6. LIVERMORE VERNAL POOL REGION

The vernal pool fairy shrimp and vernal pool tadpole shrimp are both known to occur within the Livermore Vernal Pool Region. The Conservancy fairy shrimp is not known to occur within this region.

6.1. Vernal Pool Habitat

The majority of the Livermore Vernal Pool Region and the entirety of the Altamont Hills Core Area were within the study areas of vernal pool and protected lands mapping efforts for the Central Valley (Vollmar et al. 2017; Witham et al. 2013; Witham et al. 2014; Witham 2021). Acreages reported throughout this section are based on those studies. However, it is possible that there are additional vernal pool grasslands in the southern and southwestern portions of this vernal pool region as well that have not been documented here. Unlike most of the Central Valley, the vernal pool habitat in this vernal pool region is mainly found in hilly areas and occasionally in rock outcrops, not flat grasslands, so the mapping efforts based on aerial imagery may have underestimated the amount of vernal pool habitat. This is evident based on the number of occurrences for vernal pool species in the Diversity Database that are outside of mapped vernal pool habitat.

Approximately 5,473 acres of vernal pool grassland existed within, or immediately adjacent to, this region when the Recovery Plan was published in 2005 (see **Figure 6.1**, **Table 6.1**; Witham et al. 2013). Approximately 5,429 acres remained as of 2012, with 59.8 acres (1.1% of 2005 total) lost between 2005 and 2012 (Witham et al. 2014). However, 16.4 acres of new vernal pool grassland were created over that same period on vernal pool mitigation banks and other managed wetlands. All of the habitat losses were due to agricultural conversion (73.1% to bare plowed agricultural land, 18.8% to rice or row crops, and 8.1% to alfalfa or irrigated pasture) (Witham et al. 2014).

By 2018, approximately 5,424 acres of vernal pool grassland remained, with a total of 65 acres (1.2% of 2005 total) lost between 2005 and 2018 (see **Table 6.1**; Witham 2021). No new areas of vernal pool grassland were identified in the 2018 aerial imagery that were either not present or not visible on the 2005 and 2012 aerial imagery. All of the habitat losses since 2005 were due to agricultural conversion (78.5% to bare plowed agricultural land, 19.9% to rice or row crops, and 1.6% to agricultural residences) (see **Table 6.2**; Witham 2021). Assuming that there were no losses of vernal pool habitat outside of Witham's (2021) study area, this vernal pool region has exhibited the lowest amount and percentage of vernal pool habitat losses (Witham 2021).

As of 2018, roughly 1,984 acres of vernal pool grassland was estimated to be protected in this region (see **Figure 6.1**, **Figure 6.2**, **Table 6.1**; Witham 2021; Vollmar et al. 2017). This represents approximately 36.1% of the currently remaining vernal pool grassland in the region and 36.2% of the vernal pool grassland that existed in the region in 2005, the Recovery Plan's baseline. Additional vernal pool habitat has been protected since 2018 within the East Contra Costa County Habitat Conservation Plan's Preserve System (ECCCHC 2022). In addition, neither Vollmar et al. (2017) nor **Figure 6.2** include the Marsh Creek Habitat Management Unit or the entire northern portion of Brushy Peak Region Preserve, which are discussed further in the Other Preserves section below.

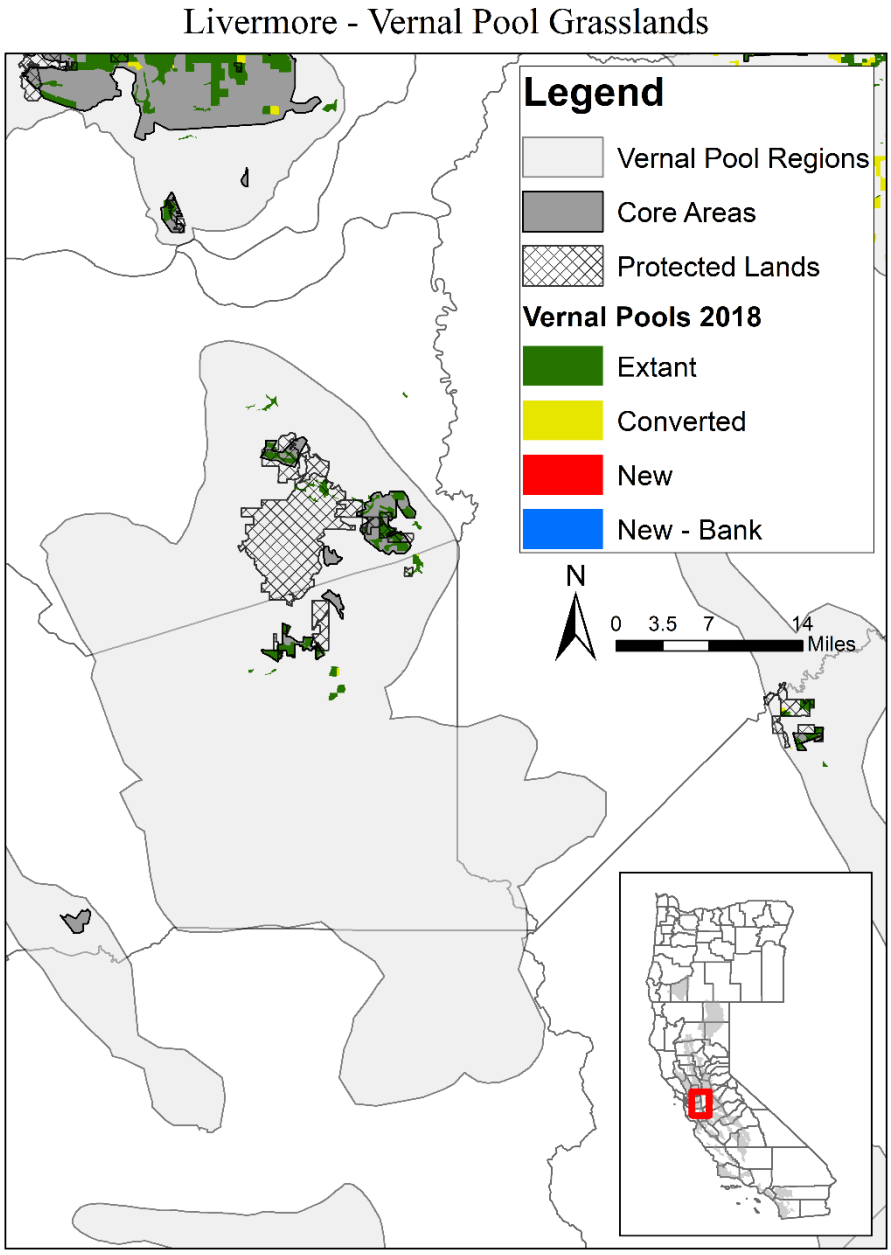

Figure 6.1. Map of vernal pool habitat within the Livermore Vernal Pool Region mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

