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Casmalia Habitat Restoration Plan for the California red-legged frog and western spadefoot toad

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Introduction

Currently, the federally threatened California red-legged frog (*Rana aurora draytonii*) and the state Species of Special Concern western spadefoot toad (*Scaphiopus hammondii*) use habitat provided by water storage ponds at the Casmalia Resources Superfund Site (Site) in Santa Barbara County, California. As the ponds may be removed to complete Site closure activities there is a potential conflict between relevant federal and state regulations guiding Site closure activities and the protection of the target species. To address this potential conflict the United States Environmental Protection Agency (EPA) and Casmalia Steering Committee (CSC) requested a plan for the adjacent Casmalia Creek riparian corridor that would allow for the establishment of the displaced target species. To meet this request the Casmalia Habitat Restoration Plan (Plan) clarifies the likely interaction between applicable laws and provides a comprehensive habitat creation and restoration plan for the riparian corridor with transferable design criteria and rationale that are applicable throughout the watershed.

Significance

This report is significant as it assists the EPA and CSC in determining the necessary measures to successfully complete Site closure activities while fulfilling species protection measures.

Legal Context

The apparent conflict between the Endangered Species Act (ESA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is uncommon but not unique. Federal agencies, in this case the EPA, have a duty to conserve listed species and the courts have affirmed this obligation even in instances when doing so may be counter to their primary mission.[ii] Closure activities at other EPA sites have been modified to minimize effects to listed species in accordance with the ESA. However, section 7 of the ESA allows conditional exemptions for federal activities that have adverse effects on listed species provided these activities do not jeopardize the species continued existence and are "incidental to, and not the purpose of, otherwise lawful activities".[iii] Therefore, the EPA and CSC are likely are modify closure activities in a manner which minimizes adverse effects to the California red-legged frog.

Figure 1. California red-legged frog in Casmalia Creek.[i]

Both target species are designated as California Species of Special Concern. This designation does not extend any specific legal protection to the species or their habitat, but rather is intended to generate special consideration in conducting actions that may negatively affect them.

Metapopulation Considerations

As the target species exist within a metapopulation, their regional persistence relies upon dispersal between local subpopulations.[iv] As such, habitat elimination at the Site may have implications that extend to include effects upon their metapopulation. For example, the San

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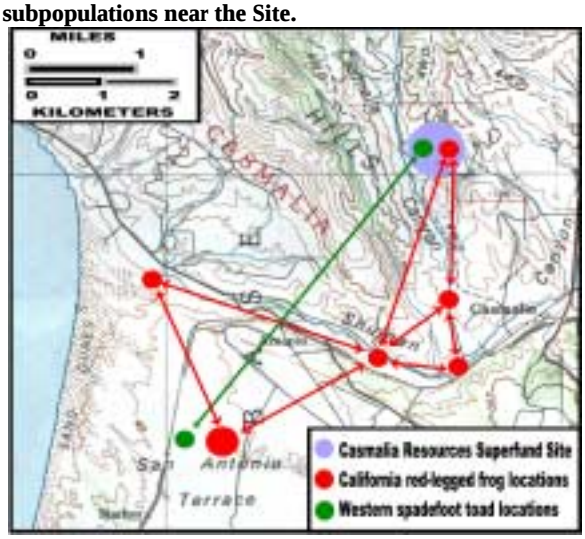
Antonio Terrace, located south of the Site, is among the most productive areas for the California red-legged frog in Santa Barbara County.[v] Individuals from this area are thought to disperse to nearby Shuman Creek,[vi] and may subsequently disperse to Casmalia Creek where the California red-legged frog has been observed.[i] As it is highly probable that California red-legged frogs in Shuman Creek are connected to the population at the Site, it is plausible that the Site species are connected to a highly productive area. In addition, the western spadefoot toad also exists on the San Antonio Terrace and is potentially connected to the Site.

Figure 2. Potential interactions between local subpopulations near the Site.



Habitat Needs and Opportunities

The habitat requirements of the target species were extensively evaluated. Based on their breeding and larval development requirements and the conditions present in the Casmalia Creek watershed two potential options to provide suitable habitat were identified: creating ponded habitat and restoring portions of Casmalia Creek. Ponded habitat that contains a suitable hydroperiod and vegetation (a minimum of 20 centimeters of water persisting from January through July) is generally thought to enhance breeding and larval development.[vii] In addition, establishing the appropriate native vegetation and improving the condition of the riparian corridor will also provide a variety of benefits. However, intense rainfall events result in high flow velocities and creek bed scouring, which make Casmalia creek unreliable breeding habitat.[viii] As a result, it was determined that creating ponds adjacent to restored portions of the riparian corridor will provide suitable breeding and non-breeding habitat.

