Rim Fire Reforestation Project

Groveland and Mi-Wok Ranger Districts
Stanislaus National Forest

Biological Assessment*

Aquatics – Federally listed species and their habitat

Prepared by:

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*Adapted from Rim Fire Recovery Project Biological Assessment (USDA 2014)

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Summary of determinations:

Species/Habitat	Status	Species known present?	Critical Habitat present?	Determination
California red-legged frog (*Rana draytonii*)	Federally Threatened	No	No	May affect, likely to adversely affect
Sierra Nevada yellow-legged frog (*Rana sierrae*)	Federally Endangered	No	No*	May affect, likely to adversely affect

*Proposed critical habitat not present

I. INTRODUCTION

The purpose of this draft Biological Assessment (BA) is to review the Rim Reforestation Project and evaluate the effects of the proposed action on federally listed threatened, endangered, and proposed species, and provide documentation of consultation with the U. S. Fish and Wildlife Service, and fulfill the requirements required by the Endangered Species Act and Forest Service Manual. As of March 2016 a "selected" alternative is not in place; therefore, this document assumes a "maximum treatment" scenario for both area treated and treatment type.

PROJECT:

Rim Fire Reforestation Project.

GENERAL LOCATION:

The project area is located on the Groveland and Mi-Wok Ranger Districts of the Stanislaus National Forest in Mariposa and Tuolumne Counties, California. The project area is generally bounded on the south by Township 2 South, the north by Township 3 North, the east by Range 21 East, and the west by Range 16 East. The USGS Quadrangles include El Portal (4381), Kinsley (4382), Buckhorn Peak (4391), Groveland (4573), Jawbone Ridge (4574), Ascension Mountain (4563), Ackerson Mountain (4564), Lake Eleanor (4561), Cherry Lake South (4562), Duckwall Mountain (4571), Tuolumne (4752), Twain Harte (4743), Hull Creek (4744), Cherry Lake North (4733), and Kibbie Lake (4734). Elevation range of the project area is approximately 800 to 7,000 feet.

ENVIRONMENTAL SETTING:

Major vegetation associations include oak grassland, chaparral, ponderosa pine, Sierran Mixed conifer. Aquatic features include springs, seeps, ponds, reservoirs, and ephemeral, intermittent, and perennial streams. Elevation range is approximately 1,000 feet to 7,000 feet.

PROJECT TYPE:

Reforestation – mechanical site preparation, herbicide application, prescribed fire.

CONSULTATION TO DATE:

The Sacramento office of the US Fish and Wildlife Service was notified of the project in 2015, and initial consultation procedures are active as of December 2015.

An official list of Federal Endangered and Threatened Species covering the Ackerson Mountain, Cherry Lake North, Cherry Lake South, Duckwall Mountain, Groveland, Hull Creek, Jawbone Ridge, Lake Eleanor, and Tuolumne U.S.G.S. 7 ½ minute quadrangles was obtained from the Sacramento U.S. Fish and Wildlife Office website on December 5, 2013, updated on April 17, 2014 (Document 140417112513), and verified via IPac November 2015. The USFWS list was used as a basis for determining which species should be considered in the Biological Assessment (BA).

Excepting herbicide use, this project is expected to comply with the parameters set forth in the following document: *Programmatic Biological Opinion on Nine Forest Programs on Nine National Forests in the Sierra Nevada of California for the Endangered Sierra Nevada Yellow-legged Frog, Endangered Northern Distinct Population of Mountain Yellow-legged Frog, and Yosemite Toad (Service File FF08ESMF00-2014-F-0557* (USFWS 2014). Based on regional guidance (107-foot application buffer), no effects to Sierra Nevada Yellow-legged frog are expected to occur from herbicide use; other effects, such as habitat modification, are analyzed in this document.

CURRENT MANAGEMENT DIRECTION:

Forest Service Manual (FSM) 2670.32 directs that a biological evaluation (BE/BA) be prepared to evaluate project effects upon threatened, endangered, proposed, and sensitive species to ensure that project decisions do not result in loss of species viability or create a trend towards Federal listing. This biological assessment (prepared in accordance with FSM 2670.3) analyzes the potential effects of fuel reduction and forest health actions for the proposed Rim Fire Reforestation Project.

A Forest Goal from the Forest Plan Direction is to "provide habitat for viable populations of all native and desired non-native wildlife, fish and plants" and to "…give special attention to sensitive species to see that they do not become federally listed as Threatened or Endangered."

II. PROJECT DESCRIPTION

The project will contain a mix of one or more of the following activities: site preparation (e.g., deep tilling), planting, prescribed fire, mechanical and/or chemical release, noxious weed eradication (mechanical and/or chemical), and plantation thinning. Summaries of the treatments are listed below, and meant to represent the maximum treatment scenario; as of March 2016, a "selected" alternative, or blend of alternatives, has not been chosen. The species analysis section addresses only those acres that are proximate to analysis species habitat; therefore, the tables below are intended to provide a basic overview. Comprehensive descriptions of potential treatments are located in Chapter 2 of the EIS.

Action Types

Deer Habitat Enhancement

Enhance deer habitat through conifer planting.

Natural Regeneration

Natural regeneration of vegetation. Reduce fuels if the amount exceeds the maximum (10 or 20 tons per acre) amount within the specific units. Monitor species and number of trees across the landscape to decide if site preparation, planting, release and burning would occur.

Noxious Weed Eradication

Noxious weed eradication. The majority of the noxious weed treatments are within the reforestation units. Appendix N (Noxious Weed Schedule, project record) displays the implementation schedule for noxious weed eradication.

Reforestation

SITE PREPARATION

Deep Till and Forest Cultivate (subsoil): Deep till utilizing tractor drawn ripper shanks with subsoil wings to pass through the soil at a depth of as much as 30 inches along the contour slope. Tractors may pull 2 or 3 ripper shanks evenly spaced behind the tractor. This is followed by pulling a forest cultivator, with ripper shanks more frequently spaced on a V-shaped bar, to cultivate to an 18 inch depth. The cultivation treatment also occurs along the contour slope to prevent channeling of water in rainstorms. Deep tilling is designed to reduce soil compaction, improve planting quality, and reduce vegetation as forest cultivation is used to uproot competing vegetation species.

Feller Buncher: Use feller bunchers to cut trees. Mechanically remove material, as firewood, shavings logs, pulpwood, or chipped biomass fuel for electric cogeneration plants, or deck on site for public firewood cutting. If these options prove infeasible, then bunch material into piles and burn. Within existing plantations, remove both dead and live conifers to reduce live conifer density and promote desired ICO structure, favoring the healthiest conifers and the most diverse mix of tree species.

Hand Cut, Hand Pile and Burn: Hand cut trees that cannot be treated mechanically for various reasons such as slope conditions and resource concerns. Remove both dead and live conifers to reduce live conifer density and promote desired ICO structure in existing plantations, favoring the healthiest conifers and the most diverse mix of tree species. In new reforestation units, cut only dead trees and pile for burning.

Machine Pile and Burn: Push brush, small trees and downed fuels into piles for burning. This treatment may sometimes include hand felling larger dead trees. Use this method in areas with high down fuel loads and areas with standing dead trees that would inhibit access and worker safety and result in high tree or seedling mortality if burned.

Manually Apply Herbicides (Glyphosate): Use backpack sprayers for application of Glyphosate (plus a surfactant and colorant) to initially set back competing vegetation.

Mastication (shred): Mastication treatments consist of a tractor, excavator or loader with a cutting head used to shred brush, small trees, and large downed woody debris. Shredded material remains on site. Cut both dead and live conifers as necessary to reduce live conifer density and promote desired ICO structure, favoring the healthiest conifers and diverse mix of tree species. Both live and dead brush would be treated.

