

Attachment E
Predator Management Measures for
the Burke Ranch California Tiger
Salamander Breeding Ponds

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Ecological Setting

A total of 6 vernal pools at Burke Ranch Conservation Bank (BRCB) appear to support suitable hydrology (i.e., continuous inundation for 70 days during the winter and early spring months) to allow for successful California Tiger Salamander (CTS) (*Ambystoma californiense*) breeding. Surveys for larval CTS conducted from 2008 to 2011 indicate that at least three, and perhaps 4 of these pools routinely support breeding CTS. These pools are shown on Figure 1 as pools 1, 2, 3, and 4. Pools 5 and 6 support a suitable hydrologic regime for breeding but no larval CTS have been detected in these features over the course of the past years' surveys. All of these pools dry completely by mid- to late-June and remain dry until winter rains re-inundate the pools.

During surveys in winter 2009-2010 and winter 2010-2011, potential aquatic predators of CTS were observed in pools 2, 3, and 4 during the course of surveys for larval CTS. Potential aquatic predators captured during CTS surveys included red-swamp crayfish (*Procambarus clarki*), fathead minnow (*Pimephales promelas*), and green sunfish (*Lepomis cyanellus*). Based on communication with CTS experts (Searcy and Clause, Pers Comm. Shaffer Lab UCD September 2011), it is expected that the green sunfish would be the species with the greatest potential to have an effect on the CTS reproduction within a breeding pool. However, it is speculated by Searcy and Clause that the high water events that may allow sunfish to access the pools also likely results in higher than average CTS breeding, which may in part offset the introduction of predator species into these pools. During seining surveys in these years only one or two individuals of the aforementioned species were detected in any one pool during sampling; all were euthanized upon detection:

- 2009 – individual crayfish found in pools 3 & 4
– two sunfish found in pool 4
- 2010 – individual crayfish found in pool 2 & 3
– fathead minnow

Because these three potential predator species are associated with perennial water bodies and can not persist in temporary water bodies like vernal pools, additional investigations regarding potential vectors or pathways of introduction were investigated in spring and summer 2011.

Aside from the highly unlikely potential of human or animal vectors depositing these species in the pools, the only explanation for their occurrence would be episodic connection between the pools, via a drainage, to a permanent water body located offsite.

The drainage at BRCB is predominantly from the north to south towards the Sacramento San Joaquin Delta. A small intermittent drainage (average width of 6 to 8 feet) drains the

property from roughly the northwest edge flowing southwesterly to the southern boundary of the BRCB and is a tributary to Barker Slough, a permanently inundated tidal slough. Approximately 0.7 mile downstream of BRCB is an impoundment on Barker Slough adjacent to the Argyll recreation park east of Highway 113. This impoundment forms a small recreational lake and the dam and spillway on the lake could form a hydrologic control on the drainage through Burke Ranch as well as the other tributary to Barker Slough which originates on Muzzy Ranch and flows through Campbell Ranch.

Based on a review of aerial photographs dating back to 1993 on Google Earth the impoundment on Barker Slough appears to continuously inundated creating suitable habitat for the growth and reproduction of the types of potential aquatic predators found on BRCB. Topographic data from USGS indicates that the spillway on the Barker Slough impoundment lies at approximately 15 feet above sea level. BRCB varies in elevation from approximately 35 feet above mean sea level on its northern most extent down to 25 feet on its southern boundary where the drainage exits the property. Therefore, when the small lake on Barker Slough is fully inundated water will not back up the drainage onto BRCB during the dry season. However, as mentioned previously the spillway and the lake itself may act as a control on outflows from the two Barker Slough Tributaries during peak runoff events. The lake, its emergent vegetation, and the size and construction of the spillway weir could all create an impediment to conveying the full natural flow of the tributaries during and shortly following large storm events. Essentially acting as a small hydrologic dam, the restricted flows out of the lake could cause increased water surface elevations within the tributary drainages extending to the west including the drainage on BRCB allowing aquatic species to move up the drainage and onto Burke Ranch. The combination of conditions related to watershed runoff, storm intensity, and other climatic variables that could allow even limited aquatic connection between this recreational lake and intermittent or ephemeral drainages on Burke Ranch is not currently well understood. However, it is likely that certain large storms that occur when the watershed is already at field capacity can produce sufficient runoff to facilitate aquatic connectivity between the small lake and BRCB.

