives to participate in conservation efforts.

Multi-agency discussion forum

We organized a multi-agency discussion forum (*San Joaquin Valley Pilot Conservation Partnership Project: Vernal Pool Communities of Fresno and Madera Counties*) that took place on August 20th, 2008 at California State University, Stanislaus. The purpose of the discussion forum was to identify incentive programs for habitat protection on private lands and regional conservation planning in the core vernal pool areas of Fresno and Madera counties. Participants in the discussion included personnel from U.S. Fish and Wildlife Service (Kathy Brown, Shannon Holbrook, Susan Jones, Rick Kuyper and Meg Laws), Reclamation (Shauna McDonald, Ned Gruenhagen, Mike Kinsey), California Dept. of Fish and Game (Annee Ferranti, Michelle Selmon, Krista Tomlinson), and the Endangered Species Recovery Program (Patrick Kelly, Scott Phillips). Presentations given during the discussion forum included:

- An overview of the Friant Division and Friant-Kern and Madera canals by USBR SCCAO.
- An overview of vernal pool species and California tiger salamander along the Friant-Kern and Madera canals by ESRP.
- A discussion of regional conservation planning in Fresno and Madera counties by the California Dept. of Fish and Game Central Region.
- Overviews of the Partners for Fish and Wildlife and Save Harbor programs by U.S. Fish and Wildlife Service California and Nevada Regional office.
- A round table discussion by attendees on the potential for a pilot conservation partnership project.

Outreach to resource conservation districts

In addition to direct landowner contact, we coordinated with Bureau staff who contacted resource conservation districts (RCDs, special districts that promote local conservation efforts) in the areas of the Madera and Friant-Kern canals (Figure 25). Shauna McDonald of the Bureau initiated contact with RCDs to explain Reclamation's need for rare species surveys in support of operations and maintenance for water deliveries. RCDs contacted to request involvement in landowner outreach included the Chowchilla-Red Top RCD and Sierra RCD. Madera RCD was not contacted directly after discussions with a resource conservationist with the district who indicated a high unlikelihood of support for such a project by the RCD (S. McDonald 2008 pers. comm.). Two additional RCDs in Tulare County (Tulare County and Navelencia RCDs) were unable to be reached by phone or by email but were also outside of the areas of CTS detection along the Friant-Kern Canal right of way.

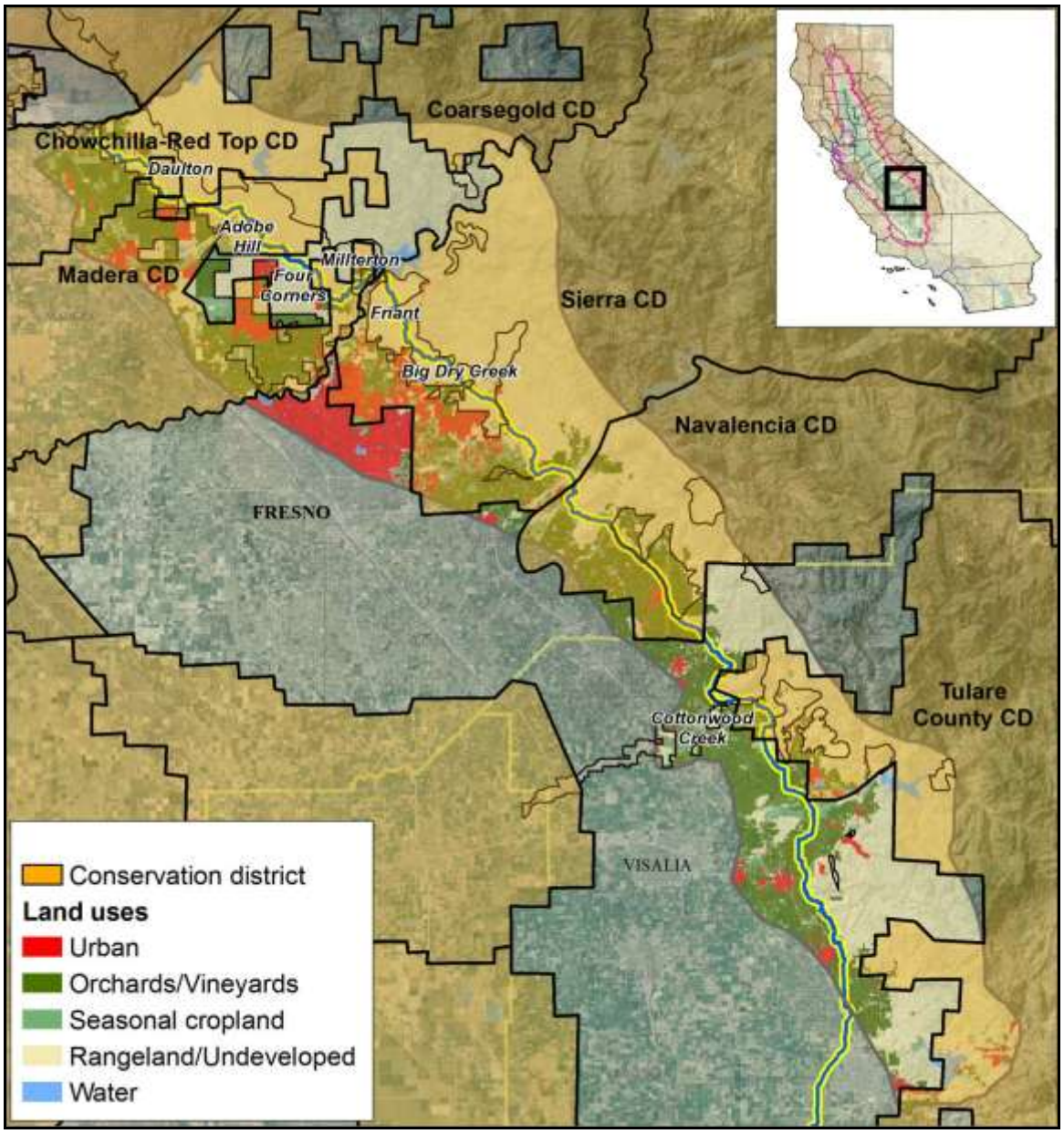

Figure 25. Resource conservation districts near the Madera and Friant-Kern canals.

RESULTS

FIELD MONITORING AND HABITAT ASSESSMENT

California Tiger Salamander Survey

A total of 25 CTS were captured during the pitfall surveys from 2008 to 2010 (Table 11; Figure 26). CTS were captured at 6 out of the 12 pitfall sites and site MAC-R-031.31.1 had the highest number of CTS captured.

Table 11. Number of California tiger salamander captures by date and pitfall array location.

	Number of California tiger salamanders captured						
	Site/Pool (Figure 3)						
Date	FKC-L 013.76.1	FKC-L 012.05.1	MAC-R 014.55.1	MAC-R 029.27.1	MAC-R 031.31.1	MAC-R 034.09.1	Total
2008-02-20	-	-	-	-	1	-	**1**
2008-05-22	-	-	-	-	1	-	**1**
2008-05-23	-	-	-	-	2	-	**2**
2008-06-04	-	-	1	-	-	-	**1**
2008-06-06	-	-	1	-	-	-	**1**
2009-01-22	-	-	-	1	-	-	**1**
2009-02-09	1	-	1	-	-	1	**3**
2009-02-13	-	-	-	-	1	-	**1**
2009-02-17	-	-	-	-	-	1	**1**
2009-02-18	-	-	-	-	1	-	**1**
2009-02-24	-	-	-	1	-	-	**1**
2009-12-12	-	-	-	1	-	-	**1**
2010-01-13	-	1	1	1	1	-	**4**
2010-01-18	-	-	-	1	1	-	**2**
2010-01-19	-	-	-	-	1	1	**2**
2010-02-06	-	1	-	-	-	-	**1**
2010-02-27	-	-	-	1	-	-	**1**
Total	**1**	**2**	**4**	**6**	**9**	**3**	**25**

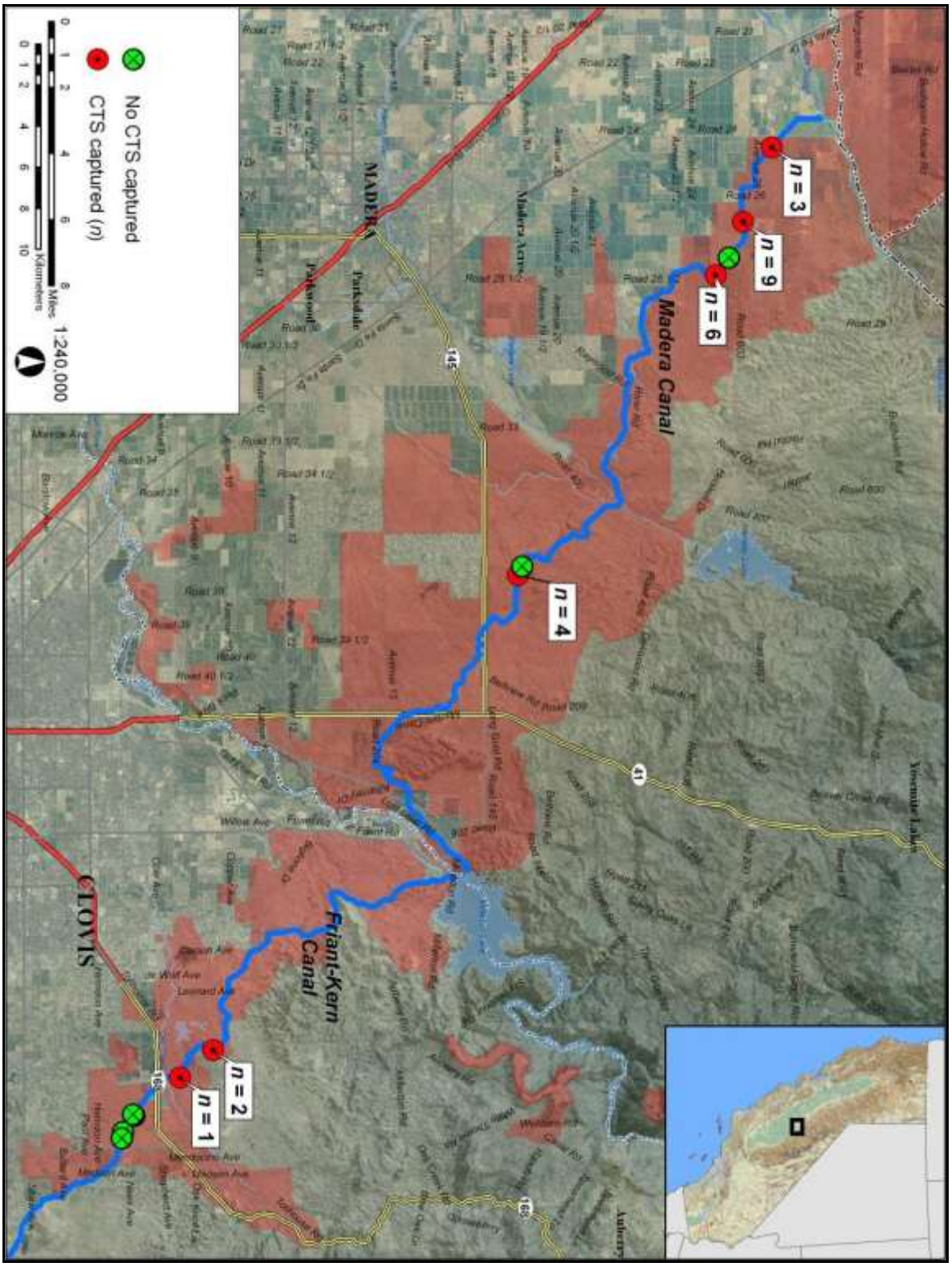

Figure 26. Number of California tiger salamander captures at each pitfall array.

Habitat Assessment

We assessed habitat quality along rights-of-way and adjacent, privately-owned lands at 34 sites along the Friant-Kern Canal (between Academy Ave. and near Auberry Rd.) and Madera Canal (from Friant Dam to the Chowchilla River). Of the 34 sites, 13 were ranked as high quality (8 to 10), 18 sites were ranked as medium quality (6 to 7), and 3 sites ranked as low quality (1 to 5; Table 12). Assessments at each site represent conditions for patches of habitat visible from the site that can range in size from 2 to 100 acres.

Table 12. Habitat rankings of field-based assessment sites (Figure 27).