Prescribed Fire (Understory Burning and Jackpot Burning): Understory burns (using low intensity fire) in areas where fuel needs to be removed prior to planting or where natural regeneration is left free to grow. Jackpot burn (consume fuel concentrations) where feasible, but entire units may be treated to remove excess fuels and/or vegetation prior to planting. This is also proposed in existing plantations prior to thinning.

PLANT CONIFERS

Base composition and density on landscape position, Strategic Fire Management Areas (SFMA) and elevation.

RELEASE

Hand grubbing or manually applying herbicides (glyphosate).

PRESCRIBED FIRE

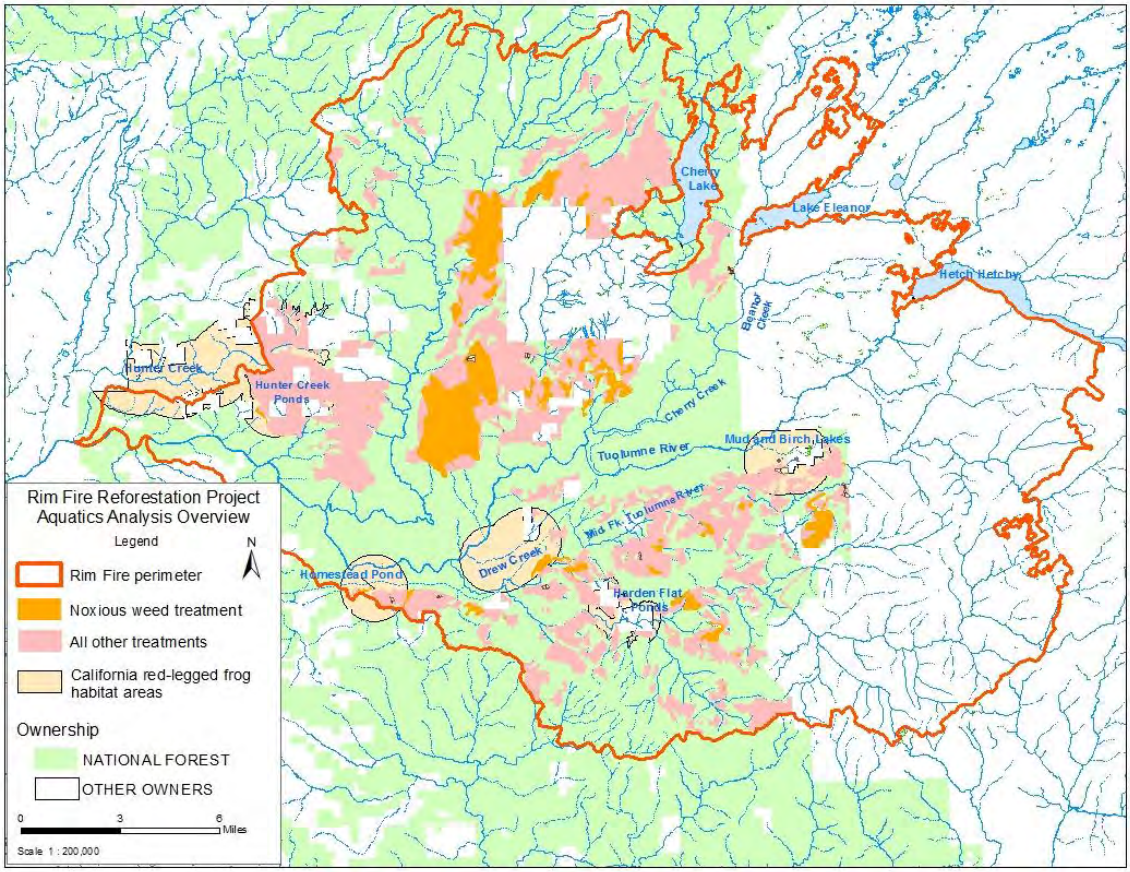
Prescribed fire in new plantations.

Thin Existing Plantations

Prescribed understory burning and thinning within existing plantations (outside of Deer Enhancement areas). Deer Enhancement areas have their own specific prescription.

III. ACTION AREA

The action area is defined by the Rim Fire perimiter (Figure 1). A map series depicting California red-legged frog habitat and project treatment overlap at finer scales is located in Appendix A.



EXISTING ENVIRONMENT:

In the sections titled "Species Account" below, occurrence records are based on the Stanislaus National Forest Aquatic Survey Database (AquaSurv, USDA 2010b), California Natural Diversity Database (CNDDB), and University of California, Berkeley, Museum of Vertebrate Zoology database (UCMVZ). When an occurrence record is followed by a date enclosed within parentheses, the date reflects the survey/observation or collection date. Under the "Habitat Account" sections, the habitats associated with the species summarize the information contained in Lannoo (2005) which compiles most of the available and relevant literature into a single account. Additional literature is referenced, as appropriate.

The project area primarily encompasses several major large rivers, multiple primary tributary streams to these rivers, and numerous very small tributary streams to either the large rivers or their primary tributaries. The two main rivers are the Tuolumne River and its largest tributary, the Clavey River. The primary tributaries to the Tuolumne River include Cherry Creek and the North, Middle Tuolumne and South Fork Tuolumne Rivers. Secondary tributaries to the Tuolumne River include Corral Creek, Granite Creek, Grapevine Creek, and Jawbone Creek. Primary tributaries to the Clavey River include the following creeks (proceeding upstream from the Tuolumne): Bull Meadow, Quilty, Bear Springs, Cottonwood, Reed, Reynolds, Bourland, Hull, and Twomile.

While the USGS maps indicate portions of the other streams are perennial, field observations made during surveys indicate these streams are largely intermittent by the middle of summer and into early fall in a typical year. Water in the larger pools may be persistent in most water years and could be considered perennial aquatic habitats. The USGS mapping designation of perennial and intermittent streams was used to determine the amount of aquatic habitat present within the project area.

IV. SPECIES/CRITICAL HABITAT CONSIDERED

If the project area is within the geographic range **but** not within the elevation range of a species, it is not considered further in this document. This applies to the Yosemite toad.

The following species are addressed further in this document for the Rim Fire Reforestation Project: California red-legged frog (*Rana draytonii*) and Sierra Nevada yellow-legged frog (*Rana sierrae*). Designated or proposed critical habitat is not present within the action area for either species.

Table 1 - Federally listed aquatic species potentially occurring within the Rim Fire Reforestation Project area.

Species	Within Local Range[1], Geographic or Elevation? Y/N	Nearest Documented Occurrence[A]	General and/or specific life stage habitat requirements[B]	Is Suitable Habitat[2] present within:		Citations supporting range, occurrence, and suitable habitat determinations
				Project Area?	One mile?	
Yosemite toad *(Bufo (Anaxyrus) canorus)* Status: Forest Service Sensitive, Federally Threatened	G = Y E = N, >7,000' locally	>10 miles @ Aspen Valley (Yosemite NP 1933), Upper Relief Valley near Granite Dome (2005)	Breeding: 1c, 2, 6 Adult: 11	N	N	[1,2,B]Lannoo 2005, Zeiner et al. 1988 [A]AquaSurv, CAS, CNDDB, MVZ
California red-legged frog (*Rana draytonii*) Status: Federally Threatened	G = Y E = Y, <4,000'	Within project area is a historic collection at Birch Lake (Mather) and outside area at Jordan Pond	Breeding: 1ab, 2, 4 General: 1abc, 2, 4, 10 Estivation: 11	Y	Y	[1,2,B]Federal Register (Vol. 70, No. 212; Vol. 71, No. 71) [A]CNDDB, MVZ
Sierra Nevada yellow-legged frog (*Rana sierrae*) Status: Forest Service Sensitive, Federally Endangered	G = Y E = N, >5,000' locally	>3 miles (northeast) @ Bourland Cr.	Breeding: 1bc, 2 General: 1bc, 2	N Y	N Y	[1,2,B]USDA 2001, Lannoo 2005 [A]AquaSurv, CAS, CNDDB, MVZ