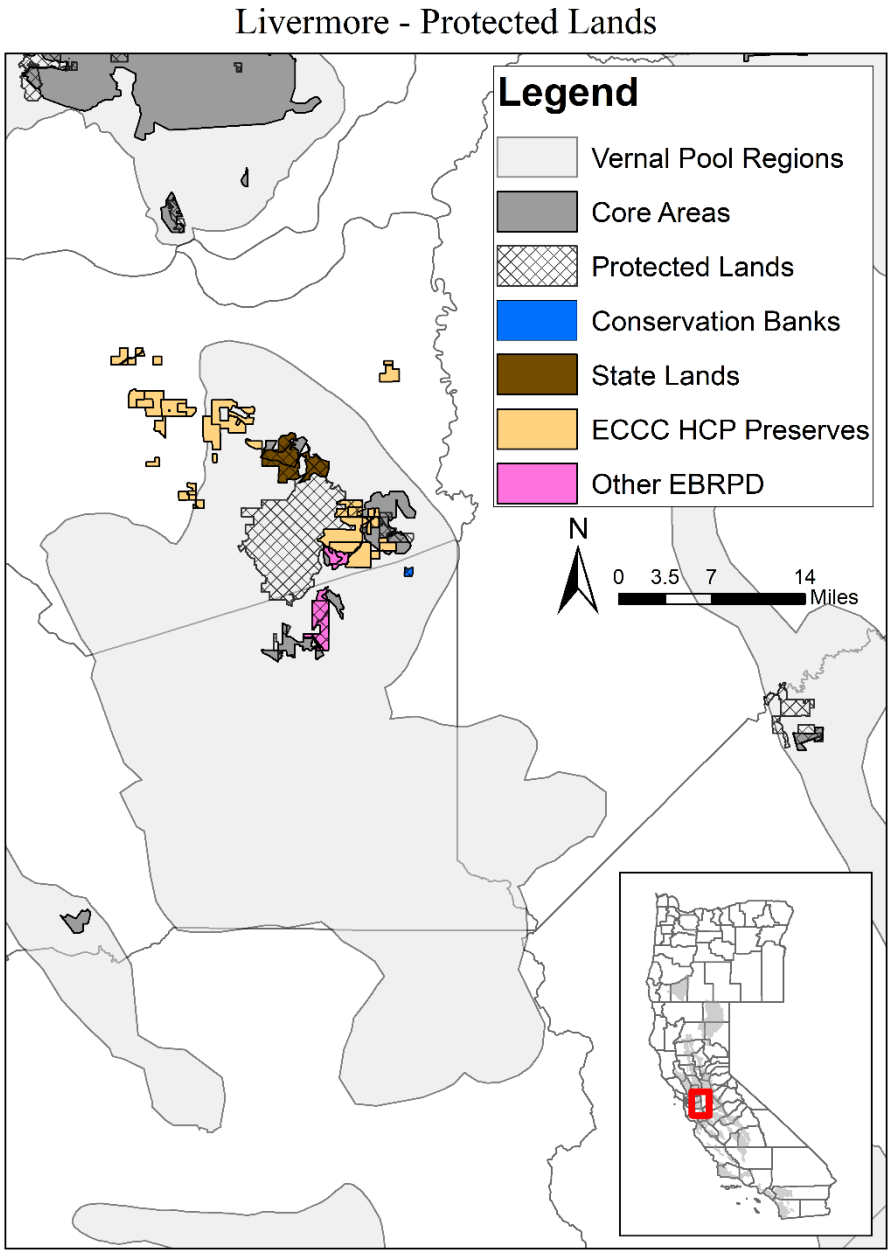

Figure 6.2. Map of protected areas that contain vernal pool grassland habitat and/or vernal pool fairy shrimp within the Livermore Vernal Pool Region**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. Zoom in for finer resolution. ECCC HCP = East Contra Costa County Habitat Conservation Plan, EBRPD = East Bay Regional Park District.

Table 6.1. Acreage of vernal pool habitat and habitat converted within the Livermore Vernal Pool Region mapped by Witham (2021). All habitat labeled as not converted, altered, or new was considered extant. Protected acreage is based on Vollmar et al. (2017).

Core Area	2005 Acres	2018 Acres Total	2018 Acres Extant (% of Total)	2018 Acres Converted – Agriculture (% of Total)	2018 Acres Converted – Urban Development (% of Total)	2018 Acres Protected (% of Total)
Altamont Hills	3,524.5	3,524.5	3,522.3 (99.9%)	2.1 (0.1%)	0.0 (0.0%)	1,321.6 (37.5%)
Livermore Vernal Pool Region Total	**5,472.7**	**5,489.0**	**5,424.1 (98.8%)**	**65.0 (1.2%)**	**0.0 (0.0%)**	**1,983.8 (36.1%)**

Table 6.2. Acreage of vernal pool habitat losses within the Livermore Vernal Pool Region between 2005 and 2018 mapped by Witham (2021), broken down by what the land use was converted to. All categories besides urban development and managed wetlands are considered agricultural conversions.

Core Area	Urban, Commercial, & Industrial	Orchards, Vineyards, Eucalyptus	Alfalfa and Irrigated Pasture	Bare Plowed Agricultural Lands	Other Ag (Rice, Row Crops, Dairy,	Agricultural Residential	Managed Wetlands	Total Losses	% Losses Urban Development	% Losses Agricultural Conversions
Altamont Hills	0.0	0.0	0.0	2.1	0.0	0.0	0.0	2.1	0.0%	100%
Livermore Vernal Pool Region Total	**0.0**	**0.0**	**0.0**	**51.0**	**12.9**	**1.0**	**0.0**	**65.0**	**0.0%**	**100%**

6.2. Species Occurrences

6.2.1. Vernal Pool Fairy Shrimp

There are 23 occurrence records of the vernal pool fairy shrimp documented within, or immediately adjacent to, the Livermore Vernal Pool Region in the Diversity Database (see **Figure 6.3**; Diversity Database 2022). These occurrences are found on land owned by a variety of private or public entities. Of these 23 occurrences, all are listed as presumed extant by the Diversity Database; 9 occurrences are within extant vernal pool habitat based on Witham's (2021) mapping efforts and 14 are outside of mapped vernal pool habitat. It is possible that some of the 23 occurrences are no longer extant, but have not been surveyed recently.

Protected areas contain, at least partially, 11 of the 23 Diversity Database records (48%) for the vernal pool fairy shrimp in this region. However, this does not mean that 48% of all occurrences of the vernal pool fairy shrimp in this region have been protected, as the Diversity Database is not an appropriate source for determining all known occurrences (individual Diversity Database records are not necessarily equivalent to occurrences, and some known occurrences may not be documented in the Diversity Database). Only 5 of the 23 Diversity Database polygons (22%) are entirely within the protected areas.