Highly-ranked sites	Rank	Medium-ranked sites	Rank	Low-ranked sites	Rank
MAC-R-029.27.1	8	MAC-R-034.09.1	6	MAC-R-005.66.1	5
FKC-L-012.19.1	8	MAC-R-031.31.1	7	MAC-L-025.75.1	3
FKC-L-015.68.1	8	MAC-R-029.98.1	6	FKC-L-013.26.1	5
FKC-L-011.39.1	8	FKC-L-012.05.1	6		
MC497	9	FKC-L-013.76.1	6		
MC595/MAC-L-004.20.1	9	MAC-R-014.89.1	6		
MAC-R-007.33.1	8	FKC-R-015.68.2	6		
MAC-R-013.24.1	8	FKC-L-016.48.1	6		
MAC-R-014.89.1	9	FKC-L-016.29.1	7		
MAC-L-015.64.1	9	FKC-L-010.24.1	7		
MC284	8	MAC-L-007.79.1	6		
MC384	8	MAC-L-009.50.1	6		
MAC-R-021.94.1	8	MC239	7		
		MC365	7		
		MAC-L-028.28.1	6		
		MAC-R-015.39.1	6		
		FKC-L-003.73.1	6		
		FKC-L-002.83.1	6		

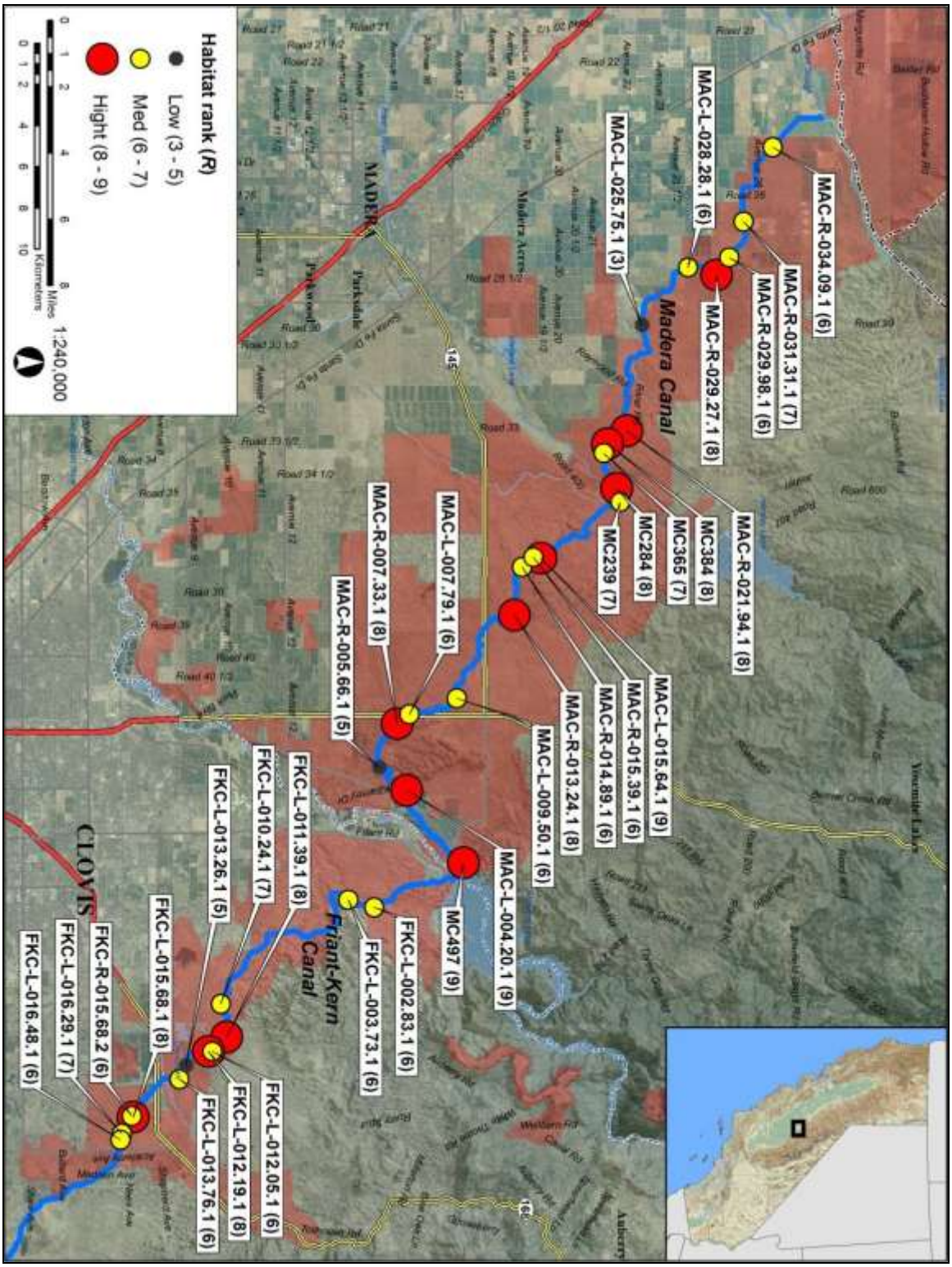

Figure 27. Habitat ranking by field site.

GEOGRAPHICAL ANALYSIS

Results of our additive model of habitat quality and recovery conservation priority rankings are presented in Figure 28 and Table 13. Areas with highest ranking habitat scores include the Four Corners, Millerton, and Big Table Mountain areas in Madera County and the adjacent Friant area in Fresno County (Figure 28). Additional areas with large blocks of moderately-high ranking habitat scores include the Daulton area of Madera County and the Big Dry Creek area of Fresno County. Areas of highest ranking habitat scores in smaller blocks are found in the Cottonwood Creek area in Tulare County (Figure 28). Results of our model of landscape threats are presented in Figure 29.

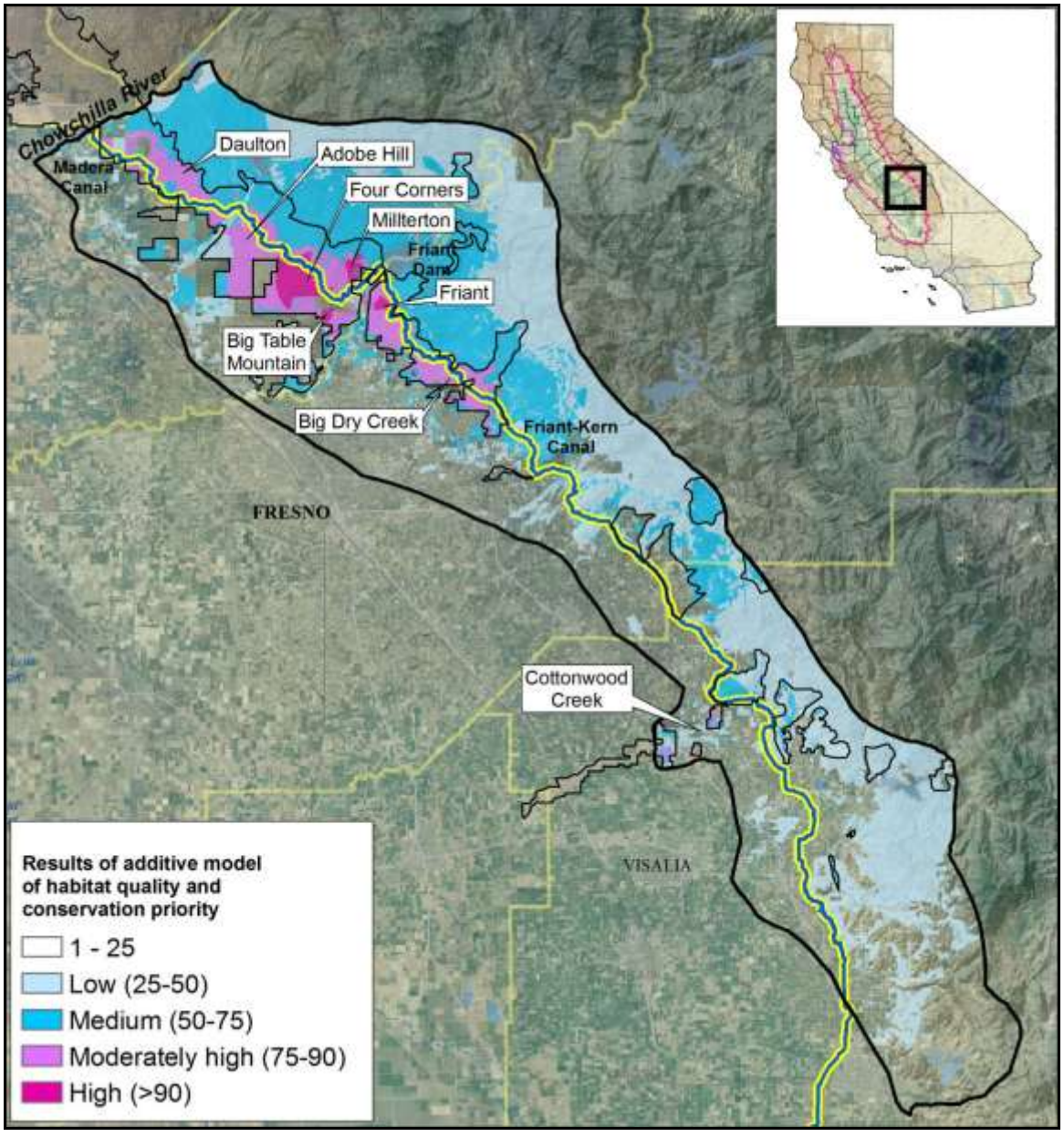

Figure 28. Result of additive model of habitat quality and recovery conservation priority rankings divided into five classes.

Table 13. Classes of conservation rankings based on habitat quality added with recovery-based conservation priority and the calculated area of each class

Class	Area (km2)	Area (acres)
Very low	1,820	449,729
Low	1,438	355,310
Medium	913	225,716
Moderately high	216	53,457
High	41	10,191

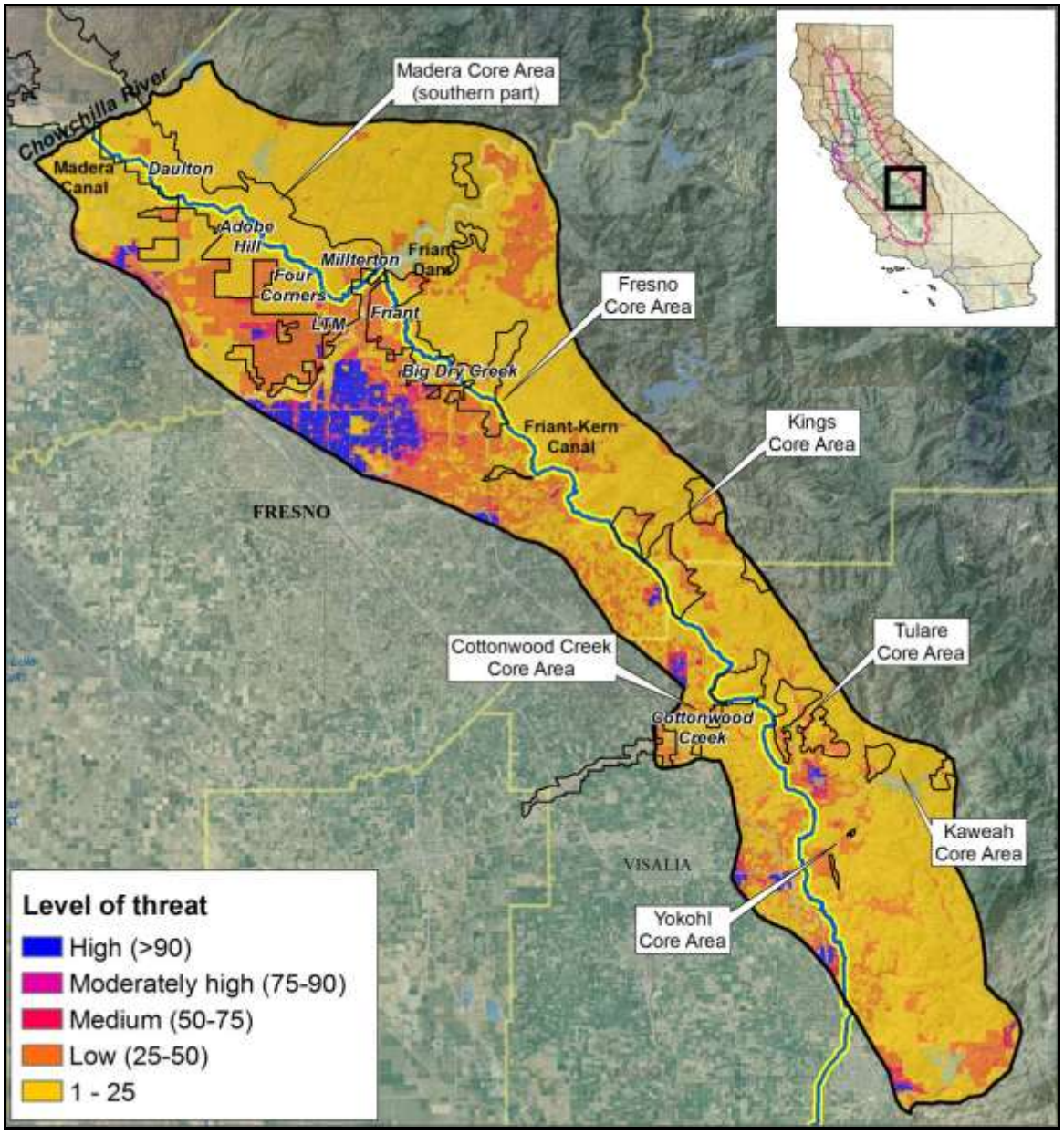

Figure 29. Estimated level of landscape threat by land use zoning, farmland importance, and population density in five categories.