[A] Sources: AquaSurv (USDA 2010c) – Stanislaus National Forest Aquatic Survey Database; CAS – California Academy of Sciences; CNDDB – California Natural Diversity DataBase; MVZ – University of California, Berkeley, Museum of Vertebrate Zoology records; USGS - (http://ca.water.usgs.gov/sanj/.html)

[B]Habitats: 1 – Perennial stream or water (a – large stream, >4th order; b – medium stream, 2nd – 4th order; c - small/headwater stream, 1st order); 2 – Permanent/Semi-permanent Pond; 3 – Slow, shallow water with cobble/boulder substrate; 4 – Nearly still pools with emergent vegetation and/or undercut banks; 5 - Waterfall spray zone and/or massive rock areas/granitic talus with flowing water; 6 – Wet meadow; 7 - Talus; 8 – South to west facing low-angle slope with compact, well-drained soils; 9 – Foothill chapparal, chamise, toyon, buckeye; 10 – Dense or well developed riparian vegetation, herbaceous and woody; 11 – Upland area surrounding aquatic/breeding features

Federally listed Threatened and Endangered Species

California red-legged frog
Stanislaus National Forest and project area status

The CRLF has not been detected on the Stanislaus National Forest since 1967 and is considered extirpated from the Tuolumne River watershed (USFWS 2002). No designated critical habitat exists within the project area. Historical records of CRLF in and near the vicinity of the project area (California Natural Diversity Database (CNDDB), USFWS 2002, Barry and Fellers 2013) are listed in Table CRLF1. The Stanislaus National Forest has completed extensive herpetofauna visual encounter surveys (Fellers and Freel 1995) across the forest since 1993. However, surveys specific to this project were not conducted and only portions of the project area have been previously surveyed. Appendix B (EIS project record) summarizes past surveys and results, indicating potential red-legged frog habitat surveyed in the project area with no detections. In addition, from 1991 to 2012 Barry and Fellers (2013) conducted day- and night-time surveys in historical red-legged frog Sierra Nevada localities and nearby suitable habitat. Their surveys included all the historical record localities from Table CRLF1 except Upper Lake in Yosemite National Park because they could not find the locality. No red-legged frogs were found.

Table 2 - Historical CRLF records from the Tuolumne and Merced River.

Locality	Year (#)	elevation	basin
Birch Lake (near Camp Mather)	1922 (1), 1945 (10)	4528’	Tuolumne River
Swamp Lake (Yosemite National Park)	1938 (1), 1939 (1), 1940 (2), 1941 (1)	5020’	Tuolumne River
Miguel Meadow (Yosemite NP)	1939 (2)	5020’	Tuolumne River
Gravel Pit Lake (Yosemite NP)	1940 (1)	5040’	Tuolumne River
Upper Lake (Yosemite NP)	1941 (?)	unk	Tuolumne River
Woods Creek (edge of Sonora)	1950 (4)	1870’	Tuolumne River
Parrot’s Ferry	1975 (1)	2103’	Tuolumne River
Jordan Creek	1967 (1)	2687’	Merced River
Piney Creek	1972 (?), 1974 (?)	1214’	Merced River

Habitat Account

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For the purpose of this analysis, potential habitat was identified from existing survey data, GIS maps, and aerial imagery. All perennial and intermittent aquatic habitats within 1 mile of proposed project activities at elevations of 4,000 feet or less (except at historic localities above this elevation) were assessed for CRLF breeding and non-breeding suitability. Potentially suitable stream breeding habitat included streams with the following characteristics: 1) low gradient (<4%), 2) presence of pools holding water for 20 weeks during timing of egg and tadpole development, 3) absence of high stream flow during the breeding period which could wash egg masses or tadpoles downstream. Potentially suitable breeding ponds were identified as large and deep enough to hold water for 20 weeks during egg and tadpole development. Non-breeding aquatic habitat includes any water bodies within 1 mile of potentially suitable breeding habitat, while upland habitat consists of terrestrial areas within 1 mile of suitable breeding habitat. Dispersal habitat includes any upland, riparian, or aquatic habitat accessible and contiguous between suitable breeding habitats, within 1 mile of each other.

Based on the above definitions, five habitat areas were identified within the Rim Fire Project. This includes Birch and Mud Lakes, Drew Creek, Harden Flat Ponds, Homestead Pond, and Hunter Creek and Ponds. The table below displays the habitat found in each specific CRLF habitat area.

Table 3 - California red-legged frog habitat by area.

Habitat Area	Upland Habitat				Breeding pond Acres	Breeding Stream Miles	Non-breeding Stream Miles
	Total Acres	Stanislaus NF Acres	Other Federal Acres	Private Acres			
Birch and Mud Lakes	2897.7	2408.5	117.7	371.5	8.3	0	7.4
Drew Creek	3604.1	3360.0	0	244.0	0	1.3	10.3
Harden Flat Ponds	1526.2	845.1	0	681.1	1.0	0	6.4
Homestead Ponds	2048.9	2046.2	0	2.6	0.2	0	4.8
Hunter Creek and Ponds	11516.0	8395.2	954.6	2166.3	1.6	8.4	26.8

The Rim Fire severely altered the landscape of the Tuolumne River basin and in turn, the potential California red-legged frog habitat. The direct effects of the fire include:

- loss of upland and riparian vegetation which can result in:
    - a loss of cover and moist litter for California red-legged frogs in upland, riparian and dispersal habitat
    - an increase in water temperature, and
- loss of soil infiltration capacity, which coupled with a loss a vegetation can result in:
    - increased water yield and higher flows, and

- increased erosion resulting in increased sediment entering the stream.

The post-fire conditions of each of the habitat areas are discussed below. Substantial vegetation recovery has occurred in the two years post-fire in many areas, primarily shrubs and grasses.

Birch and Mud Lakes are considered potential pond breeding habitat within the Rim Fire Recover Project. Birch Lake is located at Camp Mather, a private property owned by San Francisco Recreation and Parks. Mud Lake is on Forest Service lands approximately 0.5 miles west of Birch Lake. These lakes are located at approximately 4500 feet elevation, at an elevation considered atypical habitat by USFWS (Federal Register 2010). However, this area is one of the historic localities for the species in the Sierra Nevada (Federal Register 2010, Barry and Fellers 2013). The lakes occur on relatively flat ground near the watershed divide. Both lakes support healthy bullfrog (*Rana catesbeiana*) populations.

As shown in Table 6, the upland habitat around Birch and Mud Lakes experienced moderate to high vegetation burn severity (greater than 60 percent), but unburned to low soil burn severity. Loss of vegetation in the upland habitats translates to a loss of cover on more than 60 percent of the area and a reduction in suitability for California red-legged frog. The area immediately adjacent to Birch Lake was unburned or burned at low severity. The area around Mud Lake burned at moderate to high severity. The dispersal habitat between the two lakes had very low burn severity, and therefore no changes to its suitability.

These lakes are located within the Lower Middle Fork Tuolumne River watershed. Erosion modeling using the Disturbed Water Erosion Prediction Program indicated that in the Lower Middle Fork Tuolumne Watershed erosion could increase from background levels of 0.1 to 0.5 tons per acre, to 2.9 tons per acre post fire. Any increased erosion due to the fire is unlikely to have added sediment to Birch and Mud Lakes due to their position high in the watershed. The reduction of vegetation around Mud Lake allows increased solar radiation and a corresponding increase in water temperature. Increased sunlight to the lake and increased temperatures can result in additional riparian and emergent vegetation at Mud Lake.