6.2.2. Vernal Pool Tadpole Shrimp

There is only one occurrence record of the vernal pool tadpole shrimp documented within the Livermore Vernal Pool Region in the Diversity Database (see **Figure 6.4**; Diversity Database 2022). This occurrence is found on private, unprotected land and is described as a small 8-inch by 12-inch claypan vernal pool in a swale; it was documented in 2003 and has not been surveyed since (Diversity Database 2022). The occurrence is presumed extant by the Diversity Database, but it is outside of mapped vernal pool grassland (Witham 2021). This is likely because it is a single isolated pool, but it may be because the habitat has been disturbed or destroyed and no longer appears on aerial imagery. To our knowledge, the species has not been found anywhere else in the region.

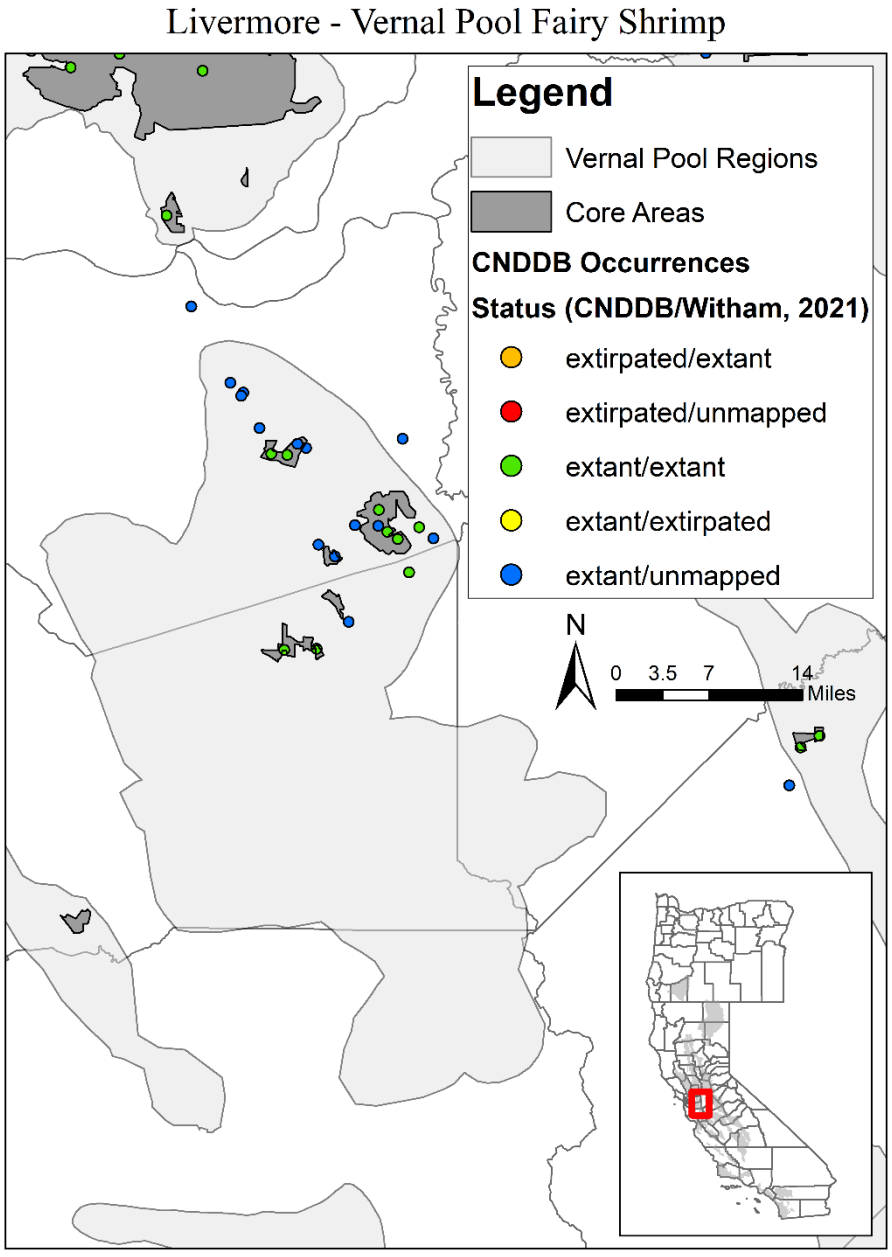

Figure 6.3. Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) in the Livermore Vernal Pool Region. Points may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both Diversity Database occurrence records and Witham's (2021) map of vernal pool habitat.