Water Budget Analysis

A water budget model was created to determine if a sufficient volume of water is available in the riparian corridor to create ponded habitat. The model used the following formula to simulate various pond scenarios created to provide habitat:

$$\mathbf{S_1 = S_0 + GWI + SWI + P - SWO - GWO - Et}$$

$\mathbf{S_1}$ = Final storage $\mathbf{S_0}$ = Initial storage
GWI = Groundwater inflow
SWI = Surface water inflow
P = Direct precipitation
SWO = Surface water outflow
GWO = Groundwater outflow (infiltration out)
Et = Evapotranspiration

The primary input to the model was stormflow from the creek, estimated using the USDA Soil Conservation Service (SCS) method. Water loss from infiltration and evapotranspiration were outputs.

Using the SCS method required daily precipitation data and an empirically based estimate of the watershed's rainfall-runoff response or curve number (CN). Forty-five years of daily precipitation data were obtained from the nearby Santa Maria Airport, due to its correlation with 10 years of Site data. An average CN of 86 was assigned to the watershed based on the hydrologic soil group, land use and cover, treatment, and hydraulic condition. As the average CN represents soil conditions with an antecedent moisture condition (AMC) II, values for AMC conditions I (dry) and III (wet) were selected. Once the CN for the three AMC classes were determined, a Microsoft Excel© spreadsheet was designed to calculate daily runoff values using the following formulas:

$$S = \frac{1000}{CN} - 10 \qquad Q = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Where S is the potential maximum retention of water by the soil in equivalent depth over the drainage area. Runoff (Q) is calculated, using S and daily precipitation (P). Total stormflow was then calculated by multiplying daily Q by the area of the watershed above potential pond locations.

However, as the creek is not gaged it was prudent to compare calculated stormflow to gaged streams in reference watersheds. This allowed for a comparison of the percentage of precipitation that becomes stormflow to determine if calculated stormflow has been over or under estimated. The nearby Orcutt Creek and Miguelito Creek watersheds were selected to serve as reference watersheds based on the presence of conditions similar to the Casmalia Creek watershed suggesting they have a similar CN.

To compare the percentage of precipitation that becomes stormflow, the average annual hydrographs, created using data from USGS gaging stations in the reference watersheds, were separated into baseflow and stormflow components. The volume of stormflow was divided by the volume of rainfall to estimate the average annual percentage of precipitation that became stormflow. In reference watersheds and the Casmalia Creek watershed stormflow was 9% and 14% of total precipitation, respectively. As the difference will mean the calculation of a significantly smaller volume of water available for ponds, the CN for the Casmalia Creek watershed was adjusted from 86 to 80. This allowed for a more conservative estimate of the volume of available water.

Table 2. Comparison of average annual stormflow as a percentage of average annual precipitation.

Casmalia Creek CN	Annual Stormflow (m^3)	Annual Precipitation (m^3)	Percentage of Precipitation Resulting in Stormflow
86	280,000	2,000,000	14%
80	180,000	2,000,000	9%

m^3 – cubic meters

Upon determining the inputs and outputs to the model it was found that 10 of 48 different pond scenarios run in the model met the target species' minimum water needs in each of the 45 years the model was run. This suggests that Casmalia Creek can provide a sufficient volume of water on an annual basis to create ponded habitat of various sizes. Of the 10 pond scenarios that met the minimum water needs, the largest pond that met the target species ideal water needs, and maximized the ponded habitat area was 2.8 acres.

Habitat Creation and Restoration Plan

Based on the EPA and CSC's request for a plan in the riparian corridor that would allow for the establishment of the displaced target species the following design parameters were developed:

Pond

- Create a 2.8 acre pond
- Include macro and microtopography
- Plant vegetation within and around the pond
- Reduce incoming flow velocity

Casmalia Creek

- Stabilize creek banks
- Plant vegetation within the riparian corridor

Management

- Manage cattle grazing
- Manage new habitat to discourage exotic predators and exotic vegetation
- Monitor for success of new habitat

Implementation

- Excavate new pond prior to January
- Evaluate natural colonization prior to draining existing Site ponds
- Drain existing ponds at the Site
- Exclude target species from drained ponds

Cost

Table 3 presents the estimated cost of implementing this Plan based on the construction of the pond, the cost of planting vegetation, and the cost of biological monitoring for the created and restored habitat.