The non-breeding habitat in this area consists of 7.4 miles of perennial (Tuolumne River, Middle Fork Tuolumne River, and unnamed tributaries) and unnamed intermittent streams (Table 5). The non-breeding stream habitat is located within the Lower Middle Fork Tuolumne River, Tuolumne River – Poopenaut Valley, and Upper Middle Fork Tuolumne River watersheds. Predicted erosion rates for the Tuolumne River – Poopenaut Valley watershed and Upper Middle Fork Tuolumne River watershed are 1.4 and 0.9 tons per acre, respectively. Although sediment delivery into the non-breeding streams is expected, the exact amount is determined by several factors, including soil type, soil texture, hillslope steepness, ground cover quantity, and rainfall intensity. Since the Rim fire California has experienced a severe drought and rainfall in the area of the Rim Fire has been limited. Nonetheless, an increase in sediment is expected. When large

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volumes of sediment are delivered to a stream channel, habitat complexity is reduced as pool and run habitats fill in and the stream bottom becomes relatively uniform. In larger streams like the Tuolumne and Middle Fork Tuolumne Rivers, extensive sedimentation could occur, but major reductions in pool volume are not likely because the energy of the streamflow is enough to keep the sediment moving downstream. Increased sedimentation can reduce macroinvertebrate production in the stream and result in a reduction in food for the frog. Monitoring of stream sedimentation after the Stanislaus Complex Fire of 1987 in this same basin indicated that sedimentation returned to pre-fire levels within one to five years.

Table 4 - Acres of California red-legged frog upland habitat by burn severity.

Habitat Area	Soil Burn Severity	Vegetation Burn Severity
Birch and Mud Lakes		
high	1.7 %	48.2 %
moderate	36.8 %	13.1 %
low	36.7 %	13.2 %
unburned/very low	24.8 %	25.5 %
Drew Creek		
high	4.0 %	68.4 %
moderate	59.7 %	10.3 %
low	26.4 %	9.5 %
unburned/very low	9.9 %	11.8 %
Harden Flat Ponds		
high	0.8 %	18.6 %
moderate	26.3 %	17.3 %
low	57.1 %	27.7 %
unburned/very low	15.8 %	36.3 %
Homestead Pond		
high	1.9 %	45.7 %
moderate	40.5 %	14.0 %
low	24.0 %	10.8 %
unburned/very low	33.6 %	29.5 %
Hunter Creek and Ponds		
high	0.3 %	17.3 %
moderate	18.5 %	12.0 %
low	30.5 %	16.1 %
unburned/very low	50.7 %	54.5 %

The **Drew Creek** habitat area includes 1.3 miles of breeding stream habitat (Drew Creek). Drew Creek was surveyed in 2007 following procedures described in the Stanislaus National Forest Streamscape Inventory (SSI) Technical Guide (USDA 2008a). Drew Creek is a small intermittent stream with average wetted width of 4.2 feet with pools averaging 1.8 feet in depth. Most of the pools had undercut banks and emergent

vegetation. At the time of the survey Drew Creek had little riparian canopy cover as a result of the 2005 Tuolumne fire. Drew Creek flows through a relatively flat valley bottom in this area and has a low gradient. Bullfrogs are not known to be present in Drew Creek. This area is moderately suitable for California red-legged frogs.

As shown in Table 6, the upland habitat in the Drew Creek habitat area experienced moderate to high vegetation burn severity (80 percent) and moderate to high soil burn severity (greater than 60 percent). The riparian corridor adjacent to the stream was unburned or burned at very low severity. Loss of vegetation in the upland areas lessened suitability for red-legged frog.

Drew Creek is located within the Tuolumne River - Jawbone Creek watershed. Erosion modeling using the Disturbed Water Erosion Prediction Program indicated that erosion could increase to 3.6 tons per acre post fire. This watershed has the highest predicted increase in erosion due to the severity of both soil and vegetation burned. It is likely there will be increased sediment in Drew Creek, however because the riparian area is intact some sediment will be filtered out before reaching the stream. In addition, after the Tuolumne Fire very high sedimentation occurred in Drew Creek. Surveys the year following the fire showed that much of the sediment that entered the stream was transported downstream. It is expected that any increased sediment will again be flushed out in one or two years, particularly with the increase in flows due to reduced soil infiltration and vegetation uptake of water. Water temperature is not expected to increase because existing riparian vegetation is largely unchanged by the Rim Fire. Dispersal habitat in this area would occur in an upstream-downstream context along Drew Creek between suitable breeding pools (Bobzien and Didonato 2007, Tatarian 2008), as no other breeding habitat occurs within 1 mile.

The non-breeding habitat in this area consists of 10.3 miles of perennial (Tuolumne River, Middle Fork Tuolumne River, and South Fork Tuolumne River) and intermittent streams (unnamed tributaries) (Table 5). The non-breeding stream habitat is primarily located within the Tuolumne River – Jawbone Creek watershed; however some non-breeding habitat exists within the Lower Middle Fork Tuolumne River and Lower South Fork Tuolumne River watersheds. Predicted erosion rates for these watersheds are 2.9 and 3.1 tons per acre, respectively. An increase in sediment is expected. As described above, sediment input into the Tuolumne River, Middle Fork Tuolumne River and South Fork Tuolumne River is expected to move through the system and return to pre-fire levels in 1 to 5 years.

There are two small ponds at Harden Flat that are considered potential pond breeding habitat within the Rim Fire Recover Project. They are located at a privately owned campground and RV park. The ponds occur on relatively flat ground near the Tuolumne River. Bullfrogs are present in the ponds. The upland area to the south of State Highway 120 and the urbanized 20 acres north of the breeding ponds are considered unsuitable for red-legged frogs. The ponds have low suitability.

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As shown in Table 6, the upland habitat around Harden Flat Ponds experienced unburned to low soil and vegetation burn severity (greater than 60 percent). Loss of vegetation in the upland habitats translates to a loss of cover on 35 percent of the area. This is a slight reduction in suitability for California red-legged frog. Suppression efforts surrounding the private property were successful and vegetation immediately adjacent to the ponds is largely unburned, therefore no changes to dispersal habitat suitability or temperature of the ponds are anticipated.

These ponds are located within the Lower South Fork Tuolumne River watershed. Erosion modeling using the Disturbed Water Erosion Prediction Program indicated that in this watershed erosion could increase from background levels to 3.1 tons per acre post fire. The unburned vegetation surrounding the ponds would filter much of the sediment before reaching the ponds, although slight increases may occur. A slight increase in sediment can improve habitat for California red-legged frog tadpoles (Bobzien and Didonato 2007).

The non-breeding habitat in this area consists of 6.4 miles of perennial (South Fork Tuolumne River, Big Creek, and unnamed tributaries) and unnamed intermittent streams (Table 5). The majority of the non-breeding stream habitat is located within the Lower South Fork Tuolumne River, with a small amount occurring in the Lower Middle Fork Tuolumne. Sediment delivery into the non-breeding streams is expected; however, it is not expected to remain in the perennial non-breeding habitat in large amounts and is expected to return to pre-fire levels in one to five years. Increased sedimentation of the non-breeding streams can reduce macroinvertebrate production in the stream and result in a reduction in food for post-metamorphic frogs. There is also a predicted increase in discharge for the South Fork Tuolumne River (Flores et al. 2013, Stewart et al. 2013) that can affect suitability for frogs and macroinvertebrates.

Homestead Pond is a small, spring-fed pond located on National Forest lands within the Rim Fire. The pond is located at 3,100 feet in elevation. The pond occurs on relatively flat ground near the top of the Tuolumne River – Grapevine Creek watershed. The pond currently supports a large bullfrog population. Riparian vegetation surrounding the pond consists of sedges and the habitat suitability is considered low based on the lack of other nearby aquatic habitats and the presence of bullfrogs.

As shown in Table 6, the upland habitat around Homestead Pond experienced moderate to high vegetation burn severity (greater than 60 percent), but unburned to low soil burn severity. There is no dispersal habitat associated with Homestead Pond.