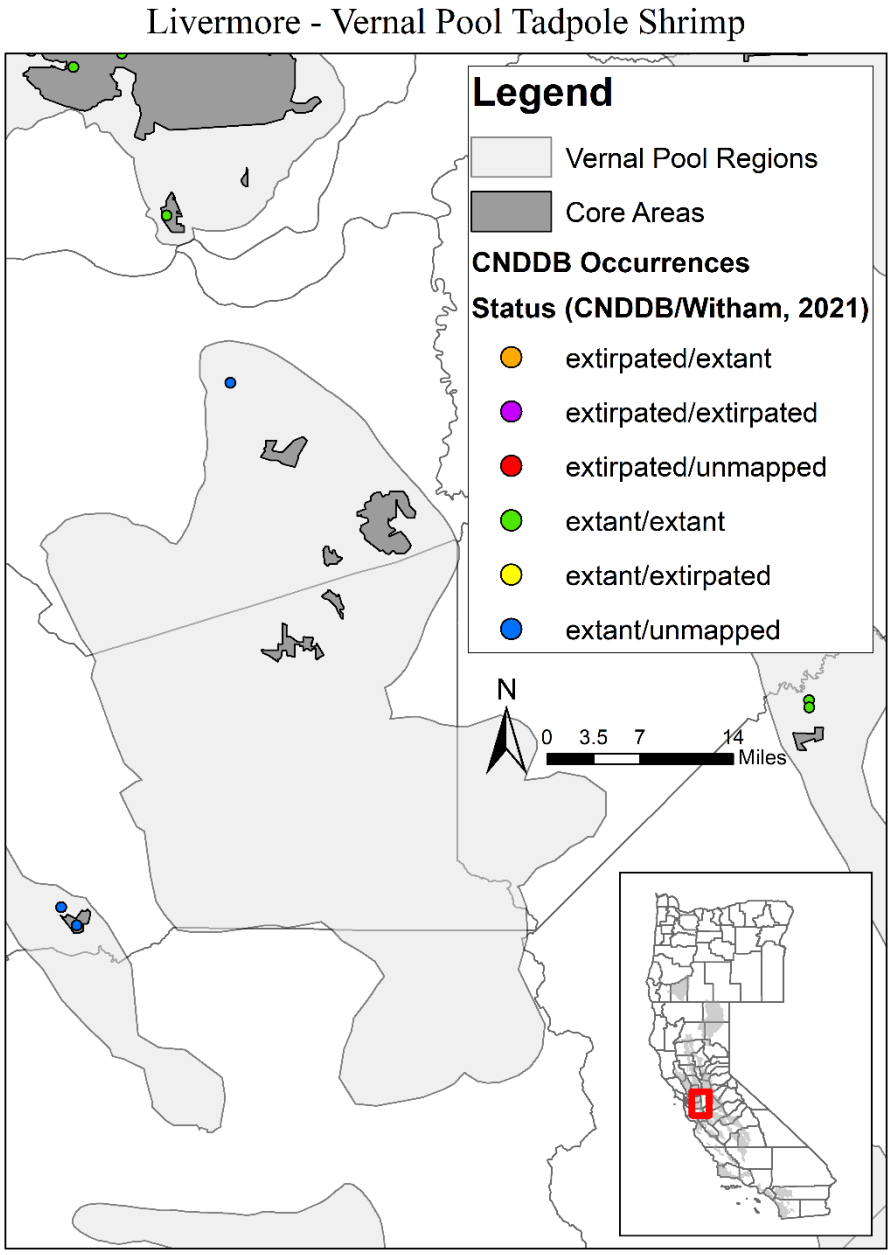

Figure 6.4. Map of known occurrences of vernal pool tadpole shrimp recorded in the Diversity Database (2022) in the Livermore Vernal Pool Region. Points may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both Diversity Database occurrence records and Witham's (2021) map of vernal pool habitat.

6.3. Federal Lands

6.3.1. National Wildlife Refuges

There are no National Wildlife Refuges with known occurrences of the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Livermore Vernal Pool Region.

6.3.2. Military Lands

There are no military lands with known occurrences of the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Livermore Vernal Pool Region.

6.3.3. Bureau of Land Management

There are no Bureau of Land Management lands with known occurrences of the vernal pool fairy shrimp or vernal pool tadpole shrimp in the Livermore Vernal Pool Region.

6.3.4. Other Federal Lands

The vernal pool fairy shrimp in known to occur in the vicinity of the Los Vaqueros Reservoir Watershed. The Bureau of Reclamation funded a reservoir expansion project there in 2012, but this area is owned and operated by the Contra Costa Water District and is discussed in the **Other Preserves** section below.

6.4. Conservation Banks

There is one conservation bank within the Livermore Vernal Pool Region that provides credits for preserved vernal pools that support the vernal pool fairy shrimp: Mountain House Conservation Bank (see **Figure 6.2**; RIBITS 2021). This 145-acre bank is located in Alameda County north of Bethany Reservoir between Kelso Road, Bruns Road, and Christensen Road. It protects habitat for a variety of federally listed species and includes a small amount of vernal pool habitat, 0.46 acre, which provides preservation credits for the vernal pool fairy shrimp (Fletcher Conservation Lands 2018). The bank is sold-out of credits and is now operating under its long-term management plan.

Wildlands' Byron Conservation Bank (a.k.a., Byron Ranch Conservation Bank) is named in the description of one Diversity Database occurrence and thus was mentioned in the previous 5-year review (Service 2007a). This occurrence spans the Byron Airport Habitat Management Lands and the adjacent area to the south. However, this property is no longer listed on Wildlands' website, and the area south of Byron Airport has been acquired as part of the East Contra Costa County Habitat Conservation Plan's Preserve System, so the Service assumes that this bank no longer exists and is now a preserve instead.

There are no conservation banks that provide credits for the vernal pool tadpole shrimp within the Livermore Vernal Pool Region.

6.5. Habitat Conservation Plans

There are two regional Habitat Conservation Plans (HCPs) within the Livermore Vernal Pool Region that include all three shrimp species as Covered Species and one regional HCP that includes only the vernal pool fairy shrimp and vernal pool tadpole shrimp as Covered Species (**Figure 6.5**).

6.5.1. East Contra Costa County HCP

The East Contra Costa County HCP covers the eastern portion of Contra Costa County, and is mostly within the vernal pool region (Jones and Stokes Associates 2006a). This HCP was permitted in 2007 and has a 30-year permit term, and the permittees are Contra Costa County, the Contra Costa County Flood Control and Water Conservation District, the East Bay Regional Park District (EBRPD) and the Cities of Brentwood, Clayton, Oakley, and Pittsburg. The goal of the HCP is to provide an effective framework to protect natural resources in eastern Contra Costa County while improving and streamlining the environmental permitting process for impacts on endangered species. The HCP's Conservation Strategy will result in an interconnected Preserve System totaling between 23,800 acres and 30,300 acres of land preserved in perpetuity.

The HCP mapped landcover types within the inventory area, and 121 acres of seasonal wetland complexes and 483 acres of undetermined wetlands were identified that may be suitable for the vernal pool fairy shrimp and vernal pool tadpole shrimp; this does not include the surrounding annual grassland or rock outcrops. Because these habitat features are difficult to identify from aerial photos and because access to private lands for field verification was restricted, habitat models for covered shrimp species were not developed. Effects on the vernal pool fairy shrimp and vernal pool tadpole shrimp from Covered Activities include loss of up to 131 acres (22%) of the seasonal wetland complexes and undetermined wetlands. The HCP has a variety of biological goals, measurable objectives, and conservation actions related to protecting covered shrimp species, including: preserving seasonal wetlands and alkali wetlands to offset losses from covered activities at a ratio of 3:1, restoring seasonal wetlands and alkali wetlands to offset losses from covered activities at a ratio of 2:1, and collecting topsoil from vernal pools to be converted by Covered Activities for later use as inoculum for the created pools (Jones and Stokes Associates 2006a).

As of December 31, 2021, Covered Activities have directly impacted 1.62 acres of seasonal wetlands and 0.15 acre of alkali wetlands and indirectly impacted 4.03 acres of seasonal wetlands and 1.00 acre of alkali wetlands (ECCCHC 2022). The East Contra Costa County Habitat Conservancy (ECCCHC) has acquired 42 properties for the Preserve System, totaling over 14,500 acres. All but one of the acquisitions were completed in partnership with the EBRPD which owns the lands and manages them together with the ECCCHC (ECCCHC 2022). In total, 13.4 acres of seasonal wetlands and 34.8 acres of alkali wetlands have been preserved. Preserve System lands known to support the vernal pool fairy shrimp include the Coehlo, Souza I, Souza II, Vaquero Farms South, Casey, and Campos Preserves. In addition, 11 restoration or creation projects have occurred, 9 of which have restored or created seasonal or alkali wetlands: Lentzner Spring, Vasco Caves Souza I Pond, Souza II Wetland, Upper Hess Watershed, Souza II Corral Seasonal Wetland, Vaquero Farms Seasonal Wetland Creation (Pools 1 and 2), Hess Creek Channel, Vaquero Farms Seasonal Wetland Creation (Pool 3), and Horse Valley Creek

and Wetland Restoration Projects. In total, these projects have restored 2.47 acres of seasonal wetlands and 0.87 acre of alkali wetlands and have created 4.58 acres of seasonal wetlands and 1.25 acres of alkali wetlands (ECCCHC 2022). The vernal pool tadpole shrimp has not been observed at any of these preserves.