Table 3. Total Estimated Cost

Item	Cost
Total Estimated Construction Costs	
Construction and Vegetation Planting	$210,000
Total Estimated Monitoring Costs	
Fauna and Vegetation Monitoring for 10 years	$130,000
Total Estimated Cost	**$340,000**

Evaluation

The analysis focused on four considerations that are critical in assessing the Plan's ability to meet the EPA and CSC's objective. These considerations are:

1. The reduction in the volume of flow downstream of the potential pond location.
2. The plausibility of establishment based on proximity to populations at the Site;
3. The likelihood of the habitat being conducive to establishment and persistence of individual members of the target species; and,
4. The likelihood of the habitat supporting an equivalent sized population.

It was estimated that capturing stormflow for pond scenarios will reduce total annual flow through Shuman Creek by approximately 4%, on average. Further, stormflow through Casmalia Creek was reduced by 10% in 1 out of every 2 years and by 100% in 1 out of every 11 years. The potentially significant reduction in flow volumes, may have an adverse impact on downstream biota. This issue must be addressed further before using the creek as a source for created habitat.

As the potential location for creating and restoring habitat is within the target species' dispersal distance, and as there are no major barriers to dispersal, it is plausible the target species could become established. As the Plan provides methods, based on extensive research, for creating and restoring suitable habitat it is likely the habitat will be conducive to the establishment and persistence of the target species. However, the elimination of ponds at the Site (25 acres of ponded habitat) and the implementation of the Plan (2.8 acres of ponded habitat) will result in a 10-fold loss in habitat area and an increase in the target species' population density.

Studies of frog and toad species indicate positive and negative effects of increased density. However, as potential effects of increased density include a decrease in larval survival rates and increased competition between adults, a prudent approach to providing habitat to the target species is advised. As implementing the Plan will result in a ten-fold reduction in area and increase target species density it is inadvisable to rely solely on it to provide sufficient habitat for the displaced target species.

As such, the B and C-drainages as well as the Site itself should be considered as possible locations to create and restore suitable habitat. These locations could allow for the creation of equivalent habitat area. Although habitat area at these locations will also be constrained by the availability of water, sources would not be limited to the creek. Potential sources of water from the Site include: storm runoff, treated groundwater, and existing pond water.

Recommendations

As the effects of reducing flow and habitat area are not fully understood it is the recommendation of the Casmalia Team that the EPA and CSC explore opportunities within the watershed that provide habitat area for the target species equivalent to that of the water storage ponds. Further, the Casmalia Team recommends restoring the Casmalia Creek riparian corridor near created habitat to provide additional benefits. Lastly, as the Plan provides habitat design parameters for creating and restoring habitat conducive to the establishment and persistence of the target species, these parameters should be incorporated into any habitat creation and restoration plan regardless of location in the watershed.

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[i] T. Carson and C. Minton, personal observation, September 25, 2001.
[ii] 898 F 2d 1410 (9th Cir. 1990).
[iii] 16 U.S.C §1536.
[iv] Hanski, Ilkka. 1999. Metapopulation Ecology. Oxford University Press, New York. 313p.
[v] Christopher, S. 1996. Reptiles and Amphibians of Vandenberg Air Force Base. Unpublished report prepared for the U.S. Department of the Air Force and U.S. Department of Interior Natural Biological Service. 145p.
[vi] Christopher, S. 1996. Reptiles and Amphibians of Vandenberg Air Force Base. Unpublished report prepared for the U.S. Department of the Air Force and U.S. Department of Interior Natural Biological Service. 145p.
[vii] USFWS 2000. Draft Recovery Plan for the California Red-Legged Frog *(Rana aurora draytonii).* U.S. Fish and Wildlife Service, Portland, Oregon. 258p.
[viii] California Regional Water Quality Control Board Central Coast Region. 1999. Staff Report for National Pollutant Discharge Elimination System Permit CA0049972; Waste Discharge Requirements Order No. 99-034.