The pond is located within the Tuolumne River – Grapevine Creek watershed. Erosion modeling using the Disturbed Water Erosion Prediction Program indicated that erosion could increase 2.0 tons per acre from background post fire. The vegetation between the spring that feeds it and the pond is unburned. Because of this unburned vegetation and the pond's location in the watershed, sediment increases to the pond are unlikely.

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The non-breeding habitat in this area consists of the perennial Tuolumne River and unnamed intermittent streams (4.8 miles, Table 5). The non-breeding stream habitat is located primarily within the Tuolumne River – Grapevine Creek watershed, with a small amount of non-breeding habitat located in the adjacent Upper North Fork Merced River and Big Creek watersheds of the Merced River drainage. The Rim Fire burned a small area of the Upper North Fork Merced River watershed (eight percent), including the headwaters of the non-breeding habitat in this watershed. Erosion was predicted to increase from backgrounds levels of 0.1 to 0.5 tons per acre up to 0.7 tons per acre. The Big Creek watershed was not burned in the Rim Fire. Sediment delivery into the non-breeding streams is expected, although the Tuolumne River is expected to flush the sediment in one to five years and the increased erosion in the North Fork Merced River is only slightly over background levels.

The Hunter Creek habitat area is the largest considered in this analysis for California red-legged frog. Hunter Creek is a small to medium sized perennial stream with a moderate overall gradient (3 – 8%) with approximately 7.5 miles of stream that provide suitable breeding habitat. There are numerous long, deep, slow moving pools with roots from riparian vegetation to permit egg attachment. The stream flow typically diminishes in April and May, bringing discharge to a suitable level during CRLF breeding season. Hunter Creek supports a naturalized population of rainbow trout, but there are no non-native predators (bullfrogs, centrarchid fishes) known from the watershed. In addition to Hunter Creek there are five ponds within the habitat area, all located on private lands that appear to provide suitable breeding habitat. Hunter Creek is considered moderately suitable for California red-legged frog.

As shown in Table 6, the upland habitat in this habitat area was largely unburned to low burn severity for both soil and vegetation burn severity (greater than 80 and 70 percent, respectively). The fire burned the upper elevation of the habitat area at the headwaters of Hunter Creek and the southern portion of the habitat area in the Tuolumne River – Grapevine Creek watershed. Over 47 percent of the habitat area is outside the Rim Fire perimeter. The five ponds all occur within the fire area. The area around Pond 1 (section 18 north of Hunter Creek) was unburned or burned at low soil burn severity with up to 50 percent loss of basal area. The area around Pond 2 (section 17 north of Hunter Creek) in unburned or has low vegetation and soil burn severity. The dispersal habitat between these ponds has unburned or low soil burn severity with a loss of vegetation basal area up to 50 percent while the intermittent channel that connects these ponds to Hunter Creek was mixed in burn severity. The areas around Pond 3 (Section 20 at Round Meadow) remained unburned or burned at low severity for both soil and vegetation, while at Pond 4 soil burn severity was moderate and vegetation lost 50 to 100 percent of the basal area. The area between the ponds at Round Meadow burned at low to moderate soil burn severity with 50 to 100 percent basal area loss. Pond 5 is located on Rogge Ranch and had unburned to low soil burn severity and vegetation loss of 0 to 50 percent of the basal area. There is no dispersal habitat for Pond 5 as it is greater than 1 mile from other breeding habitat.

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Hunter Creek and ponds 1 and 2 are within the Lower North Fork Tuolumne River watershed where erosion was predicted to increase to 0.9 tons per acre. Ponds 3, 4 and 5 are located within the Tuolumne River – Grapevine Creek watershed where erosion is predicted to increase to 2.0 tons per acre. Sediment at the headwaters of Hunter Creek is expected to increase slightly, however the sediment is expected to be washed downstream fairly quickly due to the gradient of the stream (three to eight percent) and the increased water flow from tributary input as you move downstream through the breeding habitat. Sediment is likely to increase in ponds 1, 2 and 5. Ponds three and four are located in the upper portion of the watershed and vegetation burned at low to moderate severity, so sediment delivery into the ponds is not expected.

The non-breeding habitat in this area consists of 26.8 miles of perennial streams (Hunter Creek, North Fork Tuolumne River) and intermittent streams (Duckwall Creek, Grapevine Creek, and unnamed tributaries). The non-breeding stream habitat is found within both the Lower North Fork Tuolumne River and Tuolumne River – Grapevine Creek watersheds. Predicted erosion rates are 0.9 and 2.0 tons per acres, respectively. Sediment increases in the non-breeding habitat are expected, however will likely be flushed from the system in one to two years. In non-breeding habitat outside the fire there will be no increase in sediment.

Sierra Nevada yellow-legged frog

Stanislaus National Forest and project area status

The SNYLF has been found throughout the Stanislaus National Forest at elevations between 5,400 feet and 9,700 feet. Survey records from 1993 to 2013 indicate the frog is associated with streams, streams or potholes in meadows, and lakes. SNYLF occurrences on the STF are most commonly found in high elevation (alpine) lake habitats. There are three occurrence records on the forest below 7,000 feet in elevation, Skull Creek (5,400 feet), Moore Creek (6,300 feet), and Snow Canyon Creek (6,550 feet). The Skull Creek occurrence is potentially extirpated based on multiple recent surveys with non-detections, while the Moore and Snow Canyon Creek populations have been recently confirmed as extant. Within the fire perimeter, 221 aquatic visual encounter surveys have been conducted including 99 surveys within the documented elevational range (between 4,500 and 6,500 feet in elevation) The surveys covered a range of stream sizes from 1st to 4th order and included approximately 70 discrete streams or sections of streams. Most surveys occurred when the frogs would have been active: eighty-nine surveys were conducted between 6 June and 19 September and 10 surveys were conducted after 28 September. No SNYLF (extant or historic) have been found within the Rim Fire Perimeter according to STF or CNDDB records.

There are three current or historically occupied localities in the vicinity (within 5 miles) of the Rim Fire perimeter: Snow Canyon Creek, Bourland Creek, and an unnamed creek in Yosemite National Park. Snow Canyon Creek is a tributary to Cherry Creek immediately upstream of Cherry Lake, located along the northern edge of the fire at an elevation of 6,600 feet, and approximately 1.5 miles northeast of the nearest project

treatment units. Portions of the stream were within the fire perimeter, but the known occupied reach was not directly affected by the fire. Bourland Creek is also located along the northern edge of the fire perimeter, and like Snow Canyon Creek, the known occupied portion of the stream was not directly affected by the fire. A small population of frogs has been documented in in creek running through Bourland Meadow at an elevation of approximately 7,000 feet. The occupied site is approximately 3.5 miles north of the nearest project units. An unnamed creek near Laurel Lake in Yosemite National Park (approximately two miles east of Lake Eleanor and three miles north of Hetch Hetchy reservoir) apparently supports a population of SNYLF (CNDDB 2014) at an elevation of 6,480 feet and is approximately 4.5 miles east of the nearest project unit.

The nearest proposed critical habitat ("Emigrant Yosemite sub-unit) to project units is located approximately 5 miles northeast of Cherry Lake. Though the Rim Fire perimeter slightly overlaps this sub-unit, no project effects would be capable of reaching this area due to topography.

Habitat Status

Two methods were used to identify suitable habitat within the project area and included a desk and/or field review of suitable habitats above 5,000 feet within the fire perimeter and subsequent application of the species distribution model developed by Roland Knapp. This model used historic and current occurrences to develop a predictive habitat model for the historical probability of occurrence of the SNYLF within the known historical range (Roland Knapp, personal communication). The forest's aquatic survey database was queried for all streams in and adjacent to the fire perimeter. For the waters within the range of the frog, physical habitat survey information was reviewed if available to determine whether pool habitat was deep enough to allow for successful tadpole rearing. Suitable breeding habitat is defined in the Federal Register (2013) as having water depths greater than 5.6 feet. For the Rim Fire Reforestation project, this definition was modified to include water depths greater than 4 feet to account for local conditions applicable to occupied sites in lower elevation streams. The lowest elevation occurrences on the forest (see Species Account) are all associated with deep (greater than 4 feet), low gradient (less than 2 percent) stream sections and most are also associated with meadows (except Moore Creek). Small (1st or 2nd order), steep (average gradient greater than 6 percent), and isolated (did not connect to a logical breeding habitat) headwater streams were discounted as being suitable breeding habitat because field data indicate they do not have sufficient water depth. This method identified potentially suitable habitat within the Rim Fire perimeter.