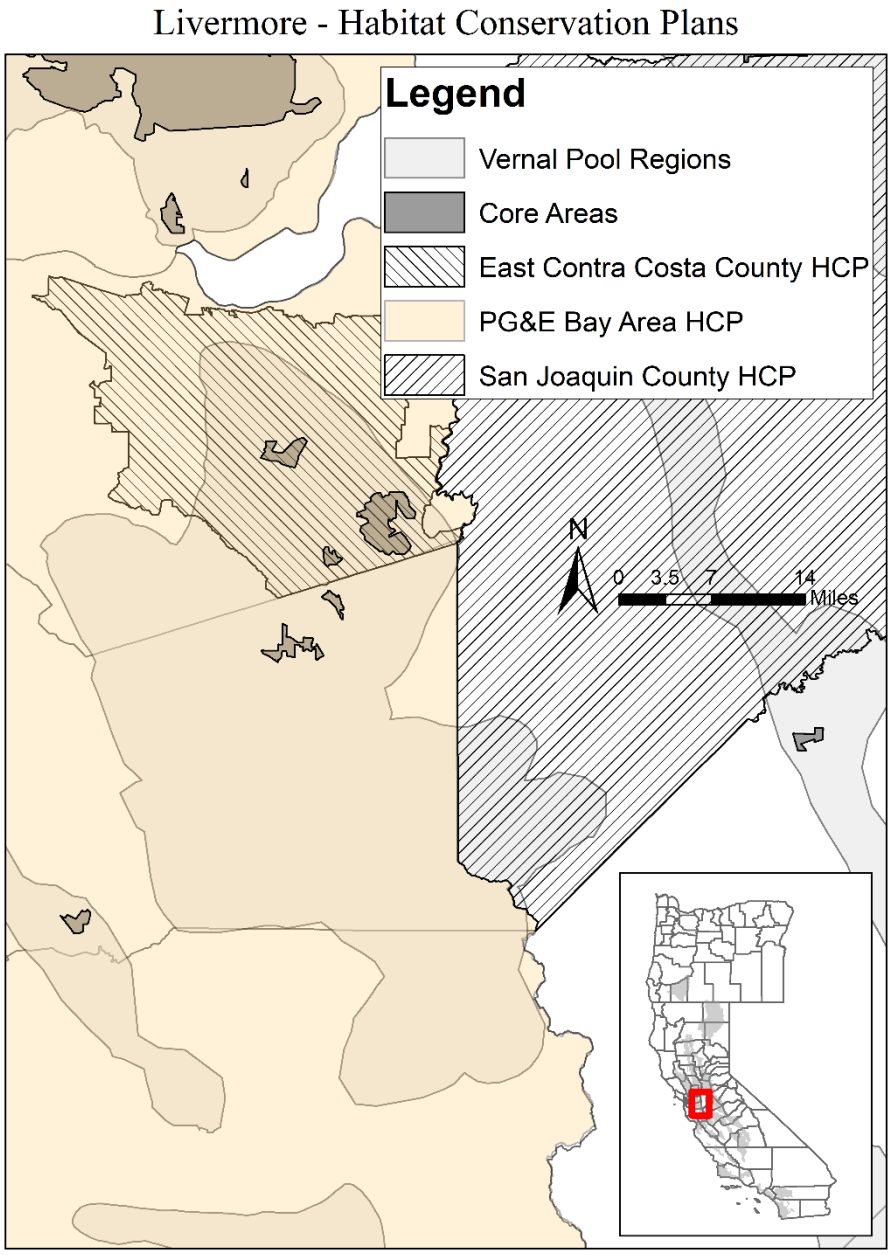

Figure 6.5. Map of the habitat conservation plans (HCPs) within the Livermore Vernal Pool Region that include any of the three shrimp species as Covered Species.

6.5.2. PG&E Bay Area Operations and Maintenance HCP

See section 3.5.1 for a description of this HCP.

6.5.3. San Joaquin County HCP

The San Joaquin County HCP covers the entirety of San Joaquin County and spans the southern end of the Southeastern Sacramento Valley Vernal Pool Region and the northern end of the Southern Sierra Foothills Vernal Pool Region (SJCHCP 2000). It also includes the northern end of the San Joaquin Valley Vernal Pool Region and the southeastern end of the Livermore Vernal Pool Region, though no vernal pool grasslands have been present in these parts of San Joaquin County since at least 2005 (Witham et al. 2013; Witham et al. 2014; Witham 2021). This HCP was permitted in 2001 and has a 50-year permit term, and the permittees include San Joaquin County and all of its incorporated cities, Caltrans, and the San Joaquin Council of Governments. The key purpose of the HCP is to provide a strategy for balancing the need to conserve Open Space and to convert Open Space while protecting the region's agricultural economy, preserving landowner property rights, providing for the long term management of plant, fish, and wildlife species, providing and maintaining multiple-use Open Spaces which contribute to the quality of life of county residents, and accommodating a growing population while minimizing costs to Project Proponents and society at large. An anticipated 109,302 acres of Open Space will be converted, and 100,841 acres of land will be preserved in perpetuity to compensate for impacts to Covered Species.

The HCP area includes a total of 77,806 acres of potential habitat for the vernal pool fairy shrimp, including an estimated 73,614 acres of natural vernal pool grassland as well as other natural and agricultural land cover types that may provide habitat for the species. Over the 50-year permit term, Covered Activities will affect 6,793 acres of vernal pool fairy shrimp habitat and 5,378 acres of vernal pool tadpole shrimp habitat. The HCP's Preserve System will compensate for habitat loss via preservation of habitat at a 3:1 ratio for natural lands and a 1:1 ratio for agricultural lands. For the vernal pools themselves, the 3:1 ratio will be achieved by preserving 2 acres of natural vernal pools per every 1 acre lost and creating 1 acre of vernal pools per 1 acre lost. Topsoil from vernal pools to be converted by Covered Activities will be collected and stored for later use as inoculum for the created vernal pools. Approximately 18,000 acres of vernal pool grassland is expected to be preserved by the HCP; these will likely be spread across the full extent of the vernal pool grasslands in the County, but there is no provision in the HCP requiring specific amounts of preservation to occur in specific vernal pool regions.

The HCP fulfilled its "jumpstart" requirement for vernal pools in 2005 with the purchase of 10.34 vernal pool preservation credits at Fitzgerald Ranch Conservation Bank, equaling 6 wetted acres and 18.585 acres of surrounding upland (SJCOG 2020). As of 2020, the vernal pool jumpstart purchase remains unused, as no vernal pool impacts have occurred requiring their use for mitigation (SJCOG 2020). The HCP has also preserved 71.76 acres of vernal pool grassland in the San Joaquin County Liberty and Dustin Road Preserve Dedication (SJCOG 2020). Both of these protected properties are in the Southeastern Sacramento Valley Vernal Pool Region.