Summarization of Habitat Quality/Conservation Priority with Threat Status

A summary of habitat quality/recovery conservation priority rankings and landscape threat levels by 260-hectare planning units is presented in Figure 30. Areas of analysis in northern Fresno County and Madera County with the highest conservation value are shown in Figure 31. Planning units assigned to the Four Corners region had the highest amount of high-quality habitat and greatest number of species occurrence records (Table 14, Table 15)

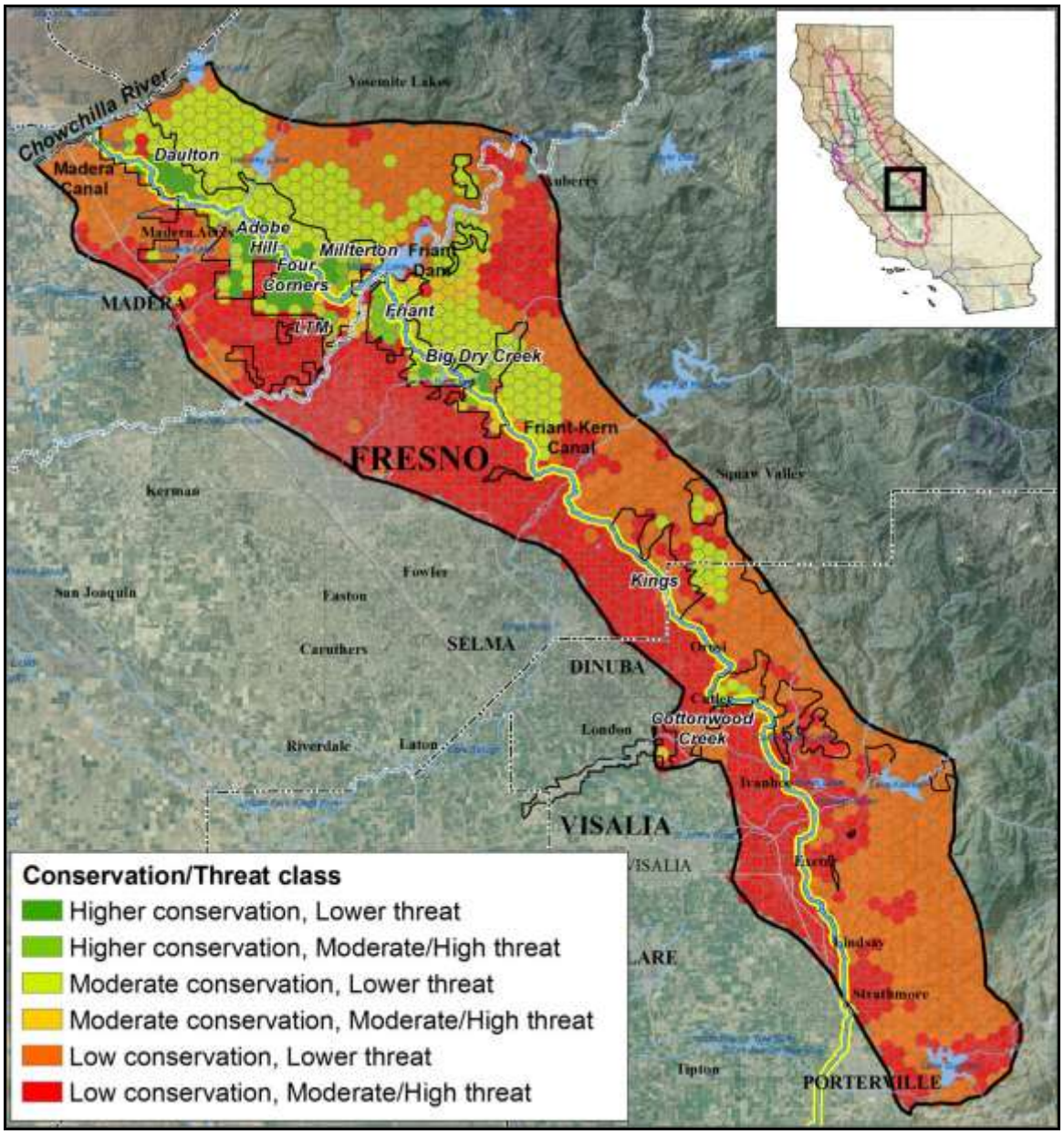

Figure 30. Summarization of habitat quality/conservation priority and landscape threat by generated 260-hectare planning units.

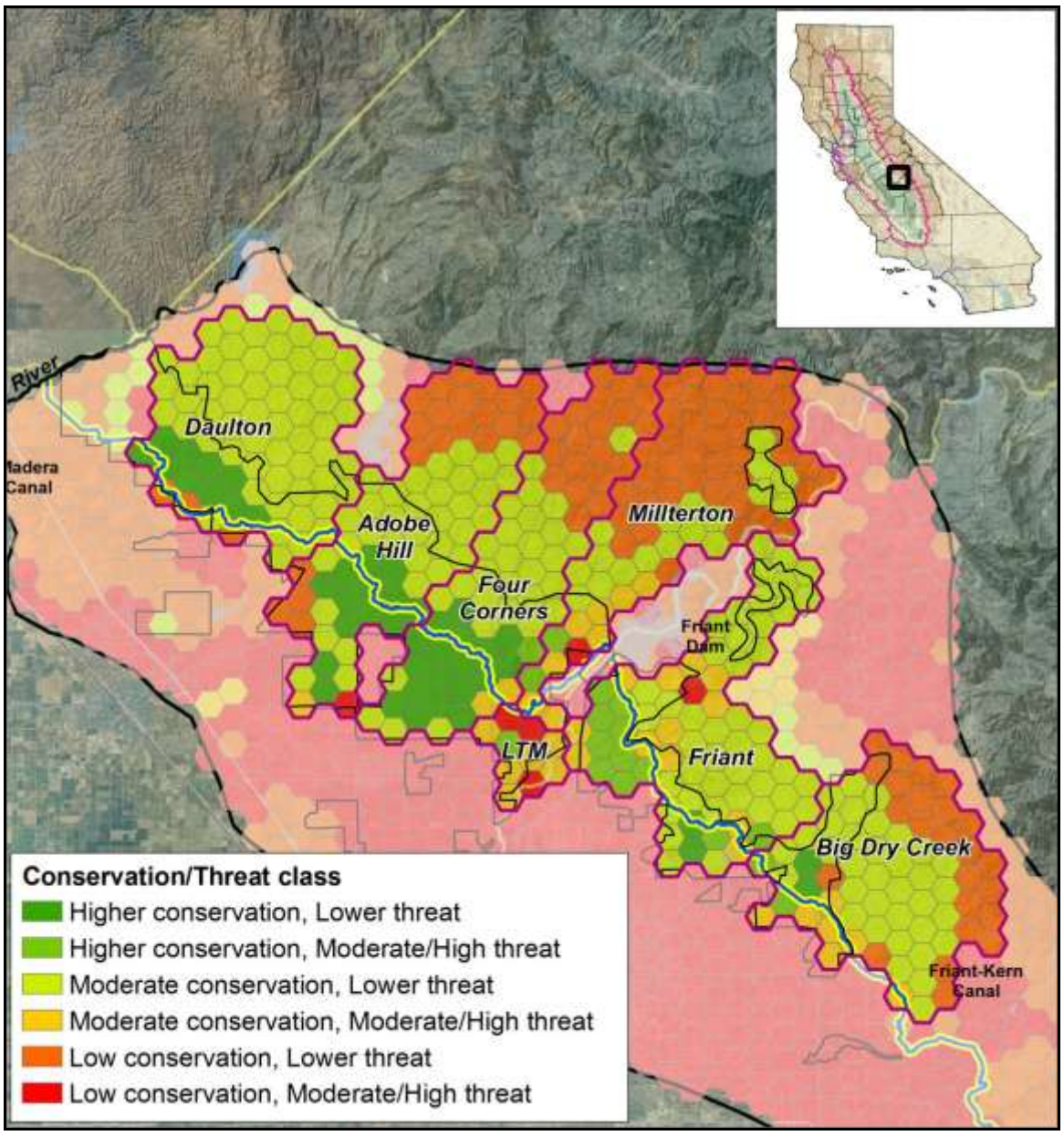

Figure 31. Hexagonal 260-hectare planning units in the Madera and Fresno Core Areas assigned to seven sub-regions for analysis.

Table 14. Summary of areas in five classes of habitat quality/conservation priority by region.

	Acres of habitat quality/conservation priority class					
Region	High (> 90)	Moderately high (75-90)	Moderate (50-75)	Low (25-50)	None/Very low (< 25)	Total
Daulton	15	9,565	32,444	1,046	1,902	44,973
Adobe Hill	36	11,896	18,812	13,374	754	44,872
Four Corners	7,328	7,642	19,912	9,091	902	44,876
Millerton	982	1,684	18,171	22,655	1,112	44,604
Little Table Mountain	533	2,096	1,611	309	1,876	6,425
Friant	646	9,482	32,430	1,089	1,326	44,973
Big Dry Creek	431	3,934	26,279	13,340	990	44,973
Other	227	7,190	75,629	286,552	428,043	797,641
Total	10,198	53,488	225,289	347,455	436,906	1,073,337

Table 15. Summary of species occurrence records by region.

Occurrence Class	Common Name	Daulton	Adobe Hill	Millerton	Four Corners	Little Table Mountain	Friant	Big Dry Creek	Other
CTS	California tiger salamander	20	12	9	9	7	24	19	36
VP inverts	California linderiella	34	4		26	1	14	19	15
	midvalley fairy shrimp				1		2		
	vernal pool fairy shrimp	15	6	1	24	14	22	16	39
	vernal pool tadpole shrimp						6		11
VP inverts Total		**49**	**10**	**1**	**51**	**15**	**44**	**35**	**65**
VP plants	Boggs Lake hedge-hyssop			3			7		
	hairy Orcutt grass	2	1			1			7
	Hoover's spurge								11
	San Joaquin Valley Orcutt grass	1		2	2	1	6		4
	spiny-sepaled button-celery				2		1		24
	succulent owl's-clover	2		5	2	2	10	1	4
	vernal pool smallscale								1
VP plants Total		**5**	**1**	**10**	**6**	**4**	**24**	**1**	**51**
VP Community	Northern Basalt Flow Vernal Pool						9		
	Northern Claypan Vernal Pool								4
	Northern Hardpan Vernal Pool	1	1		3	1	1	2	10
VP Community Total		**1**	**1**		**3**	**1**	**10**	**2**	**14**
Other herps	western pond turtle		1	2	3		1	1	8
	western spadefoot	10	2	3	19	9	6	13	26
Other herps Total		**10**	**3**	**5**	**22**	**9**	**7**	**14**	**34**
Other plants	Hartweg's golden sunburst			1			3		
	San Joaquin adobe sunburst							4	18
Other plants Total				**1**			**3**	**4**	**18**
Grand Total		**85**	**27**	**26**	**91**	**36**	**112**	**75**	**218**

LANDOWNER OUTREACH FOR MONITORING AND HABITAT ENHANCEMENT

Private Land Access

Seventy-six private landowners of 247 parcels within 1.5 miles of the Friant-Kern and Madera canals were contacted to request access to lands for sensitive species surveys

(Appendix B, Appendix C). We were not able to obtain sufficient contact information for three additional landowners to request access. Of the 247 parcels, access was granted to three parcels. Landowners for additional parcels either allowed limited access (no pitfall trapping) or did not allow access at the time of request but left open the potential for future access (Table 16, Figure 32).

Table 16. Summary of landowner contact results

Response to access request	Number of parcels
No response to request	187
No access granted	57
Access granted	3
Limited access	1
Possible access	1

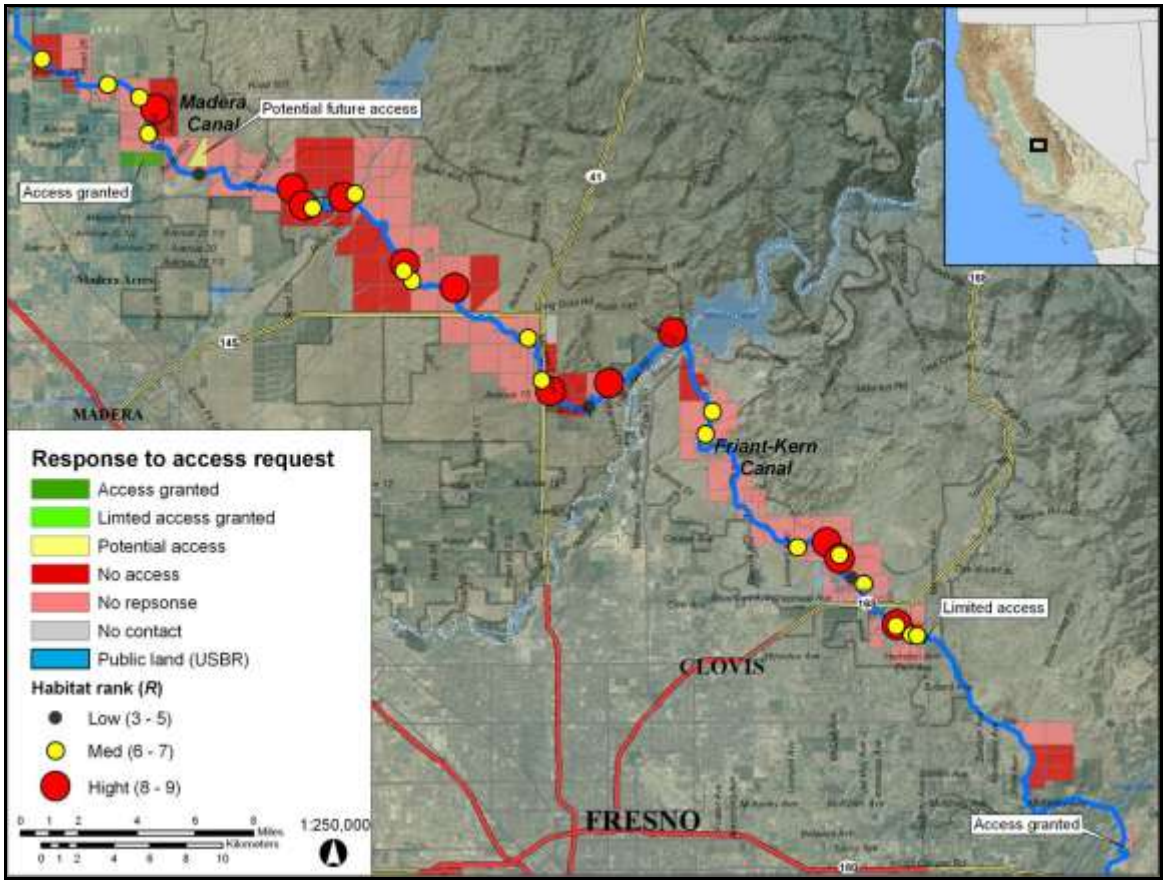

Figure 32. Private landowner response to access requests.