The second method used included the application of the SNYLF range map developed by Roland Knapp. We overlaid the range map with the fire perimeter and identified the overlapping streams and other aquatic features. These streams are consistent to previous determinations of suitable habitat for the frog and include the upper portion of Reynolds Creek, two ponds on Kibbie Ridge, a short section of Eleanor Creek below Lake Eleanor, and a portion of the Middle Fork Tuolumne River. These four suitable habitats are described below.

Reynolds Creek

Aquatic Breeding, Rearing and Non-breeding Habitat: Reynolds Creek is one of the main tributaries to Reed Creek, a tributary of the Clavey River. The portion of Reynolds Creek within the range of the SNYLF (using the Knapp distribution model) lies almost entirely within an 8th level HUC (hydrologic unit code) and provides approximately 4.3 miles of mapped perennial channel and 1.9 miles of mapped intermittent channel. Approximately 0.9 miles of the perennial channel is 2nd order, with the remainder being 1st order stream. Average gradient in the 2nd order reach is 2.0 percent (range 1.2 to 3.6 percent), but the average gradient in the 1st order tributaries ranges from 8.4 to 24.4 percent. In July 2008, pool measurements, including pool depth, were taken along approximately three miles of the mainstem from an elevation of 5,720 to 6,160 feet. Both of the headwater tributaries were also surveyed during this time (up to an elevation of 6,920 feet). Average pool depth in the 2nd order section was 0.65 feet (range 0.3 to 1.5 meters (1 to 5 feet)). Of the 76 pools measured in the 2nd order section, 14 (18 percent) were over 1.0 meter in depth. The depths and pool frequency indicate the stream could potentially support the SNYLF. In the two headwater tributaries, pool depths were much lower on average (0.5 meters) and did not have any pools greater than one meter in depth. The overall habitat suitability in Reynolds Creek is considered to be very low because the stream supports a self-sustaining trout population where there is low gradient (less than 4 percent), deep water (greater than 1.0 meter) and does not maintain deep, permanent water (average depth 0.3 meters) in the fishless sections.

The fire affected approximately 80 acres of the 1,930 acre 8th level HUC, or 4 percent of the watershed. Fire severity in was generally low with 58 percent in the low burn severity class (less than 25 percent tree mortality), 32 percent in the low-moderate class (25 to 50 percent mortality), 6 percent in the moderate class (50 to 75 percent mortality), and 4 percent in the high mortality class. Post-fire increases in erosion are expected to be very small, if detectable, due to the low amount of fire in the higher vegetation burn severity classes and the high levels of ground cover and tree canopy remaining in the burned portion of the watershed. For the lightly burned areas, the scorched needles were dropped by the trees and very high levels of ground cover (greater than 70 percent) are present to limit erosion. Also, the main patch (12 acres) of higher burn severity is located over 0.5 miles from the creek, and the high levels of ground cover in between the creek and fire area should be effective at minimizing the sediment delivery to the stream associated with surface and rill erosion.

Upland Habitat: There are approximately 85 acres of upland habitat adjacent to the perennial stream sections of Reynolds Creek and an additional 38 acres adjacent to the intermittent streams within the distribution range of the frog. Approximately 12 acres of upland habitat was affected by the fire. All of the 25 meter SNYLF upland area burned in the lowest two severity classes and there was very little loss of riparian shading. There was some loss of ground level cover (logs, herbaceous vegetation, shrubs), but adequate levels remain and habitat suitability was slightly reduced from high to moderate. Approximately 0.4 miles of perennial suitable habitat and 0.2 miles of intermittent channel are within the fire perimeter. As discussed earlier, post-fire increases in

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sedimentation in all of the Reynolds Creek watershed affected by the fire are expected to be very minor.

Kibbie Ridge Area

This area includes two ponds situated near the top of Kibbie Ridge, Big and Little Kibbie Ponds, and a short section of Eleanor Creek.

Big Kibbie Pond

Aquatic Breeding, Rearing and Non-breeding Habitat: Big Kibbie Pond is approximately 0.7 acre in size and fish-free, providing approximately 0.15 miles (234 meters) of shoreline at an elevation of 5,400 feet. No physical habitat assessments have been completed for Big Kibbie Pond but aquatic amphibian and reptile visual encounter surveys report an average depth of 3.6 feet (43 inches) and the estimated maximum depth is less than 6 feet. There is little to no canopy and ample basking opportunities are present. Submergent aquatic grasses and algae dominate the vegetation on the shallow banks. Half of the water's surface is covered by lilies at times of the year. Big Kibbie Pond provides moderate to high suitability breeding habitat because water is deep enough to maintain aquatic habitat perennially in almost all years and prevent freezing solid. The only limitation to the pond is that water depth can be less than 3 feet by the end of summer even in wetter than average years. If the pond does not fill prior to the onset of winter, then water depth may not be adequate to prevent freezing during cold weather (the pond likely fills during snowmelt). The hydrology of the pond is apparently influenced by groundwater because there are no defined inlet or outlet streams.

Big Kibbie Pond sits close to the top a ridge and there is a limited potential for measurable increases in post-fire sedimentation because of the lack of a drainage network leading into the pond, and the slopes adjacent to the pond are very low (less than 3 percent) enough to prevent overland transport of sediment to the pond. The habitat suitability will remain unchanged in the post-fire environment. Big Kibbie pond has been surveyed six times since 2004 and SNYLF have not been detected. Four of the surveys (2004) were tied to California red-legged frog surveys where two day visits (June 29 and July 14) and two night visits (July 1 and 14) were made. The pond was also surveyed on June 16, 2008 and April 11, 2014. The other waters near the pond that provide some type of aquatic habitat include Cherry Lake and Lake Eleanor, both of which are unsuitable for supporting a frog population per considerations listed in the Federal Register (2013). Big Kibbie Pond is considered to be unoccupied because multiple surveys have been conducted in the past ten years without a detection of the SNYLF (see Species Account section).

Upland Habitat: Within 25 meters of Big Kibbie Pond there are approximately 3 acres of potential upland habitat. Additionally, there are 2.5 acres of upland habitat between Big and Little Kibbie Ponds because they are within 150 meters of each other. The primary CWHR vegetation types are Sierran Mixed Conifer (41 percent), Montane Chaparral (38 percent), and Perennial Grassland (20 percent). The upland habitat mainly burned at moderate to high severity (94 percent combined) and will have low suitability

for at least 5 years due to the low amount of existing ground cover. Some boulders and downed woody debris remain as cover objects.

Little Kibbie Pond

Aquatic Breeding, Rearing and Non-breeding Habitat: Little Kibbie Pond is approximately 0.6 acre in size, fish-free, and located at approximately 5,400 feet. No physical habitat assessments have been completed for Little Kibbie Pond, but amphibian and reptile visual encounter surveys (2004, 2008, 2014) report an average depth of 20 inches (1.7 feet) with very little canopy cover provided by surrounding conifers. The pond was almost dry during the April 2014 survey. Short herbaceous vegetation covers the banks and shallow areas of the pond. Breeding habitat suitability is low due to its shallow depth and complete drying in average and below precipitation years. The pond does provide high quality non-breeding aquatic habitat due to its close proximity to Big Kibbie Pond (approximately 125 meters to the north) and lack of predatory fish. Approximately 73 percent of the vegetation in the Little Kibbie Ponds watershed burned at high severity; however, because the pond sits atop a ridge, there are no defined inlet streams, and the hillslopes adjacent to the pond are low gradient, there is a very low likelihood that the pond will receive any measurable levels of sedimentation from the effects of the Rim Fire. Therefore, the aquatic habitat suitability will remain unaffected by the fire. The survey history for Little Kibbie Pond is the same as that given for Big Kibbie Pond and Little Kibbie Pond is assumed to be unoccupied by the frog.