Although the Conservancy fairy shrimp was not and still is not known to occur in San Joaquin County, it was included in this HCP at the request of the Service due to the identification of

scattered vernal pools south of I-580 (Livermore Vernal Pool Region) with the potential to support the species in 1998 (SJCHCP 2000). Pre-construction surveys are required in potential habitat, and full avoidance if the species is found. The nearest known occurrence of the Conservancy fairy shrimp is from Mapes Ranch in Stanislaus County.

6.6. Other Preserves

Besides land within the East Contra Costa County HCP Preserve System, East Bay Regional Park District also has two other preserved lands in Contra Costa and Alameda Counties with vernal pool habitat (**Figure 6.2**). The 1,979-acre Brushy Peak Regional Preserve is located just northeast of the City of Livermore. The original 507-acre portion of the preserve is owned and managed by the Livermore Area Regional Park District, and EBRPD owns and manages the more recently acquired 1,472 acres. Note that **Figure 6.2** does not depict a small section of land that is part of the preserve in the northeastern part of the preserve, inside the Altamont Hills Core Area. The 763-acre Vasco Caves Regional Preserve is located in southern Contra Costa County and is surrounded by the ECCHCP Preserve System to the north and east and the Los Vaqueros Watershed to the west. It is jointly owned and managed by EBRPD and Contra Costa Water District. Both of these preserves are characterized by rock outcrops with indentations that seasonally pool water and act as vernal pools. The vernal pool fairy shrimp is known to occur on both of these Regional Preserves, as well as the endangered longhorn fairy shrimp (*Branchinecta longiantenna*) (Diversity Database 2022).

The Byron Airport Habitat Management Lands consist of 814 acres of land on the southwest side of the Byron Airport which were preserved to offset impacts of the airport's expansion in 1994 (The Wildlife Project 2013). The land is owned by Contra Costa County and has a conservation easement held by CDFW. Most of the land is annual grassland with vernal pools, and several acres of vernal pools and seasonal wetlands have been created onsite (0.06 acre of vernal pools in Pasture 5, 1.33 acres of pools for California tiger salamanders [*Ambystoma californiense*] in Pasture 5, and 7.02 acres of seasonal wetlands and alkali wetlands in Areas A and B) (The Wildlife Project 2013). The vernal pool fairy shrimp has been found on or near this preserve consistently since 1997 (Diversity Database 2022). Management tasks include grazing at appropriate levels, monitoring wetlands every five years, and preventing activities inconsistent with the conservation easement, and funding has been provided for maintenance, management, monitoring, and consulting services (The Wildlife Project 2013).

Marsh Creek State Park (a.k.a., Cowell Ranch/John Marsh Home) is owned by the California Department of Parks and Recreation (CDPR) and is located in the southwestern portion of the City of Brentwood. The park has 3,600 acres of various habitat types. The vernal pool fairy shrimp is known to occur in 16 vernal pools in the Briones Valley, which is located on the western half of the park and is within one polygon of the Altamont Hill Core Area (CDPR 2012). Management includes grazing and siting trails to avoid impacts to vernal pools while also allowing the public to appreciate the pools (CDPR 2012).

The Los Vaqueros Reservoir is a 1,900-acre off-stream storage reservoir located within the 18,535-acre Los Vaqueros Watershed in southeastern Contra Costa County. The reservoir and watershed are owned and managed by the Contra Costa Water District, and the Bureau of Reclamation (BOR) provided funding in 2012 to expand the reservoir's capacity (Service

2020b). As mitigation for habitat loss caused by the expansion project, Contra Costa Water District purchased 5,079 acres of conservation lands in the surrounding areas. Vernal pool habitat and vernal pool fairy shrimp are known from the northeastern portion of the watershed (H.T. Harvey and Associates 2019a) and the Marsh Creek Habitat Management Unit – Deer Valley West Subunit of the conservation lands (ICF 2015); Witham (2021) also mapped vernal pool habitat within the northern portion of the watershed and in the Marsh Creek Habitat Management Unit – Deer Valley East Subunit. Note that the Marsh Creek Habitat Management Unit was not captured in Vollmar et al. (2017) or included in **Figure 6.2**. In 2018-2019, the vernal pool fairy shrimp was found in the Kellogg and Temblor vernal pool complexes (H.T. Harvey and Associates 2019a). Management of these lands, such as grazing, weed management, and avoidance of vernal pools, is prescribed by a resource management plan for the watershed (ICF 2016) and a habitat management plan for the conservation lands (ICF 2015). A section 7 consultation which covered routine operations and maintenance activities across these lands was written in 2012 and updated in 2020 (Service 2020b).

Other preserved lands include 5 private mitigation lands with conservation easements (2 held by CDFW, 2 held by Wildlife Heritage Foundation, 1 unknown), a 45-acre parcel owned by Contra Costa Water District surrounded by EBRPD land near Byron Airport, and a 119-acre parcel owned by the University of California north of Livermore (Vollmar et al. 2017).

6.7. Vernal Pool Core Areas

There is one Core Area within the Livermore Vernal Pool Region that is designated in the Recovery Plan for the vernal pool fairy shrimp: Altamont Hills. This core area has not met the target of 85% of vernal pool habitat protected, but as of 2018 it had lost less than 0.01% of the baseline level of habitat that was present in 2005 (see **Table 6.1**; Vollmar et al. 2017; Witham 2021).

There are no Core Areas within the Livermore Vernal Pool Region that are designated in the Recovery Plan for the vernal pool tadpole shrimp.

6.7.1. Altamont Hills

This is a zone 1 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp. The core area is located in southeastern Contra Costa County and northeastern Alameda County.

There were approximately 3,524 acres of vernal pool grassland within this core area when the Recovery Plan was published in 2005 (Witham et al. 2013). As of 2018, there were 3,522 acres of vernal pool grassland remaining, with only 2.1 acres lost due to agricultural conversion (see **Figure 6.6**, **Table 6.1**; Witham 2021). The total acreage of vernal pool habitat in this region is likely higher, given that many areas of vernal pool habitat occur in hilly terrain or rock outcrops which are not as clearly identifiable on aerial imagery as the flat vernal pool grasslands of the Central Valley. Within the bounds of the Altamont Hills Core Area, vernal pools that were not mapped by Witham (2021) are known to occur north of the Marsh Creek State Park, within the Vasco Caves area, and on the northern part of the Brushy Peak Regional Preserve based on presumed extant occurrences of the vernal pool fairy shrimp and the longhorn fairy shrimp in the

Diversity Database. Roughly 1,322 acres of mapped vernal pool grasslands (Witham 2021) were protected within this core area as of 2017 based on Vollmar et al.'s database (Vollmar et al. 2017), representing 37.5% of the 2005 baseline. In addition, areas of mapped (Witham 2021) and unmapped vernal pool habitat have been preserved within protected lands that were not captured by Vollmar et al.'s (2017) database, including Marsh Creek Habitat Management Unit, Vasco Caves Regional Preserve, Brushy Peak Regional Preserve, and several ECCC HCP preserves that were acquired after 2017 (**Figure 6.7**).