Comparison of playa pool sampling data and rainfall data from the Hastings Tract East rain gauge (CIMIS) approximately 3 miles to the east of BRCB appear to suggest that certain storm events may be correlated with aquatic predator detections in the playa pools. Detections of aquatic predators in sampling years 2009-2010 and 2010-2011 were both preceded by at least one month with an excess of 5 inches of rainfall and with at least one sizeable storm event that exceeded 1.8 inches of total precipitation within 48 hours. It is hypothesized that the exceptionally high water levels result in the drainage on the property overtopping its bank, resulting in a temporary surface water connection to the CTS breeding pools. Aquatic predators have the opportunity during this period to opportunistically relocate from the drainage to the pools, where they persist until the pools dry in late spring.

Proposed Adaptive Control Plan

The need for and potential frequency for future predator detection is undefined as the vector for predator introduction is currently unknown. The key feature of this Plan is a two phased approach:

1. Phase I – monitoring of the site will occur for three years to determine how and under what circumstances the predators are coming on to the site, and evaluating if there is a viable method for their exclusion. Because the circumstances conducive to predator introduction likely only occur during specific rainfall events the three years of effort may require more than three seasons to complete. Elements of this program include:
 - a. Further documentation of site hydrology related to peak storm events and flows;
 - b. Sampling for aquatic predators (to minimize take* of vernal pool invertebrates or CTS associated with incidental damage or death during the seining process, predator sampling and control will be conducted by a biologist with a valid Section 10(a)(1)(A) permit for listed vernal pool invertebrates and CTS, as well as a valid California State Scientific Collectors Permit); and
 - c. Aquatic predator control and prevention.

Each of these elements is described below. These actions will be undertaken for a period of three years (winter 2011/2012, 2012/2013, and 2013/2014) to develop a more complete understanding of the CTS breeding pools at BRCB. All costs to complete these activities have been added to the property stewardship endowment.

2. Phase II – work with the resource agencies once there is sufficient data, and develop a method to reduce or eliminate predatory effects in the field. Future monitoring protocols, including duration and frequency, to confirm viability of any exclusionary methods, would be worked out as part of Phase II.

Phase I - Baseline Data Collection

Documentation of Site Hydrology. Hydrologic conditions at BRCB will be documented in the field through the use of ground level photographs within 24 hours following a storm event where total precipitation exceeds 1.5 inches in a 48 hour period as measured at the Hastings Tract East rain gauge. If surface water is observed forming a direct connection between the drainage and any of the CTS breeding pools, representative depth measurements will be made across the intervening span to identify the maximum and average depth of connection. Sampling for aquatic predators will be conducted within the CTS breeding pools within one week of the field visit if either a direct hydrologic connection was

* “Take” is defined by in California State law as the act of “hunt, pursue, catch, capture or kill” an individual species. The Federal Endangered Species Act has a broader definition of take, which is to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct”.

documented or if field observations indicate that sufficient aquatic connectivity was present during the storm event to produce drift lines or other indicators.

Predator Sampling. To adequately sample the pool for predators while minimizing the impact to CTS and listed vernal pool invertebrates, two seine hauls, or coverage of 30 percent of the ponded area, will be performed across the full width and length of the breeding pools. If CTS aquatic predators are detected they will be removed from the pool and euthanized. The total number and species of potential predators will be recorded for each seine haul. If green sunfish (*Lepomis cyanellus*) are detected in a pool during predator sampling or routine CTS monitoring, complete seining of the breeding pool will be conducted to maximize detection and removal of this potential predator (see “Predator Control and Prevention” below).

Predator Control and Prevention. Should predator control be needed the CTS breeding pools they will be seined completely to remove aquatic CTS predators. Any full and complete seining of the CTS breeding pools will only be conducted following written approval from the US Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG).

Reporting. Results will be reported in the Annual Monitoring Report for the BRCB.

Phase II - Agency Coordination

Following the three years of data collection, or at any time during this period should data indicate an increasing use of the site by predatory species, WES will request a meeting with the CBRT to investigate if preventative measures are viable to limit predatory access to the site. Alternatives which may be considered include limiting access of the onsite drainage to potential predators from offsite locations, or restricting overland flows in the vicinity of the CTS breeding pools. Prevention actions may include installing a physical barrier such as a mesh screen on the drainage where it exits the property on the southern boundary of the BRCB, modifications to the drainage itself, or provision of other physical barriers to prevent colonization of the breeding pools by CTS predators.