Upland Habitat: Within 25 meters of Little Kibbie Pond there are approximately 1.5 acres of upland habitat. There are 2.5 additional upland habitat acres connecting Big and Little Kibbie Ponds because they lie within 150 meters of each other. The primary WHR vegetation types are Sierran Mixed Conifer (54 percent) and Montane Chaparral (40 percent). Vegetation in the upland habitat primarily burned at moderate to high severity (85 percent combined) and the habitat will have low suitability for at least 5 years due to the limited amount of cover.

Eleanor Creek

Aquatic Breeding, Rearing and Non-breeding Habitat: There is approximately one mile of Eleanor Creek downstream of Eleanor Dam within the range (using the Knapp distribution model) of the frog and 0.5 miles is on the STF within the fire perimeter. The elevation ranges of these sections of stream are from 4,320 to 4,610 feet and 4,320 to 4,420 feet for the 1.0 and 0.5 mile reaches, respectively. This section of stream on the STF is below the lower elevation range of the species (4,500 feet) listed in the Federal Register (2013), but is within the Knapp distribution range. The creek below the dam provides very low suitability habitat for the SNYLF because the streamflow is regulated by an upstream dam, there is a self-sustaining population of introduced trout, and is at or below the lower elevation range of the frog. As noted in the Federal Register (2013), the presence of dams greatly reduces habitat suitability, potentially rendering them unsuitable, through habitat fragmentation, creation of migration barriers, alteration of hydrology (irregular and unseasonal flows), and maintenance of introduced fish populations. There is a very low likelihood of occupancy based on the factors identified above.

The portion of the Eleanor Creek watershed downstream of the dam and extending to the STF boundary burned at high or very high severity. This suggests that the steeper hillslopes adjacent to the stream are exceptionally vulnerable to post-fire erosional processes and extensive sedimentation of slower water habitats is likely. Deep water should be maintained in the pools of higher gradient (>8 percent) sections of stream and there would be adequate habitat available to individuals.

Upland Habitat: There are approximately ten acres of upland habitat within 25 meters of the section of stream on the STF and 22 acres of upland along the one mile of stream below Eleanor Dam. Greater than 95 percent of the upland area burned at high or very high vegetation severity which suggests most of the upland cover was eliminated by the fire. As such, the upland habitat suitability was greatly reduced and currently provides low to low-moderate suitability habitat for the frog. Some refuge habitat is available in the crevices of rocks along the stream, but very little woody or herbaceous obligate riparian vegetation is present.

Middle Fork Tuolumne River

Aquatic Breeding, Rearing and Non-breeding Habitat: There is approximately 1.1 mile of the Middle Fork Tuolumne River (MFTR) and 0.4 mile of intermittent tributary streams on Forest Service lands that is also within the range (using the Knapp distribution model) of the species. The MFTR covers an elevation range of approximately 4,600 to 4,900 feet, and the tributaries extend to elevations of approximately 5,200 feet on Forest Service lands. The MFTR is a free-flowing tributary to the Tuolumne River and originates in Yosemite National Park (YNP). Breeding habitat suitability in the MFTR is very low due to a self-sustaining population of trout which extends several miles into YNP. Because this section of the MFTR is well below the lowest known populations on the forest, a self-sustaining population of introduced trout has been present for approximately 100 years, and this relatively large river is atypical of SNYLF habitat at lower elevations, it is unlikely that the river on the STF is occupied by SNYLF.

The upper MFTR watershed was extensively affected by the Rim Fire. The Upper MFTR 6th level HUC watershed is approximately 31,354 acres in size. Approximately 54% of the watershed (17,028 acres) was affected by the fire with most of the unburned area located in the upper portion of the watershed. In the portion of the watershed affected by the fire (STF and YNP combined), vegetation burn severity ranged from 5,041 combined acres of very low and low severity (30 percent), 3,228 acres of moderate severity (19 percent), and 8,759 acres of high severity (51 percent). The amount of area affected by high and moderate severity fire is high enough that moderate to high levels of sedimentation should affect the main channel of the MFTR in the next two to five years. While some sedimentation of slow water habitats is expected, the high annual snowmelt flows will be effective at maintaining deep water non-breeding habitat areas suitable for the SNYLF. The anticipated increase in sedimentation would not affect the overall habitat suitability because of the factors identified above or likelihood of occupancy in the next five years.

Upland Habitat: There are approximately 1,508 acres of suitable upland habitat in the Upper MFTR 6th level HUC and 954 acres of suitable upland habitat within the fire perimeter. On STF lands, there are approximately 22 acres of suitable upland habitat adjacent to the MFTR and 8 acres of upland habitat adjacent to the 0.4 mile of intermittent stream. Burn severity within the upland area was variable, but moderate and high severity was most common (>45 percent) within this habitat type. The mosaic of burn severity indicates that some patches of moderate to moderate-high suitability habitat are present along the MFTR and the intermittent tributaries, but habitat suitability was reduced to low to moderate in the higher burn severity areas. As with Eleanor Creek, extensive boulder and bedrock areas adjacent to the stream provide cover within the upland habitat.

AFFECTED ENVIRONMENT

Note: Effects to aquatic habitat from the Rim Fire are described below in general terms. Post-fire (2+ years) recovery of near-stream and in-stream habitat components is highly variable across the landscape. See Rim Fire Recovery EIS for a detailed summary of post-fire effects on aquatic and riparian habitats within the Rim Fire perimeter.

The Rim Fire affected a variety of aquatic habitats including wetlands, ponds, natural and man-made lakes, streams, and rivers. The aquatic features at lower elevations, less than 2,500 feet, are primarily influenced by rainfall during the wet season (November through April), while aquatic features above this elevation are influenced by rainfall, snowpack, or a combination of both. Streams in the rainfall zone typically see peak flows following larger rain events and some intermittent streams may support surface water for several months. Streams in the rain/snow zones may see very high peak flows if rain falls on a snowpack, but streams typically show a period of peak flow as the snow melts in the late spring and early summer.

All of the larger stream systems affected by the Rim Fire are bedrock rivers (versus alluvial rivers) shaped by snowmelt runoff during the late spring (mid-May) to middle summer (mid-July). Geomorphic complexity in bedrock rivers in the Sierra Nevada requires variable annual flow (winter floods, snowmelt peak flows, winter and summer baseflow), periodic inputs of large volumes of sediments (landslides, hillslope mass wasting), and multiple flow thresholds (variable levels of flooding) (McBain and Trush 2004). Most of these rivers have steep canyons, and steep tributary streams, ascending to more gentle terrain above the canyon rim.

A very large proportion of the fire area occurred in the Tuolumne River watershed. The Tuolumne River originates in Yosemite National Park and has several large tributaries originating in the Park or on the Stanislaus National Forest. Five primary tributaries join the Tuolumne within the fire area: the Clavey and Middle, North, and South Fork Tuolumne Rivers, and Cherry Creek. The Middle and South Fork Tuolumne Rivers originate in Yosemite then flow in a westerly direction to join each other and then the main Tuolumne. Cherry Creek and the North Fork Tuolumne and Clavey Rivers originate from the Stanislaus and primarily flow in a southerly direction into the Tuolumne. There are many minor tributaries to the Tuolumne River and its principal tributaries including: Alder, Big, Corral, Drew, Grapevine, Indian, and Jawbone Creeks

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(Tuolumne River); Basin and Hunter Creeks (North Fork Tuolumne River); Big Creek (South Fork Tuolumne River); Eleanor Creek and Granite Creek (Cherry Creek); and Hull, Reed (including Bourland, Reynolds, and Little Reynolds Creeks), and Twomile Creeks (Clavey River). Additionally, there are numerous very small, typically unnamed tributaries to each of these listed streams and rivers.