This core area is partially within the boundary of the East Contra Costa County HCP (Jones and Stokes Associates 2006a). To date, the ECCCHC has preserved six properties known to support the vernal pool fairy shrimp, four of which are within the Altamont Hills Core Area (**Figure 6.7**), and conducted nine restoration projects involving seasonal wetlands or alkali wetlands, two of which are within the core area (ECCCHC 2022). Other preserves that are within this core area include: Marsh Creek State Park, Marsh Creek Habitat Management Unit (not included in **Figure 6.7**), the Byron Airport Habitat Management Lands, Vasco Caves Regional Preserve, the northeastern (not included in **Figure 6.7**) and southern portions of Brushy Peak Regional Preserve, a 45-acre parcel owned by Contra Costa Water District near Byron Airport, and four small private mitigation lands with conservation easements.

6.7.1.1.Vernal Pool Fairy Shrimp Occurrences

There are 10 occurrence records from the Diversity Database for the vernal pool fairy shrimp within this core area (see **Figure 6.8**; Diversity Database 2022). As of 2018, seven of these occurrences were partially or entirely within protected areas mapped by Vollmar et al. (2017) and one additional occurrence was protected within the Vasco Caves Regional Preserve. Of the 10 records, 4 were known at the time of listing in 1994 and 7 were known at the time the Recovery Plan was published in 2005; these 7 occurrences are located throughout the core area. The three newer records are all located near the Byron Airport within the Byron Airport Habitat Management Lands or the East Contra Costa County HCP Preserve System.

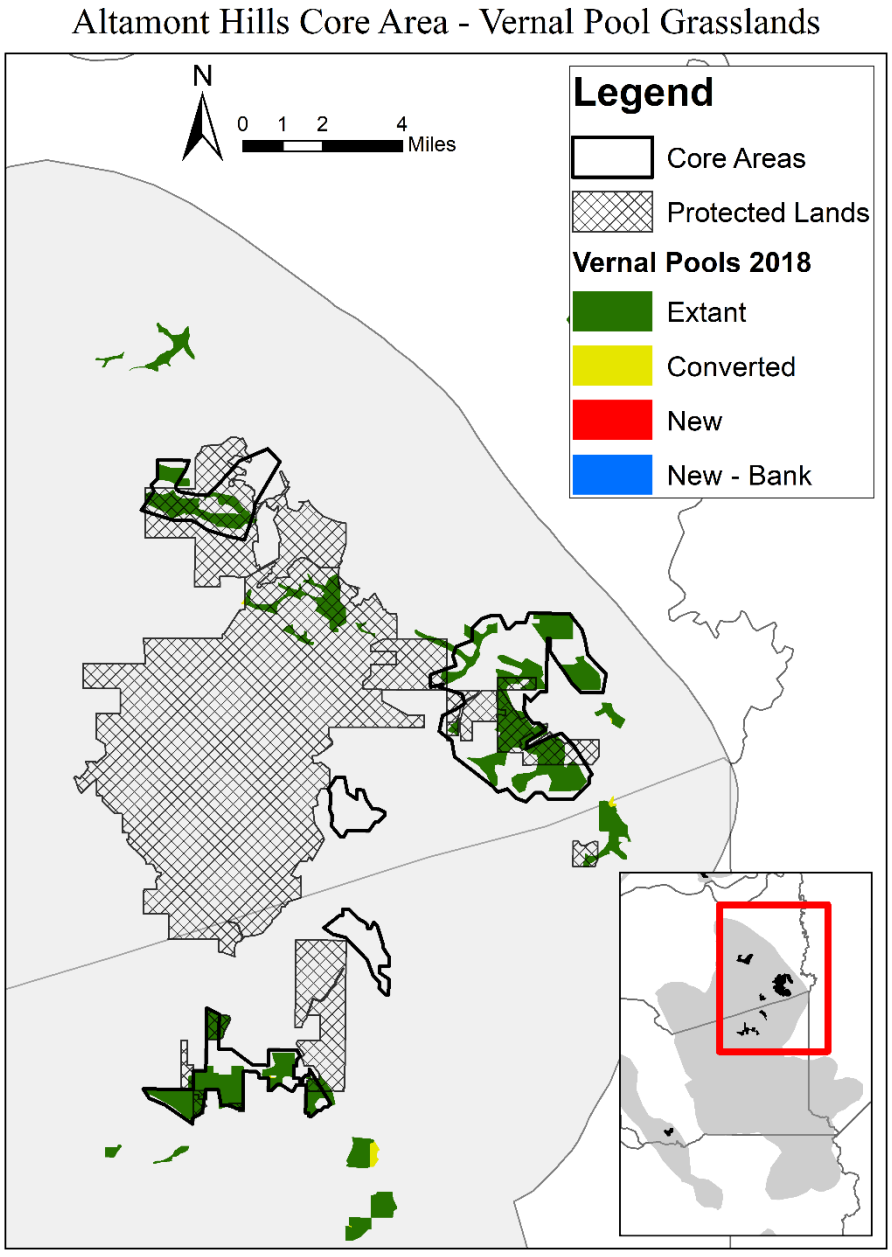

Figure 6.6. Map of vernal pool grassland habitat within the Altamont Hills Core Area mapped by Witham (2021) created using aerial imagery from 2018 compared to 2005 and 2012. "New" vernal pool habitat refers to areas not seen in the 2005 or 2012 aerial imagery (either missed or restored). "New - bank" refers to newly created vernal pool habitat on mitigation lands. Converted habitat refers to vernal pool habitat that was seen in 2005 or 2012 aerial imagery and by 2018 was converted to other land uses. Modified habitat as described by Witham (2021) was altered but still provides suitable vernal pool habitat (e.g., mitigation banks, lands managed for waterfowl), and so is mapped as extant. Zoom in for finer resolution.