Access was granted to a block of two parcels near the Madera Canal (FJ Venture). While the property appeared to have historically supported vernal pools (topography, Figure 33), it is currently developed with vineyards and orchards. Some remnant depressions with standing water were sampled and were dominated by vernal pool insects such as water mites, water boatmans (*Corixa sp.*), seed shrimp, diving beetles and Pacific tree frogs

(*Hyla regilla*; adults, eggs, and larvae observed). This property was considered a poor conservation target due to incompatible land use and apparent lack of target species.

Figure 33. Vineyard and inundated area in a low relief on accessed property near the Madera Canal.

On a second parcel of rangeland near the Madera Canal, access was not allowed at the time of surveys but also not excluded for the future (*potential access*, Figure 32). However, habitat conditions (as measured from the canal right of way) for this property were among the lowest ranked during habitat assessment surveys (*Rank* = 3; Figure 27, Figure 32) due to high levels of ground disturbance and proximity to developed land uses (rural residential and permanent crops).

Limited access was granted to a block of two parcels on the Friant-Kern canal near Herndon Avenue. Access was limited to site visits and we were not permitted to install pitfall arrays to sample and monitor potential CTS. The site itself was not suitable for CTS monitoring due to its topography (steep slope), which minimized pooling necessary to provide CTS breeding habitat. Access was granted along the Friant-Kern Canal at a fourth location which likewise lacked suitable habitat.

In March of 2008 we were granted permission to access an additional property (Hollowell Ranch) outside of the immediate area of canal rights of way and conduct surveys for CTS. The ranch, which is currently protected by a conservation easement, was found to have CTS in a deep stocking pond.

DISCUSSION

FIELD MONITORING AND HABITAT ASSESSMENT

California Tiger Salamander Surveys

In 2004, a total of 380 vernal pools were documented along both the Friant-Kern Canal and Madera Canal (Tomlinson et al. 2007a, 2007b). From 2004 to 2007, 19 of the 380 vernal pools were discovered to be inhabited by CTS, and in 2008, 12 vernal pools from the 19 with CTS were selected to be installed with pitfall arrays. Placement of the pitfall arrays was limited to the right of way, which was sometimes only as wide as 1.5 m. Some of the available sites for pitfall installation along the right of way were very narrow, located next to ditches, or on top of steep inclines, which could have contributed to CTS being captured at only half (6 out of 12) of the vernal pools with pitfalls. This limited access to the vernal pools was due to the land owners denying access and placement of any materials on their private property in 2007. Site FKC-R-015.68.2 (Table 12, Figure 3, Figure 6) is a good example of this situation. The available right of way where the pitfall arrays were placed is about 1.5 meters up an almost 90° slope at the eastern end and 2.5 meters above the pool at the western end with a similar slope. During pitfall surveys from 2008 to 2010, no CTS were captured at site FKC-R-015.68.2, but CTS larvae and post-metamorphs were previously documented during a dip net survey of an on-site vernal pool.

Pools with captures were typically larger pools extending onto adjacent lands and very few captures were near pools limited to narrow rights of way. Other studies have reported similar observations (Pittman 2005) regarding shape and size of pools. Typical pools with CTS captures were likewise not located near tops of steep slopes, next to ditches or within the narrowest sections of rights of way.

Low CTS captures in some areas may be due to disturbance on adjacent lands, particularly disking or plowing of rangeland noted during habitat assessments. These activities can degrade upland habitat CTS depend on during the non-reproductive months of the year (which is most of the year). Not only is habitat destroyed or degraded but CTS can be directly killed as well. For example, site MAC-R-029.98 (Figure 3, Figure 4) is located along the Madera Canal right of way with a pool extending into adjacent private land. The area of the pool was disked in late December 2009 and appeared to have signs of disturbance indicating previous, similar ground disturbance. The lack of CTS captured during pitfall surveys (2008 to 2010) at this vernal pool might be attributed to the plowing. This vernal pool (MAC-R-029.98.1) has been documented with CTS in the past and is also located about 1 mile from vernal pool pitfall array MAC-R-031.31.1, where the largest number of CTS was captured and which does not appeared to have been plowed. Plowing of CTS habitat continues to be a concern.

California tiger salamander pitfall surveys at vernal pools along both the Friant-Kern Canal and Madera Canal was restricted to a thin strip of disturbed habitat. This limited area for surveys can provide some information on how CTS use of the rights-of-way but not enough to assess the overall health and size of the local CTS population. A key

concern in these areas is disturbance to habitat on adjacent private lands (plowing, construction, cultivation, and pesticide and herbicide control) and its impact on vernal pools, and adjacent uplands that are essential to the survival of any local CTS population.

Habitat Assessment

None of the sites assessed along the Friant-Kern and Madera canals were found to be in pristine condition and all had some form of visible human disturbance (surface disturbance, rural residential housing). With that in mind, we developed a relative ranking system using criteria from the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005a) and additional CTS-specific studies (Marsh et al. 2004, Porej 2004, Pyke 2004, Trenham 2000, 2001, 2005, Searcy 2007, Semlitch 2000). Without access to adjacent private properties, our assessments were limited to remote observation from canal rights of way.

We categorized sites along the canals into three classes (*high*, *medium* and *low*), with habitat size, level of disturbance and threat, quality of vernal pools, and presence or absence of California tiger salamander as the key factors separating classes. Sites in medium to high classes had fewer threats from disturbance and larger blocks of habitat. For example, the areas near one site (*MAC-R-014.55.1;* Figure 27) was ranked as *high* due to lack of immediate human threats (i.e., cultivation or development), presence of CTS, and the presence of a large (~460m x ~910m), contiguous pool which was hemmed in by rolling hills. By contrast, the three sites ranked as *low* (Table 12, Figure 27) had greater levels of disturbance in the immediate area and were among locations without CTS captures despite focused surveys and pitfall trapping.

Geographical Analysis

The Madera Canal, and to a lesser extent, the Friant-Kern Canal also coincide with and thread through the base of the Sierra Nevada foothills where best quality vernal pool complexes remain (Figure 10, Figure 11, Figure 12). Due to habitat quality and presence of listed vernal pool species, they also adjoin areas with the highest number of overlapping critical habitats and the highest priority recovery core areas (Figure 22, Figure 23).

Madera Core Area, Southern Part

Adobe Hill, Four Corners, Millerton, Little Table Mountain Areas

The highest concentration of higher-ranked and higher priority habitat falls along the Madera Canal between Millerton Lake and the Fresno River (Figure 34, Figure 35, Figure 36, Figure 37) with a particularly large block of highest-ranked habitat in the Four Corners area, southwest of Highways 41 and 145 and other blocks of highest-ranked habitat near the Millerton/Little Table Mountain areas.

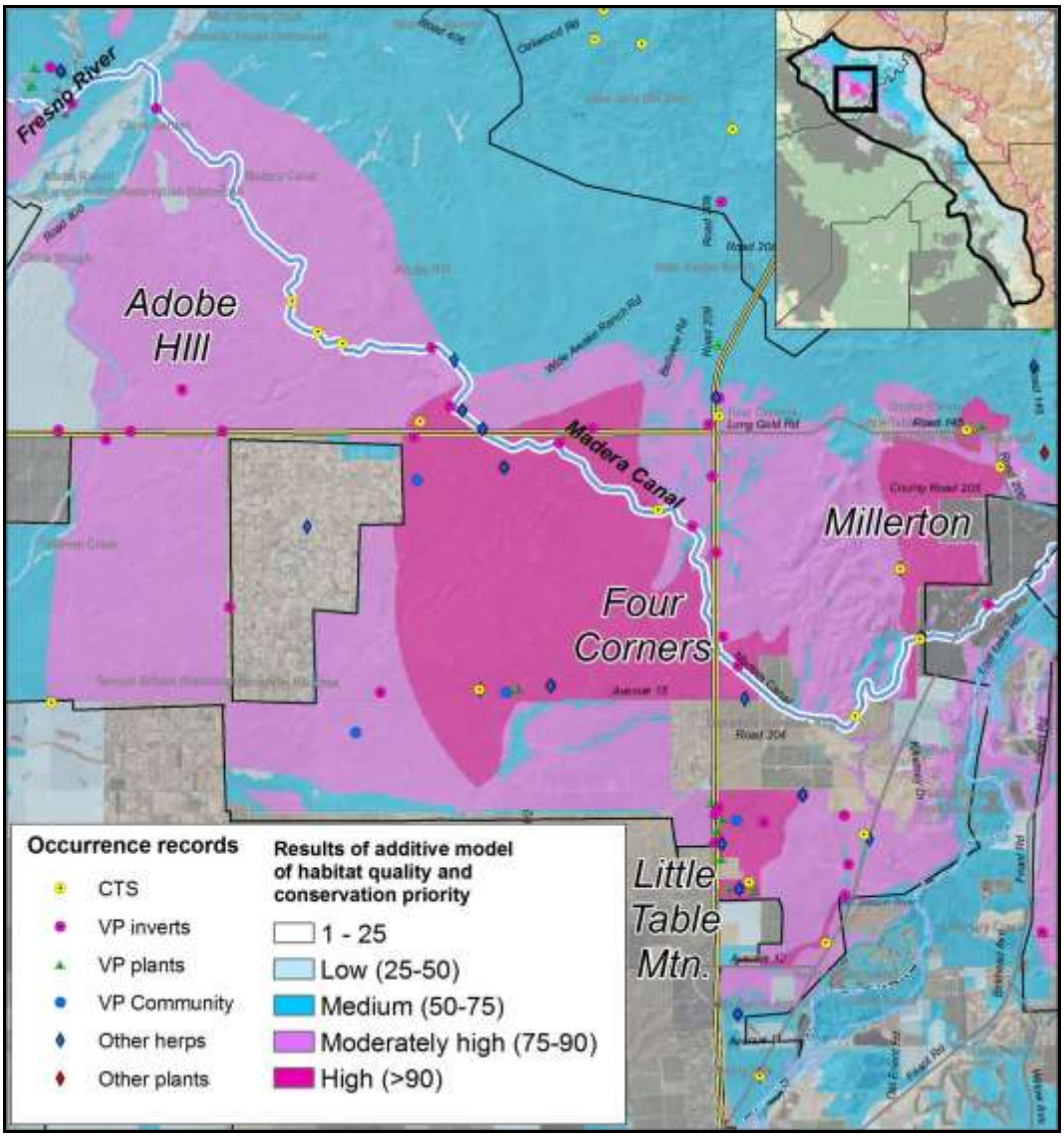

Figure 34. Result of additive model of habitat quality and recovery conservation priority rankings and sensitive species occurrence records in the Adobe Hill, Four Corners, Little Table Mountain, and Millerton areas, southern Madera Core Area, Madera County, California.

Figure 35. Habitat conditions in the Adobe Hill area, southern Madera County Core Area, Madera County, California.

Figure 36. Habitat conditions in the Four Corners area, southern Madera County Core Area, Madera County, California.

Figure 37. Habitat conditions in the Millerton area, southern Madera County Core Area, Madera County, California.

Daulton Area

The Daulton area of the southern Madera County Core Area (Figure 28, Figure 38) contains large blocks of moderately high-ranked, high priority habitat. While much of the former habitat adjacent to the Madera Canal has been converted or degraded by higher intensity agricultural land uses, a number of sensitive vernal pool branchiopods and CTS breeding pools persist along canal rights of way.

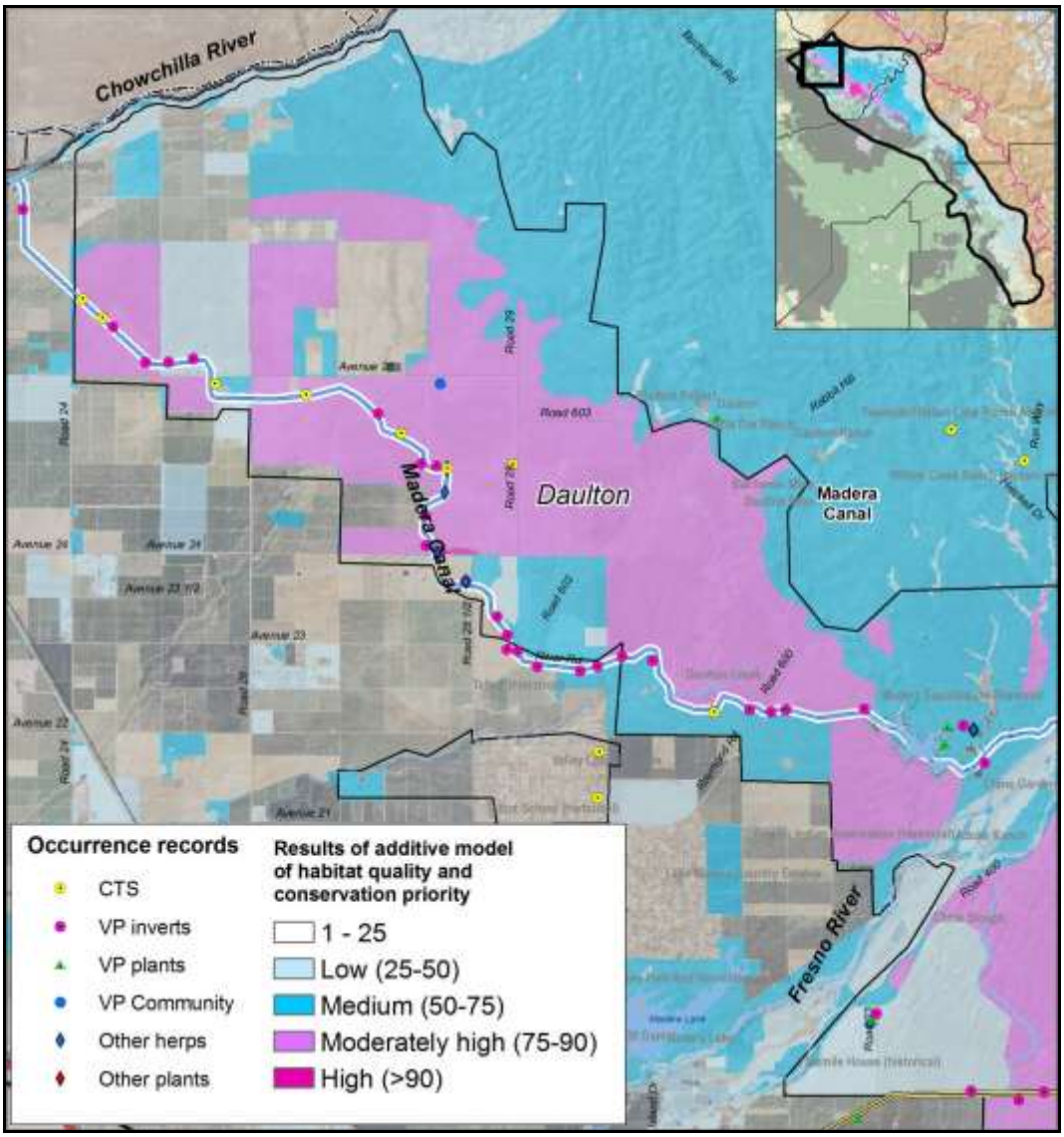

Figure 38. Result of additive model of habitat quality and recovery conservation priority rankings and sensitive species occurrence records in the Daulton area, southern Madera Core Area, Madera County, California.

Figure 39. Habitat conditions in the Daulton area, southern Madera County Core Area, Madera County, California.

Fresno Core Area

Friant and Big Dry Creek Areas

The Fresno Core area including the areas near Friant and Big Dry Creek (Figure 40, Figure 41, Figure 42) share characteristics with the southernmost areas near the Madera Canal (Adobe Hill, Four Corners, Millerton, Little Table Mountain) but contain of the highest-ranked sites for habitat quality and conservation priority. Threats to these areas include development pressure from the Fresno/Clovis metropolitan area and potential development in the area near Friant.

Figure 40. Habitat conditions in the Friant area, Fresno County Core Area, Fresno County, California.

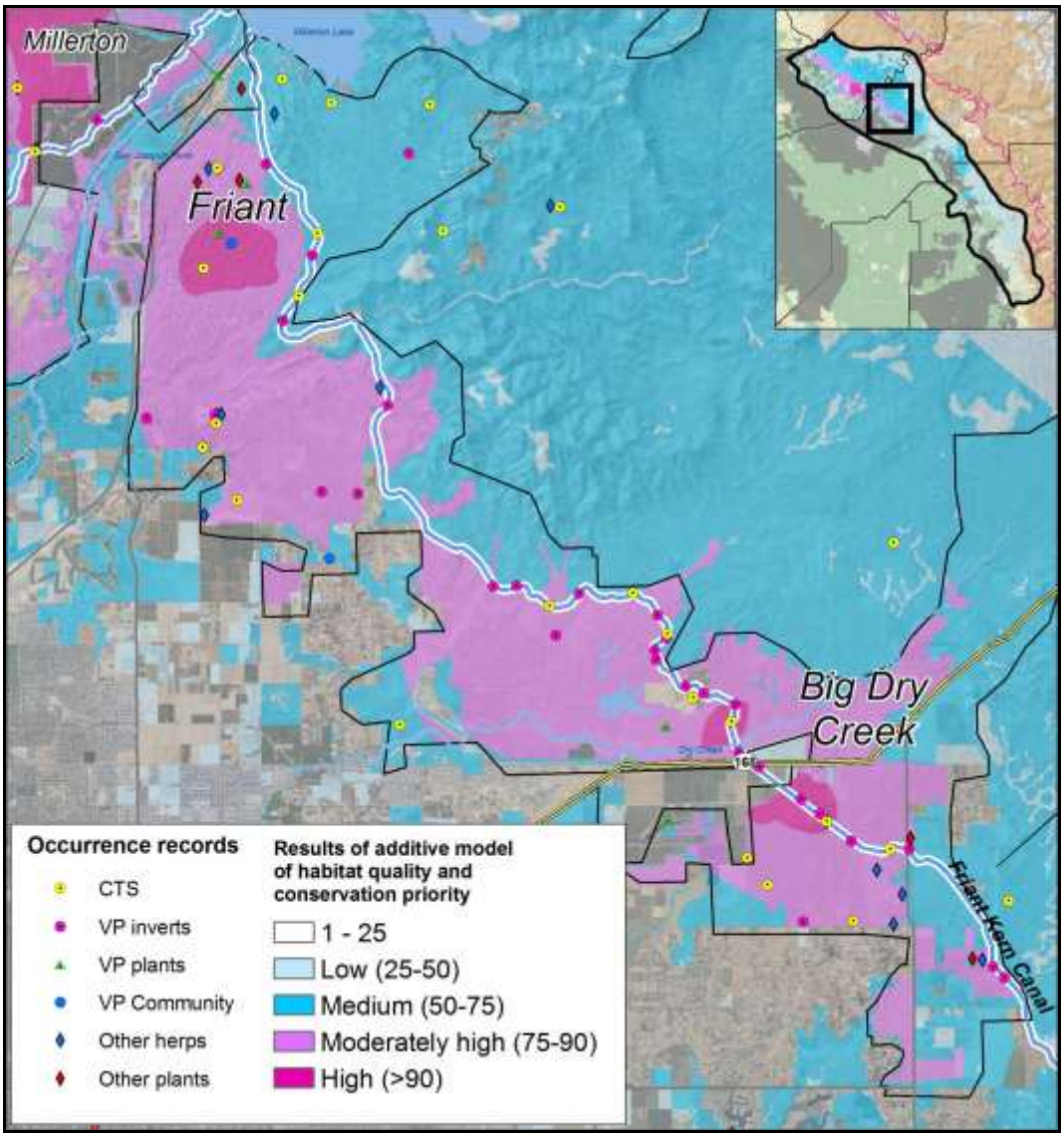

Figure 41. Result of additive model of habitat quality and recovery conservation priority rankings and sensitive species occurrence records in the Fresno and Big Dry Creek areas, Fresno Core Area, Fresno County, California.

Figure 42. Habitat conditions in the Big Dry Creek area, Fresno County Core Area, Fresno County, California.

Other Areas

Cottonwood Creek Area

Outside of the Madera County and Fresno County core areas, small areas of the highest-ranked habitat quality/conservation priority were found off the Friant-Kern Canal in the Cottonwood Creek area, primarily on protected lands at the California Dept. of Fish and Game Stone Corral Ecological Reserve (Figure 43).

Figure 43. Habitat conditions at Stone Corral Ecological Reserve near the Cottonwood Creek area, Cottonwood Creek Core Area, Tulare County, California.

LANDOWNER OUTREACH FOR MONITORING AND HABITAT ENHANCEMENT

A significant issue for this project was access to private lands. Our ability to achieve project goals was predicated on gaining access to private lands adjacent to Reclamation lands. However, despite significant effort by ESRP as well as Reclamation staff, there was little success in obtaining permission to access private lands. In particular, this is significantly inhibited our ability to assess California tiger salamander populations on lands adjacent to Reclamation properties. The lack of cooperation by adjacent landowners also limited the known information on species presence, which is a key consideration in developing an effective conservation strategy for California tiger salamanders and other vernal pool species in the region.

While most (nearly all) targeted private lands with high-quality vernal pool and California tiger salamander habitat lack conservation easements or other protection, most remaining rangeland in the region is under contracts with local government under the California Land Conservation Act of 1965 (Williamson Act) that restrict land use to agricultural or open space (Figure 44). While not providing protections specific to natural resources, such land use restrictions with may help limit habitat loss (or disturbance) though land use change from grazing to more intensive non-agricultural uses.

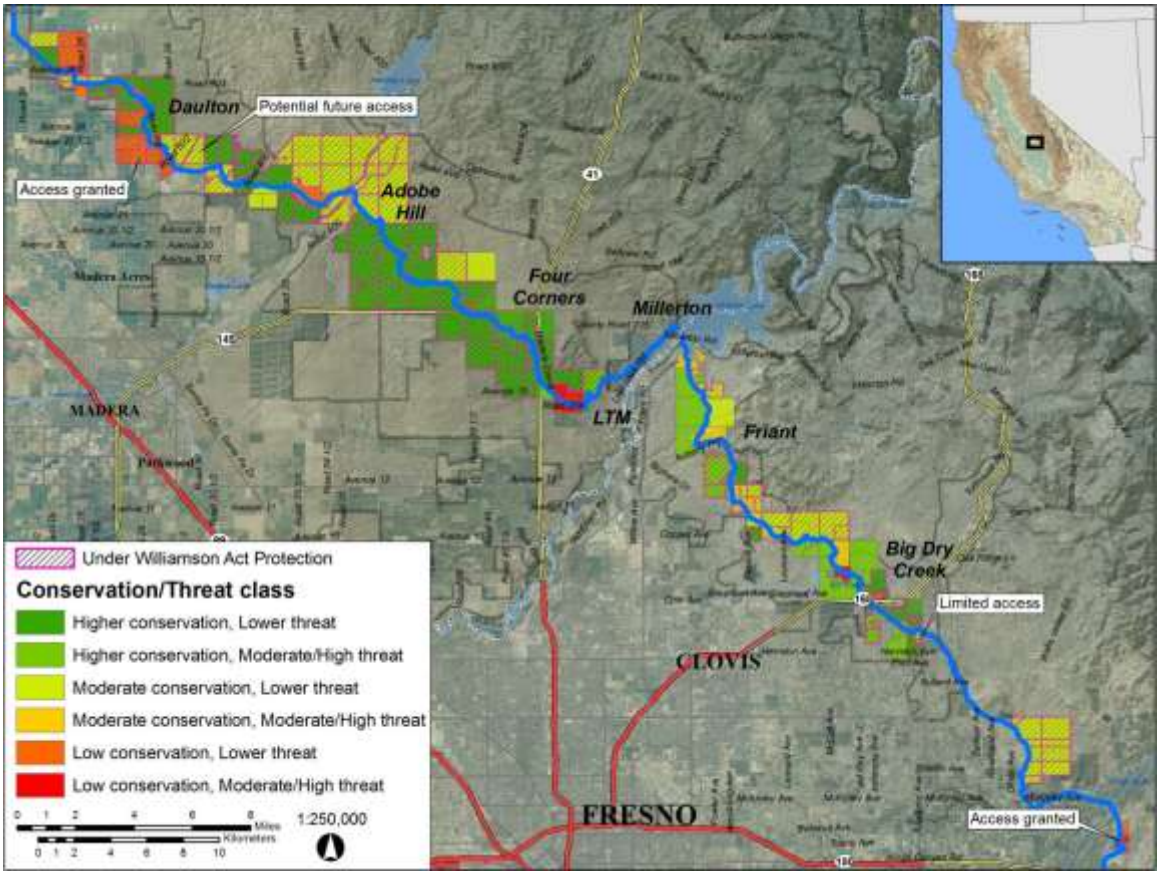

Figure 44. Targeted lands near Friant-Kern and Madera canals with Williamson Act protection status and summarized conservation and threat status.

RECOMMENDATIONS

Recommendations are to adapt Priority 1, 2 and 3 actions from the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Appendix D) that are applicable to the conservation of vernal pool communities as well as California tiger salamanders near the Friant-Kern and Madera canals. Actions specific to Zone 1 core areas (Priority 1) are applicable to most of the Madera Canal and those specific to Zone 2 core areas are applicable to portions of the Friant-Kern Canal, particularly those in northern Fresno County. Priority 3 actions are applicable to habitat outside of a Zone 1 or 2 core area.

Recovery Actions

Conduct standardized vernal pool habitat site assessments for Southern Sierra Foothills vernal pool region (Priority 1 Action 1.3.14)

Standardized vernal pool habitat assessments and surveys have been conducted along Bureau of Reclamation rights of way (Tomlinson et al. 2007a, b) and adjacent sites where permitted. Lack of landowner permission access to private lands outside of the rights of way has been a key issue in completing on-site habitat assessments and has been partially supplemented by visual assessments of adjacent lands from canal rights of way and geographical analysis of habitat conditions in the region. However, additional on-site surveys are necessary to assess species presence and use of adjacent private lands.

Ensure Federal agencies use their authority to protect species occurrences and their vernal pool habitat

Specifically, this task addresses Zone 1 and 2 core areas (Priority 1 Action 1.4.1.1, Priority 2 Action 1.4.1.2) or outside of core areas but within a vernal pool region (Priority 3 Action 1.4.1.4). The level of priority for this task would apply, in order to the Madera Canal area (Priority 1), portions of the Friant-Kern Canal (Priority 2), and other habitats outside of Zone 1 or 2 core areas (Priority 3).