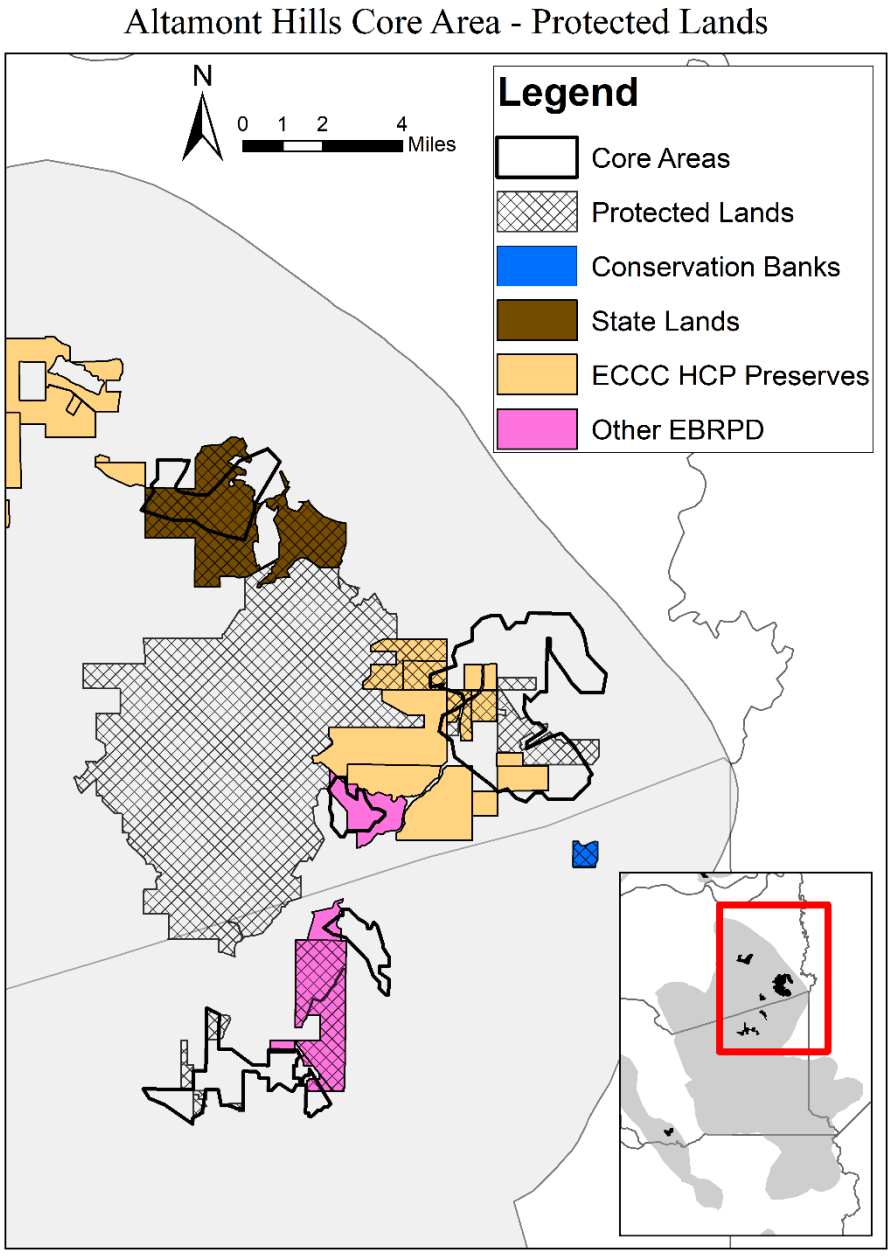

Figure 6.7. Map of protected areas within the Altamont Hills Core Area**.** Protected lands are based on Vollmar et al. (2017) and include various preserves. ECCC HCP = East Contra Costa County Habitat Conservation Plan, EBRPD = East Bay Regional Park District.

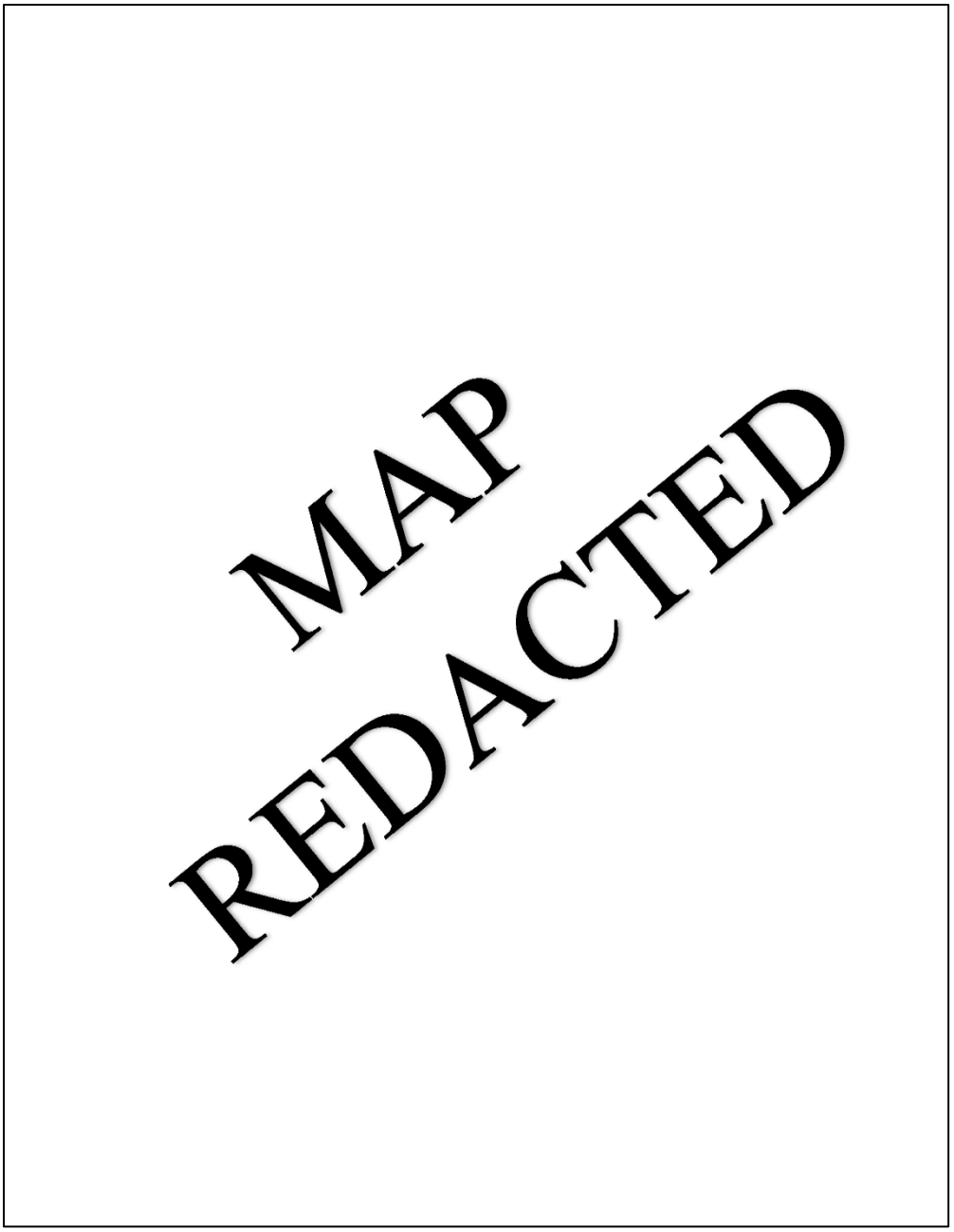

Figure 6.8. Map of known occurrences of vernal pool fairy shrimp recorded in the Diversity Database (2022) within the Altamont Hills Core Area. Polygons may represent individual pools, multiple pools, whole properties, or entire vernal pool grassland complexes. Occurrences are color coded as extant or extirpated based on both the Diversity Database and Witham's (2021) map of vernal pool habitat.