This action would be best achieved by protecting or acquiring large parcels of vernal pool habitat, or for California tiger salamander, upland habitat adjacent to vernal pools (Pyke 2004, Trenham 2001, USFWS 2005b) and that are protected from future threats such as development or cultivation (Semlitsch 2000). Habitat characteristics beneficial to California tiger salamander (CTS) include:

- Interconnected vernal pools (within 700m) that can be considered a CTS metapopulation (Pyke 2005, Searcy 2007, Porej 2004, Trenham 2000, 2001).
- Providing or protecting 700 meter buffer of upland habitat around a single pond for aestivation (Trenham 2005, USFWS 2005b).
- Lack of barriers that can prevent migration and dispersal (Marsh et al. 2000, USFWS 2005b).
- Low road density or reduce road impact by providing safe crossings for CTS (Barry and Shaffer 1994, Pyke 2004, USFWS 2005b, Porej 2004).

- High number of small mammal burrows, which can provide cover, or promote high numbers of small mammal burrows (earthen mounds, no bait station or plowing; Loredo 1996, Searcy 2007, Trenham 2001).

Ensure Federal agencies conduct interim habitat management and develop or improve existing management and monitoring plans

Specifically, this task addresses interim habitat management and plan development for Zone 1 and Zone 2 core areas (Priority 1 Actions 2.1.1.1/ 2.3.2.1, Priority 2 Action 2.1.1.2/2.3.2.2) and habitat outside of core areas within the Southern Sierra Foothills vernal pool region (Priority 3, Actions 2.1.1.4/2.3.3.1). We offer the following recommendations for habitat management for vernal pool communities and California tiger salamander near canal rights of way.

Habitat management recommendations for California tiger salamander

CTS populations have declined primarily due to habitat loss, fragmentation, and degradation associated with land use conversion from rangeland to urban or intensive agricultural use (USFWS 2004). Additional threats include introduction of non-native predators, reduction of ground squirrel populations (and their associated burrows needed by CTS) through widespread rodent control; vehicle strikes of dispersing individuals, and deformity causing parasites (Fisher and Shaffer 1996, Shaffer et al. 1993, and Zeiner et al. 1988). The primary management recommendation would be actions to deter future habitat loss due to land use change where possible. Additional suggestions to protect breeding areas, refugia, migratory routes, and adjacent upland areas include:

1. Distribute maps of CTS breeding pools to canal maintenance staff to avoid alteration or disturbance of known breeding pools.
2. Where possible, assist adjacent landowners in safe land management practices to ensure that the integrity of pools shared with rights of way and their adjacent uplands will be maintained.
3. Work with local mosquito abatement districts to ensure that methods of treatment in CTS breeding pools do not include introduction of mosquito fish (*Gambusia affinis*), and/or other harmful methods that could impact adult and larval salamanders.
4. Minimize rodent control in areas of vernal pools to avoid reducing burrows that provide refugia to CTS.
5. Avoid infrastructure designs or habitat modifications that would block or restrict movements of migrating CTS.
6. Periodically monitor known CTS breeding pools to make sure pond inundation is not hindered by canal maintenance, adjacent land use activities or water theft.
7. Avoid major soil disturbances in vernal or ephemeral pools that are known to, or have some likelihood of harboring sensitive vernal pool species.

8. Conduct focused investigations on water quality in vernal pools located in agricultural interface – particularly for those known or suspected to provide CTS breeding habitat.

Habitat management recommendations for vernal pool branchiopods

Branchiopods such as vernal pool fairy shrimp (*Branchinecta lynchi)*, California fairy shrimp (*Linderiella occidentalis*) and California clam shrimp (*Cyzicus californicus*), occur in and near canal rights-of-way and have, like other vernal pool-associated species, declined due to habitat loss and fragmentation. Although adapted to survive in inundated soil for extended periods of time, populations that irrupt in degraded pools lack critical elements to sustain long-term viability. Habitat management recommendations for vernal-pool obligate branchiopods include:

1. Distribute maps of sensitive branchiopod populations and vernal pool habitats to canal maintenance staff to avoid alteration or disturbance of pools or adjacent habitat.
2. Conduct focused investigations on water quality in vernal pools located in agricultural interface.
3. Protect vernal pool water quality by diverting run-off from adjacent agricultural fields (so it doesn't empty into pools).
4. Provide outreach and, if possible, incentives to adjacent landowners to protect vernal pools shared with canal rights of way.
5. Work with local mosquito abatement districts to identify vernal pools containing sensitive species to ensure that insect control methods are safe for sensitive species or the pools can be avoided.

Habitat management recommendations for vernal pool-associated or other rare plants

Vernal pool and grassland vegetation in and near canal rights-of-way has been lost or degraded by initial canal construction, canal maintenance activities, agricultural run-off, and artifacts of canal construction (i.e., prolonged periods of inundation particularly on the east side of the canal, hindrance of seed dispersal, etc.). Native vegetation that persists and is dependent on ephemeral pools and adjacent upland can be valuable resources and contribute to conservation efforts in the San Joaquin Valley.

Continued grazing on adjacent lands is likely critical to the persistence of vernal pools (and associated species) in near canal rights-of-way. Changes to grazing in adjacent parcels could contribute to loss of species diversity while increasing competition from non-native plants. Outreach to adjacent landowners on incentive programs to keep lands as grazed rangelands could provide benefits to sensitive species within rights-of-way.

Other recommendations for vegetation management within rights of way include:

1. Restrict pesticide (herbicide) use in and around ephemeral pool margins while applying pesticides to roads and noxious weeds only.
2. Assist adjacent land owners by providing recommendations for grazing regimes to adjusting timing of grazing to maximize *Orcuttia* fruiting periods.

3. Provide outreach, or where possible incentives, for adjacent land owners to keep lands as grazed rangeland.
4. Where feasible, conduct vegetation restoration efforts in the right-of-way to maintain connectivity between natural lands, which will enhance seed dispersal and genetic diversity of populations.
5. Fence vegetated stream areas to enhance riparian vegetation and corridors to minimize erosion and overgrazing from cattle.

Ensure Federal agencies implement long-term, comprehensive habitat management and monitoring plans

Specifically, this task addresses habitat management and monitoring for Zone 1 and Zone 2 core areas (Priority 1, 2 and 3 Actions 2.3.3.1.1-3). While the location of pools with sensitive branchiopods (and other species) has been documented (Tomlinson et al. 2007a, b), comprehensive habitat management and monitoring plans should include continuing and regular monitoring efforts. In addition to adding to what is currently known about sensitive species distribution, monitoring efforts, more importantly, are needed to adaptively manage pools or adjacent habitat under changing conditions. In addition to sensitive branchiopods, we recommend additional monitoring for sensitive species and other sensitive plants including:

1. Annual winter surveys for migrating adult CTS to help locate additional breeding pools.
2. Annual winter and early spring CTS vehicle mortality searches on surrounding roads following evenings of heavy rain to obtain genetic samples.
3. Annual monitoring efforts for larval and dispersing CTS.
4. Long-term population studies incorporating the surveys for all life stages to evaluate demography of CTS in Madera and Fresno counties.
5. Focused investigations on water quality in CTS breeding pools.
6. An assessment of all vegetation communities in canal rights-of-way to provide thorough documentation of natural resources and assist in mapping efforts.
7. Vegetation sampling in and around vernal pools.
8. Focused surveys for rare plant species including *Pseudobahia bahiifolia*, *Tuctoria greenei*, and *Orcuttia pilosa*.
9. Submission of findings of sensitive animals, plants, and communities to the California Dept. of Fish and Game California Natural Diversity Database (CNDDB).

REFERENCES

Barry, S. J., and H. B. Shaffer. 1994. The status of the California tiger salamander (*Ambystomacaliforniense*) at Lagunita: A 50-year update. Journal of Herpetology 28: 159-164.

California Dept. of Water Resources. 2010. Land use data. URL: http://www.water.ca.gov/landwateruse/lusrvymain.cfm

California Dept. of Conservation. 2008. Farmland Monitoring and Mapping Program. URL: http://www.conservation.ca.gov/dlrp/fmmp

California Dept. of Conservation. 2010. Williamson Act Data. URL: ftp://ftp.consrv.ca.gov/pub/dlrp/WA/

California Resources Agency/University of California Davis. 2004. General Plans Rural (genplans_rr). California Resouces Agency, Legacy Project, Sacramento, CA. URL: http://projects.atlas.ca.gov/frs/?group_id=42

Fisher, R. and H. B. Shaffer. 1996. The Decline of Amphibians in California's Great Central Valley. Conservation Biology, 10: 1387-1397.

Holland, R.F. 1998. Great valley vernal pool distribution, photorevised 1996. Pages 71-75 *in*: C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferren Jr. and R. Ornduff, editors. Ecology, Conservation, and Management of Vernal Pool Ecosystems—Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, CA.

Holland, R.F. 2005. California's Great Valley Vernal Pool Habitat Status and Loss: Photorevised 2005. Report prepared for the Placer Land Trust. URL: http://www.vernalpools.org/vpreports/Great%20Valley%20Vernal%20Pool%20Distribution_Final.pdf

Keeler-Wolf, T., D. R. Elam, K. Lewis, and S. A. Flint. 1998. California vernal pool assessment preliminary report. California Department of Fish and Game, Sacramento, California.

Loredo, I., V. D. Vuren, and L. M. Morrison. 1996. Habitat use and migration behavior of the California tiger salamander. Journal of Herpetology 30: 282-285.

Marsh, D. M., and C. P. Trenham. 2001. Metapopulation dynamics and amphibian conservation.Conservation Biology 15: 40-49.

National Agricultural Imagery Program (NAIP). 2005. Digital Orthorectified County Mosaics. U.S. Department of Agriculture, Farm Service Agency, Aerial Photography Field Office.

National Agricultural Imagery Program (NAIP). 2010. Digital Orthorectified County Mosaics. U.S. Department of Agriculture, Farm Service Agency, Aerial Photography Field Office.

Porej, D., M. Micacchion, and E. T. Hetherington. 2004. Core terrestrial habitat for conservation of local populations of salamanders and wood frogs in agricultural landscapes. Biological Conservation 120: 399-409.

Pyke, C. R. 2005. Assessing Suitability for Conservation Action: Prioritizing Interpond Linkages for the California Tiger Salamander. Conservation Biology 19: 492–503.

Schill, S. and G. Raber. 2008. Protected Area Tools (PAT) for ArcGIS 9.2 (version 2.0) software http://www.gispatools.org. The Nature Conservancy, Arlington, VA.

Shaffer, H. B., R. N. Fisher, and S. E. Stanley. 1993. Status report: The California Tiger Salamander (*Ambystoma californiense*). Final report to the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova California, under Contracts (FG9422 and 1383).

Smith, D.W. and W.L. Verrill. 1998. Vernal Pool-Soil-Landform Relationships in the Central Valley, California. .Pages 15-23 in: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Editors). *Ecology, Conservation, and Management of Vernal Pool Ecosystems* – Proceedings from a 1996 Conference. California Native Plant Society, Sacramento, CA. 1998.

Tomlinson K.R., C.E. Uptain, A.J. Kokx, S.E. Phillips, and P.A. Kelly. 2007a. Baseline Survey of Vernal Pools and Sensitive Species along the Friant-Kern Canal Right of Way, 2004-2006, Central Valley Project, California. Unpublished report to the U.S. Bureau of Reclamation, South-Central California Area Office.

Tomlinson K.R., C.E. Uptain, A.J. Kokx, S.E. Phillips, and P.A. Kelly. 2007b. Baseline Survey of Vernal Pools and Sensitive Species along the Madera Canal Right of Way, 2004-2006, Central Valley Project, California. Unpublished report to the U.S. Bureau of Reclamation, South-Central California Area Office.

Trenham, P. C. 2001. Terrestrial habitat use by adult California tiger salamanders. Journal of Herpetology 35: 343-346.

Trenham, P. C., D. W. Koenig, and H. B. Shaffer. 2001. Spatially autocorrelated demography and Interpond dispersal in the salamander *Ambystoma californiense*. Ecology 82: 3519-3530.

Trenham, P. C., and H. B. Shaffer. 2005. Amphibian upland habitat use and its consequences for population viability. Ecological Applications 15: 1158-1168.

Trenham, P. C., H. B. Shaffer, D. W. Koenig, and R. M. Stromberg. 2000. Life history and demographic Variation in the California tiger salamander (*Ambystoma californiense*). Copeia 2: 365-377.

Semlitsch, R. D. 2000. Principles for management of aquatic-breeding amphibians. Journal of Wildlife Management 64: 615-631.

Searcy, C. A., and H. B. Shaffer. 2007. Calculating biologically accurate mitigation credits: Insights from the California tiger salamander. Conservation Biology 22: 997-1005.

U.S. Dept. of Commerce, United States Census Bureau. 2010. Census Block Shapefiles with 2010 Census Population and Housing Unit Counts. URL: http://www.census.gov/geo/www/tiger/tgrshp2010/pophu.html

U.S. Fish and Wildlife Service. 1991. Biological opinion for the Friant Division water contract renewals. Fish and Wildlife Enhancement, Sacramento Field Office, Sacramento, Ca 47 pp. + appendices.

U.S. Fish and Wildlife Service. 1996. Interim survey guidelines to permitees for recovery permits under section 10(a)(1)(A) of the Endangered Species Act for the listed vernal pool branchiopods.

U.S. Fish and Wildlife Service. 2004. Endangered and threatened wildlife and plants; determination of threatened status for the California tiger salamander; and special rule exemption for existing routine ranching activities; Final Rule Federal Register 69:47,211-47,248.

U.S. Fish and Wildlife Service. 2005a. Recovery plan for vernal pool ecosystems of California and Oregon. U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

U.S. Fish and Wildlife Service. 2005b. Endangered and threatened wildlife and plants; designation of critical habitat for the California tiger salamander, Central population; final rule. August 23, 2005. Federal Register 70: 49379-49458.

U.S. Fish and Wildlife Service. 2011. National Wetlands Inventory. URL: http://www.fws.gov/wetlands/

U.S. Fish and Wildlife Service and California Department of Fish and Game. 2003. Interim guidance on site assessment and field surveys for determining presence or negative finding of the California tiger salamander. 11 pp.

Zeiner, D. C., W. F. Laudenslayer, Jr., and K. E. Mayer. 1988. California's wildlife. Volume I. Amphibians and reptiles. California statewide wildlife habitat relationships system, California Department of Fish and Game, Sacramento, California.

APPENDICIES

APPENDIX A. HABITAT ASSESSMENT RANKING WORKSHEET

Vernal Pool Habitat Assessment

Date:_____ Vernal Pool/WPT 1&2:_____ Start Time:_____ End Time:_____

Researchers:_____ Photo# : _____

Parcel #: _____

Surrounding Habitat Type:_____

Mima mounds Y / N

Land Contour:_____

Nearest Human Disturbance:_____

_____

Land use:_____

Threats to habitat:_____

How large is habitat: _____X_____ (yard)

Ridge obstructing view Y/N; Visible Distance:_____

Pool (circle one): Natural / Man Made Size:_____X_____(m) Bottom veg: Y / N

Emergent veg. Y/N; Description: _____

Pool Description: swale/hummock concave/depression draw/drainage stock pond

_____

_____

Soil texture: sand loam silt clay Water retention: fills quickly fills slowly dries quick/mod persists

_____

Known California tiger salamander: Y / N & Fairy Shrimp: Y / N
Species:_____

_____

Other amphibians, fish,..etc:_____

Ground Squirrel/Burrow Count: _____

VP Plant description:_____

_____

Holland vernal pool attribute class: 0 1 2 3 4 5 6 7 8 9

high----------_low

Rank Pool & Surrounding Habitat: 10…9…8…7…6…5…4…3…2…1

APPENDIX B. EXAMPLE LANDOWNER CONTACT LETTER.

CALIFORNIA STATE UNIVERSITY, STANISLAUS

ENDANGERED SPECIES RECOVERY PROGRAM

[Date]

[Name]
[Address]
[City/State/Zip]

Subject: Access request for wildlife survey

Dear [Name],

I am writing to seek permission to access your property (APN # [APN]) along the [Canal] Canal to conduct wildlife surveys adjacent to U.S. Bureau of Reclamation (Reclamation) property.

The CSU Stanislaus, Endangered Species Recovery Program (ESRP) has been working with Reclamation and private land owners since 1992 to conduct surveys and research on various species of plants and animals on Central Valley Project (CVP) and other lands throughout the San Joaquin Valley, including the California tiger salamander (*Ambystoma californiense*). These salamanders breed in vernal pools, including pools along canal rights-of way, but during the non-breeding season they can be found in adjacent grasslands. To further categorize habitat quality along canal rights-of-way, we would be very interested in conducting focused surveys on your land adjacent to the Madera Canal by installing temporary structures that allow us to capture and release salamanders. The structures would consist of plywood cover boards and/or short drift-fence/pitfall arrays, depending on landowner wishes.

Your assistance with this research project would be greatly appreciated. Please feel free to contact myself or Krista Tomlinson (ESRP Wildlife Biologist; 559-453-1103) if you have any questions regarding this study. Please know that we coordinate very closely with landowners whenever granted access to private property, always respecting the property as well as the wishes of the landowner.

Sincerely,

Patrick A. Kelly, Ph.D.
Professor of Zoology & Coordinator
Endangered Species Recovery Program

cc: Mike Kinsey, Bureau of Reclamation

1900 N. GATEWAY BLVD, SUITE 101 • FRESNO, CALIFORNIA 93727 • ESRP.CSUSTAN.EDU • PHONE (559) 453-1103 • FAX (559) 453-1227

APPENDIX C. LANDOWNERS CONTACTED TO REQUEST CALIFORNIA TIGER SALAMANDER SURVEYS ON LANDS NEAR CANAL RIGHTS OF WAY

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
030-130-028	Alvin Marital Gisler L.	128 Imperial Ave.	Ventura, CA 93004	Letter received 9 Apr. 07
030-080-003	Alvin Marital Gisler	128 Imperial Ave.	Ventura, CA 93004	No access
known contact:	Marital Gisler Alvin (number not known)			
052-130-013	Campbell Edward E. Sr.	P.O. Box 3260	San Jose, CA 95156	Phone in 22 Feb. 07
known contact:	Edward E. Campbell Sr. (408) 259-6700			Possible access
051-185-003	Cardoza Elizabeth Anne	17381 Highway 41	Madera, CA	No contact
known contact:	Elizabeth Cardoza (number not known)	*zip not known		lack of zip code
031-051-006	Cerrillo Pete L. & Rosa	21904 Road 30	Madera, CA 93638	No response
known contact:	Pete & Rosa Cerillo (number not known)			
052-100-025	Chew Robert L. & Keiko	583 62nd Street	Oakland, CA 94609	No response
known contact:	Robert & Keiko Chew (number not known)			
052-100-024	Coleman Land Company LLC	443 E. Rialto Ave.	Fresno, CA 93704	No response
known contact:	not known			
052-100-004	Daulton Clay H. III & Candace Aileen	31131 Road 603	Madera, CA 93637	Letter received 28 Feb. 07
052-100-003	Daulton Clay H. III & Candace Aileen	31131 Road 603	Madera, CA 93637	No access
known contact:	H. Clay Daulton			
030-190-045	Dhatt Pami	5274 Tudor Rose Glen	Stockton, CA 95212	Phoned in 2 Mar. 07
known contact:	Rish Dhatt (number not known)			No access
052-100-020	Espinosa Jesus & Esperanza	15132 Harding Road	Turlock, CA 95380	No response
known contact:	Jesus & Esperanza Espinosa (number not known)			
052-130-017	F J Venture Partnership	P.O. Box 488	Ceres, CA 95307	Phoned in 22 Feb. 07
052-130-019	F J Venture Partnership	6342 Bystrom Road	Ceres, CA 95307	Access granted
known contact:	Rick Irwin (209) 556-6738			met on 5 Mar. 07
051-181-001	Fenston Page M.	372 Pacheco Street	San Francisco, CA 94116	No response
051-182-001	Fenston Page M.	372 Pacheco Street	San Francisco, CA 94116	
known contact:	Page Fenston (number not known)			
030-200-014	Fowler Jimmy O.	26360 Avenue 26	Chowchilla, CA 93610	No response
known contact:	Jimmy Fowler (number not known)			
052-130-010	Garoupa Leonard V. & Patsy D.	207 Kendall Lane	Cambria, CA 93428	No response
known contact:	Leonard & Patsy Garoupa (number not known)			
030-140-002	Gisler Joel	1470 N.E First Street #150	Bend, OR 97701	
030-090-003	Gisler Joel	1470 N.E First Street #150	Bend, OR 97701	No response
030-140-001	Gisler Joel	1470 N.E First Street #150	Bend, OR 97701	
known contact:	Joel Gisler (number not known)			
030-200-013	Gudino Victoria	17018 Road 31	Madera, CA 93638	No response
known contact:	Victoria Gudino (number not known)			
031-042-010	JCM Farming Inc.	201 Lomas Santa Fe Drive #400	Solana Beach, CA 92075-1289	No response
052-130-011	JCM Farming Inc.	201 Lomas Santa Fe Drive #400	Solana Beach, CA 92075-1289	
known contact:	not known			

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
051-186-002	Jamison Betty F.	P.O. Box 40	O'Neals, CA 93645	Phoned in 22 Feb. 07
051-220-001	Jamison Betty F.	P.O. Box 40	O'Neals, CA 93645	No access
known contact:	Betty & Jim Jamison (number not known)			
051-215-002	Jamison Sean O.	P.O. Box 1249	Oakhurst, CA 93644	No response
known contact:	Sean Jamison (number not known)			
051-142-002	Johnson Roberta Suc	211 S. Citrus Ave.	Los Angeles, CA 90036-3037	Letter received 26 Feb. 07
known contact:	Carol Ann Laquer (number not known)			No access
030-190-047	King Cayious Jr. & Mae	15826 Road 26	Madera, CA 93637	No response
known contact:	Cayious & Mae King			
051-142-003	Klein William Klein	4949 Gensta Ave. #201	Encino, CA 91316	No response
known contact:	William Klein (number not known)			
031-032-008	Lasgoity Rosemary	2310 Camden Way	Madera, CA 93637	No response
known contact:	Rosemary Lasgoity (number not known)			
051-184-002	Lehl Herbert William	1120 E. Harvard Ave.	Fresno, CA 93704	No response
known contact:	Herbert Lehl (number not known)			
052-130-018	Loma Acquisition Company LLC	1901 S. Lexington Street	Delano, CA 93215	No response
known contact:	not known			
030-190-040	Luus Investments LLC	6545 Stockton Blvd.	Sacramento, CA 95823	No response
known contact:	not known			
031-062-005	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	No response
031-061-001	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
052-130-005	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-031-001	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-092-002	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-091-009	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-062-007	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-052-003	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
051-215-003	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-032-005	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
052-130-014	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
031-033-002	Morgan Martin & Betty Jean	600 W. Fremont Street	Stockton, CA 95203	
known contact:	Martin & Betty Jean Morgan (number not known)			
051-220-015	Rio Mesa Holdings LLC	7020 N. Van Ness Blvd.	Fresno, CA 93711	Letter received 2 Mar. 07
051-220-002	Rio Mesa Holdings LLC	7020 N. Van Ness Blvd.	Fresno, CA 93711	No access
known contact:	Robert A. McCaffrey (559) 256-7000			
052-202-002	SWD Investments Inc.	1322 E. Shaw Ave.	Fresno, CA 93710	No response
known contact:	not known			
051-141-001	SWD Investments-Fulton Ranch Inc.	1322 E SHAW #340	Fresno, CA 93710	Letter received 26 Mar. 07
known contact:	Bryan N. Wagner (Attorney on behalf) (559) 224-0885			No access
052-100-022	Sahota Sohan Singh	10443 Vincent Road	Delhi, CA 95315	No response
052-100-021	Sahota Sohan Singh	10443 Vincent Road	Delhi, CA 95315	
030-200-005	Sahota Sohan Singh	10443 Vincent Road	Delhi, CA 95315	

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
030-200-004	Sahota Sohan Singh	10443 Vincent Road	Delhi, CA 95315	
030-200-010	Sahota Sohan Singh	10443 Vincent Road	Delhi, CA 95315	
030-200-006	Sahota Sohan Singh	10443 Vincent Road	Delhi, CA 95315	
known contact:	Sohan Sahota (number not known)			
052-183-004	Simi Donald Albert & Carol Ann	8470 Road 26	Madera, CA 93637	No response
known contact:	Donald & Carol Simi			
052-182-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	Letter received 13 Mar. 07
052-181-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	No access
052-172-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-174-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-173-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-171-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
031-132-002	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-156-002	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-154-006	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-152-004	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
031-092-004	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
031-062-008	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-153-005	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-151-004	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-140-001	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
052-140-002	Smith Adobe Ranch Family LP	1547 34th Ave.	San Francisco, CA 94122	
known contact:	Clarkson Smith (number not known)			
051-230-003	Smith Janette L.	P.O. Box 378	Le Grand, CA 95333	No response
known contact:	Janette Smith (number not known)			
052-130-012	Thomas Earenst Sr.	23762 Road 602	Madera, CA 93638	No response
known contact:	Earnest Thomas Sr. (number not known)			
051-220-003	USA			Access allowed by Reclamation
052-153-004	USA			
052-154-007	USA			
052-152-005	USA			
052-151-003	USA			
known contact:	USA lands are Reclamation owned (Fresno office)			
051-215-005	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	No response
051-215-004	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	
051-186-001	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	
051-184-001	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	
051-220-009	Urrutia William Michael	P.O. Box 33	Friant, CA 93626	
051-185-004	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	
051-183-001	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	
051-213-001	Urrutia William Mike	P.O. Box 33	Friant, CA 93626	
known contact:	(Mike) William Urrutia (559) 822-2339			
052-201-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	No response

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
052-176-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-174-002	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-173-002	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-162-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-156-003	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-155-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-175-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-140-003	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-140-004	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
052-161-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
152-164-001	Will Gill & Sons	974 S. Pine Street	Madera, CA 93637-9067	
known contact:	David Gill (559) 674-8843			
051-246-002	No info found through parcel quest			Unknown
known contact:	not known			
158-061-19	B & G Holdings LLC/Modesto Gateway LP	19272 Crisp	Saratoga, CA 95070	Phoned in 28 Feb. 07
158-330-49	B & G Holdings LLC/Modesto Gateway LP	19272 Crisp	Saratoga, CA 95070	No access
158-061-24	B & G Holdings LLC/Modesto Gateway LP	19272 Crisp	Saratoga, CA 95070	
158-061-25	B & G Holdings LLC/Modesto Gateway LP	19272 Crisp	Saratoga, CA 95070	Bob Combs owner would allow but
known contact:	Bob Combs (408) 828-3391			rancher who leases did not agree
300-080-56	Becker Robert P. & Barbara M.Trustees	5539 N. Fresno #B	Fresno, CA 93710	No response
300-080-68	Becker Robert P. & Barbara M.Trustees	5539 N. Fresno #B	Fresno, CA 93710	
300-080-80	Becker Robert P. & Barbara M.Trustees	5539 N. Fresno #B	Fresno, CA 93710	
300-090-19	Becker Robert P. & Barbara M.Trustees	5539 N. Fresno #B	Fresno, CA 93710	
581-010-15	Becker Robert P. & Barbara M.Trustees	5539 N. Fresno #B	Fresno, CA 93710	
581-040-32	Becker Robert P. & Barbara M.Trustees	5539 N. Fresno #B	Fresno, CA 93710	
300-080-13	Becker Robert P. & Barbara M.Trustees	1103 N. Senda Verde	Santa Barbara, CA 93105	
known contact:	Barbara & Robert Becker (number not known)			
150-020-14	Big Dry Creek Ranch/B.A. McKoane	6338 N. Blackstone	Fresno, CA 93710	No response
150-020-13	Big Dry Creek Ranch	6338 N. Blackstone	Fresno, CA 93710	
known contact:	B. A. McKoane (number not known)			
300-021-50	Bigelow-Silkwood Friant Ranch	P.O. Box 22	O Neals CA, 93645	Phoned in (attorney) 7 Mar. 07
300-021-51	Bigelow-Silkwood Friant Ranch	P.O. Box 22	O Neals CA, 93645	No access
300-050-01	Bigelow-Silkwood Friant Ranch	P.O. Box 22	O Neals CA, 93645	
known contact:	Brian Wagner (Attorney on behalf) (559) 224-0871			
581-040-02	Biglione Azalea Trustee	641 W. Ellery	Clovis, CA 93612	No response
581-040-03	Biglione Azalea Trustee	641 W. Ellery	Clovis, CA 93612	
known contact:	Azalea Biglione (number not known)			
300-050-08S	Blasingame Jesse Knox Jr.,Carol L. TRS, & Brenda Jill	P.O. Box 3350	Clovis, CA 93613	No response
300-050-06S	Blasingame Jesse Knox Jr.,Carol L. TRS, & Brenda Jill	P.O. Box 3350	Clovis, CA 93613	
300-080-84S	Blasingame Jesse Knox Jr.,Carol L. TRS, & Brenda Jill	P.O. Box 3350	Clovis, CA 93613	
known contact:	Jesse, Carol & Brenda Blasingame (number not known)			
333-430-64	Bravo Dario & Rita	865 Carolina	Clovis, CA 93611	No response
known contact:	Dario & Rita Bravo (number not known)			

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
300-080-05T	City of Clovis	1033 5th	Clovis, CA 93612	Not contacted
300-080-83S	City of Clovis	1033 5th	Clovis, CA 93612	
known contact:	(559) 324-2060			
150-102-25	DeGraw Michael R. & Tracy S.	11611 Tollhouse Rd.	Clovis, CA 93619	No response
known contact:	Michael & Tracy DeGraw (number not known)			
150-190-35	Estill James C.	14296 E. Bullard	Clovis, CA 93611	Phoned in 28 Feb. 07
known contact:	James C. Estill; estilljs@earthlink.net			No response but interested
150-102-22	Estill Rosalie Trustee Johntz Enterprise LLC	11524 E. Herndon	Clovis, CA 93619	No response
150-102-15	Estill Rosalie Trustee Estill Donald Estate	11524 E. Herndon	Clovis, CA 93619	
150-102-54	Estill Rosalie Trustee Estill Donald Estate	11524 E. Herndon	Clovis, CA 93619	
known contact:	Rosalie Estill & Donald C. Estill (number not known)			
300-080-04	Fleming Daniel J.	4222 W. Alluvial	Fresno, CA 93722	No response
known contact:	Daniel Fleming (number not known)			
300-540-03	Fleming Wilma I. Trustee	6077 Millerton Rd.	Friant, CA 93626	No response
known contact:	Wilma Fleming			
333-430-61	Ford Ranches Inc.	26719 Wellbarn Rd.	Clovis, CA 93619	Phoned in
known contact:	Mr. & Mrs. Ford (number not known)			Access granted
300-080-76	Fresno Rifle & Pistol Club	15687 Auberry Rd.	Clovis, CA 93611	No response
known contact:	(559) 299-6365			
150-060-32	Harlan Land Company-C/O Floyd L. Harlan	9010 E. Tollhouse Rd.	Clovis, CA 93611	No response
150-060-34	Harlan Land Company-C/O Floyd L. Harlan	9010 E. Tollhouse Rd.	Clovis, CA 93611	
150-060-68	Harlan Floyd L.	9010 E. Tollhouse Rd.	Clovis, CA 93611	
150-060-02	Harlan Floyd L.	9010 E. Tollhouse Rd.	Clovis, CA 93611	
150-060-31	Harlan Land Company	9010 E. Tollhouse Rd.	Clovis, CA 93611	
150-060-15	Harlan Land Company	9010 E. Tollhouse Rd.	Clovis, CA 93611	
150-060-33	Harlan Land Company	9010 E. Tollhouse Rd.	Clovis, CA 93611	
150-060-59	Harlan Land Company	9010 E. Tollhouse Rd.	Clovis, CA 93611	
known contact:	Floyd L. Harlan (number not known)			
300-050-25	Harris Donavan	P.O. Box 620	Friant, CA 93626	Letter received 4 Mar. 07
known contact:	Donavon Harris (559) 822-3333			No access
300-021-82	Harris James Donavon	7411 N. Flora	Fresno, CA 93720	No response
300-550-23	Harris James Donavon	7411 N. Flora	Fresno, CA 93720	
300-550-24	Harris James Donavon	7411 N. Flora	Fresno, CA 93720	
300-021-77	Harris James Donavon	7411 N. Flora	Fresno, CA 93720	
known contact:	James Donavon Harris (number not known)			
150-180-20S	Howard Douglas L. & Howard Brenda G.	8443 N. 4th	Fresno, CA 93720	No response
known contact:	Douglas & Brenda Howard			
150-180-17	Johntz Enterprises LLC Attn: F Johntz	2116 Arlington Ave #302	Los Angeles, CA 90018	Letter returned
known contact:	F. Johntz (number not known)			No contact
150-102-18	Lim Mee Ching	731 Canterbury Rd.	San Marino, CA 91108	No response
150-102-34	Lim Mee Ching	731 Canterbury Rd.	San Marino, CA 91108	
150-102-35	Lim Mee Ching	731 Canterbury Rd.	San Marino, CA 91108	

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
known contact:	Mee Ching Lim (number not known)			
333-450-19	Lonestar California Inc./RMC Pacific Materials Inc.	P.O. Box 5252	Pleasanton, CA 94566	No response
known contact:	not known			
300-050-10	Marshall George L. & Evelyn F. TRS	26014 Auberry Rd.	Clovis, CA 93611	No response
known contact:	Evelyn & George Marshall (number not known)			
150-180-21	O'Day Jason James & Sandy Lynn	2550 Buckingham Way	Clovis, CA 93611	Phoned in 23 Feb. 07
known contact:	Jason & Sandy O'Day (559) 681-1924			No access
158-270-08	Peoples Jeramy R. & Laura L. Woller	19808 E. Belmont	Sanger, CA 93657	No response
known contact:	Jeramy Peoples & Laura Woller (number not known)			
158-061-22	Plaugher Wilbur P. & Ruth D.	2515 Tamarack	Sanger, CA 93657	Phoned in 28 Feb. 07
158-130-11	Plaugher Wilbur P. & Ruth D.	2515 Tamarack	Sanger, CA 93657	No access
158-061-27	Plaugher Wilbur P. & Ruth D.	2515 Tamarack	Sanger, CA 93657	
known contact:	Ruth D. & Wilbur P. Plaugher (number not known)			
150-190-38	Poulan Key & Kathy	1658 E. Lexington	Fresno, CA 93720	Phoned in 27 Feb. 07
known contact:	Key & Kathy Poulan (559) 299-5399			Access granted but no pitfalls
333-430-55	Prewitt Billy John & Brooke M.	662 N. Frankwood	Sanger, CA 93657	No response
known contact:	John & Brooke Prewitt (number not known)			
150-190-36	Pritchard Glenn & Cecille	6324 N. Ranger	Clovis, CA 96311	Phoned in 27 Feb. 07
150-190-37	Pritchard Glenn & Cecille	18265 Gas Point Rd.	Cottonwood, CA 96022	No access
known contact:	Glenn & Cecille Pritchard (number not known)			
150-060-28	Sample Bonner A. & Barbara J. Trustees	11000 Tollhouse Rd.	Clovis, CA 93611	No response
150-060-52	Sample Bonner A. & Barbara J. Trustees	11000 Tollhouse Rd.	Clovis, CA 93611	
known contact:	Bonner A. & Barbara J. Sample (number not known)			
158-330-35	Robinson Jay S. & Betty R. Trustees	17000 Watts Valley Rd.	Sanger, CA 93657	No response
158-061-26	Robinson Jay S. & Betty R. Trustees	17000 Watts Valley Rd.	Sanger, CA 93657	
known contact:	Jay S. & Betty R. Robinson			
150-102-23	Sample Thomas E. LP	11611 E. Tollhouse Rd.	Clovis, CA 93619	No response
known contact:	Thomas Sample (number not known)			
581-040-46	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	No response
581-090-21	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-170-30	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-170-44	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-040-12	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-040-16	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-040-30	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-040-44	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
581-040-31	Sharer Salley Sample Trustee	14180 E. Shepherd	Clovis, CA 93611	
known contact:	Gordon D. & Sally Lynn Sharer (number not known)			
300-360-16	Shiba Kristine	3261 McKelvy	Clovis, CA 93611	No response
known contact:	Kristine Shiba (number not known)			
333-430-63	Smith Jerry E. & Diane L.	111 Trout Lake Dr.	Sanger, CA 93657	No response
known contact:	Jerry & Diane Smith (number not known)			

APN	Owner name or contact for property	Mailing address	City, State, Zip	Response status
150-102-17	Tollhouse Partners LP	9010 Tollhouse Rd.	Clovis, CA 93619	No response
known contact:	not known			
150-060-04T	U S A			Access allowed by Reclamation
150-060-24T	U S A			
150-060-25T	U S A			
150-101-66T	U S A			
150-101-69T	U S A			
300-050-14T	U S A			
581-040-38T	U S A			
581-040-40T	U S A			
300-080-72T	Bob Werner, Fresno County Assesor - State Land (?)			
known contact:	USA lands are Reclamation owned (Fresno office)			
150-180-22	Veu Victor Kao & Ong Vue Kong & Chou	1300 E. Shaw #117	Fresno, CA 93710	No response
known contact:	Victor, Ong, & Chou Vue (number not known)			
300-021-53	Whispering Springs LLC	1322 E. Shaw	Fresno, CA 93710	Letter received 22 Mar. 07 by attorney
known contact:	Bryan N. Wagner (559) 224-0885			No access
158-270-32	Zweigle Vern J. & Marilyn Sue	1440 Piedra Rd.	Sanger, CA 93657	No response
known contact:	Marilyn Sue & Vern Zweigle (number not known)			

APPENDIX D. RECOVERY ACTIONS FROM THE *RECOVERY PLAN FOR VERNAL POOL ECOSYSTEMS OF CALIFORNIA AND SOUTHERN OREGON* APPLICABLE TO THE MADERA AND FRIANT-KERN CANAL REGIONS.

Priority	Action Number	Action Description
1	1.3.14	Conduct standardized vernal pool habitat site assessments for Southern Sierra Foothills vernal pool region
1	1.4.1.1	Ensure Federal agencies use their authority to protect species occurrences and their vernal pool habitat in Zone 1 core areas.
1	2.1.1.1	Ensure Federal agencies conduct interim habitat management on lands in Zone 1 core areas.
1	2.3.2.1	Ensure Federal agencies develop or improve existing management and monitoring plans.
1	2.3.3.1.1	Ensure Federal agencies implement long-term, comprehensive habitat management and monitoring plans on lands in Zone 1 core areas.
2	1.4.1.2	Ensure Federal agencies use their authority to protect species occurrences and their vernal pool habitat in Zone 2 core areas.
2	2.1.1.2	Ensure Federal agencies conduct interim habitat management on lands in Zone 2 core areas.
2	2.3.3.1.2	Ensure Federal agencies implement long-term, comprehensive habitat management and monitoring plans on lands in Zone 2 core areas.
3	1.4.1.4	Ensure Federal agencies use their authority to protect species occurrences and their vernal pool habitat that do not occur within a core area, but do occur within a vernal pool region.
3	1.4.1.5	Ensure Federal agencies use their authority to protect all other species occurrences and their vernal pool habitat that do not occur within a vernal pool region, but do contribute to recovery and long-term conservation of species addressed in this recovery plan.
3	2.1.1.4	Ensure Federal agencies conduct interim habitat management on lands that do not occur within a core area, but do occur within a vernal pool region.
3	2.1.1.5	Ensure Federal agencies conduct interim habitat management on lands that do not occur within a vernal pool region, but do contribute to recovery and long-term conservation of species addressed in this recovery plan.
3	2.3.3.1.3	Ensure Federal agencies implement long- term, comprehensive habitat management and monitoring plans on lands in Zone 3 core areas.
3	2.3.3.1.4	Ensure Federal agencies implement long-term, comprehensive habitat management and monitoring plans on lands that do not occur within a core area, but do occur within a vernal pool region.
3	2.3.3.1.5	Ensure Federal agencies implement long-term, comprehensive habitat management and monitoring plans on lands that do not occur within a vernal pool region, but do contribute to recovery and long-term conservation of species addressed in this recovery plan.