Obligate riparian vegetation (e.g., willow and alder) along most streams in the affected area is typically restricted to a narrow (less than 50 feet) band adjacent to the edge of the water. There are some wetlands in fire perimeter that support obligate herbaceous riparian species as dominant plant community types.

The **direct effects** of fire on aquatic and riparian systems are generally associated with the mortality of individuals, either plants or animals. Mortality of fish has been documented, but it is rare that all individuals are killed in a stream. Mortality is likely associated with very high fire intensity which causes water temperatures to exceed a tolerance threshold or changes in water chemistry via the assimilation of smoke and gases into the water. Mortality of vegetation is an obvious effect of a wildfire and is typically variable at patch and landscape scales, where "islands" of live vegetation can be found within large patches of high vegetation mortality. Vegetation mortality typically involves the loss of the above ground portion of the plant. Most obligate riparian species, those species requiring very close contact with water (also called phreatophytic), have evolved strategies to survive disturbances (like fire) by resprouting from root crowns, living stems, roots, and rhizomes; production of seeds light enough to be dispersed by wind and water; and production of refractory seeds which require the heat from fire or chemicals produced by burned vegetation to germinate.

The **indirect effects** associated with a fire may last for years or decades and influence watershed characteristics such as increased hillslope erosion and sedimentation of aquatic systems, stream channel erosion, changes in patterns of stream water discharge, nutrient pulses and changes in productivity, reduced stream shading, increases in stream temperatures, and alteration of large woody debris dynamics. Observations made during 2015 indicated that many areas are experiencing a robust vegetation response, mostly comprised of shrub growth. This recovery is likely to substantially reduce impacts (e.g., sediment input) to aquatic habitat over the next few years, though pre-fire conditions in may not return for a decade or more, particularly in areas of high burn severity.

<u>Expectations for the watersheds affected by the Rim Fire</u>
Several sources of information were used in predicting the extent to which we expect changes in aquatic and riparian systems. First, patterns and extent of fire severity, both vegetation and soil, were examined using aerial imagery and fire severity mapping. Watersheds with a high proportion of moderate and high severity fire were singled out for having a high potential to see significant changes in post-fire erosional processes, including erosion rates, sedimentation, and discharge. Then, the fire patterns within these watersheds were evaluated, especially as related to proximity to the streams. Data generated by the 1) Rim Fire Burned Area Emergency Response reports and 2) specialist reports for this EIS were incorporated. The primary sources used to develop expectations for watershed response included the soils, hydrology, and geology. The soils reports

(BAER and Rim Reforestation Project) detail erosion and sedimentation, the hydrology reports (BAER and Rim Reforestation Project) detail changes in stream discharge and channel response, and the geology report (BAER) details the potential for landslides. All of this available information was used to develop specific expectations for the suitable and occupied habitats for the species considered in this document. Table 7 displays the anticipated changes in stream flow and sediment delivered to the stream channel at the most downstream point in the watershed.

Table 5 - Changes in streamflow and sediment yield to channel for selected streams providing suitable habitat for aquatic species in the area affected by the Rim Fire.

5th Level HUC Watersheds	6th Level HUC Watersheds	Streams	Pre-fire stream flow (in cubic ft/second)[1, 2]	Post-fire stream flow (in cubic ft/second)[1,2]	Sediment Yield[3] (in tons)
North Fork Merced River	Upper N. Fk. Merced R.	N. Fk. Merced R.	237	237	9,805
		Deer Lick Cr.	n/c	n/c	1,955
		Moore Cr.	n/c	n/c	3,223
		Scott Cr.	n/c	n/c	1,250
	Bull Cr.	Bull Cr.	331	356	2,586
Cherry Cr.	Kibbie Cr.	Kibbie Cr.	175	214	1,311
	Miguel-Eleanor Cr.	Eleanor Cr.	825	1,214	13,709
	Lower Cherry Cr.	Cherry Cr.	1,891	3,038	56,494
		Granite Cr.			14,843
Tuolumne River – Big Creek	Hetch Hetchy-Tuolumne R.	Tuolumne River	3,457	3,486	n/c
	Poopenaut Valley-Tuolumne R.	Tuolumne River	3,707	4,311	24,659
	Jawbone Cr.-Tuolumne R.	Tuolumne R.	5,505	8,216	99,846
		Alder Cr.	n/c	n/c	5,312
		Corral Cr.	n/c	n/c	21,417
		Drew Cr.	n/c	n/c	4,420
		Jawbone Cr.	n/c	n/c	40,058
	Grapevine Cr.-Tuolumne R.	Tuolumne R.	8,849	14,435	43,752
		Grapevine Cr.	n/c	n/c	12,587
Middle Fork Tuolumne River	Upper M. Fk. Tuolumne R.	M. Fk. Tuolumne R.	404	849	22,263
	Lower M. Fk. Tuolumne R.	M. Fk. Tuolumne R.	603	1,600	43,073
South Fork Tuolumne River	Upper S. Fk. Tuolumne R.	S. Fk. Tuolumne R.	558	1,161	29,060
		Ackerson Cr.	n/c	n/c	9,907
	Lower S. Fk. Tuolumne R.	S. Fk. Tuolumne R.	1,317	3,421	62,180
Clavey River	Reed Cr.	Reed Cr.	397	821	29,256
	Lower Clavey R.	Clavey R.	1,350	2,502	51,831
		Adams Gulch	n/c	n/c	2,341
		Bear Springs Cr.	n/c	n/c	7,287
		Bull Meadow Cr.	n/c	n/c	3,016
		Indian Springs Cr.	n/c	n/c	1,239
		Quilty Cr.	n/c	n/c	3,462

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5th Level HUC Watersheds	6th Level HUC Watersheds	Streams	Pre-fire stream flow (in cubic ft/second)[1, 2]	Post-fire stream flow (in cubic ft/second)[1,2]	Sediment Yield[3] (in tons)
		Unnamed Tributary 1	n/c	n/c	2,908
		Unnamed Tributary 2	n/c	n/c	1,579
		Unnamed Tributary 3	n/c	n/c	5,115
		Unnamed Tributary 4	n/c	n/c	1,099
		Unnamed Tributary 5	n/c	n/c	2,073
	Mid. Clavey R.	Clavey R.	819	1,076	26,880
		Cottonwood Cr.	n/c	n/c	7,972
		Russell Cr.	n/c	n/c	935
North Fork Tuolumne River	Lower N. Fk. Tuolumne R.	N. Fk. Tuolumne River	891	1,026	16,060
		Basin Cr.	n/c	n/c	807
		Hunter Cr.	n/c	n/c	15,205

n/c = not calculated, [1]Values from the Rim Fire BAER hydrology report. [2]Values are not additive for the stream segments lying upstream. [3]Assumes all sediment eroded from hillslope is routed to the channel and transported to the most downstream point in the watershed.

Three general categories were used for these watersheds: low, moderate, and high post-fire response. For the low category, the post-fire watershed responses may not be readily observable at suitable breeding sites. The ability to reproduce is considered to be a key factor in maintaining recruitment as the watersheds recover, because most populations are small and the loss of a recruitment class could have a population-level consequence. In high concern watersheds, we expect major impacts to all habitat types, especially significant reduction of pool and other deep water habitat. Deep water habitats are refuges and critical to overwintering success and escape from perceived predation attempts. In moderate concern habitats, extensive sedimentation of all habitats is expected, but deep water habitats should be maintained by the scouring action of water.

V. EFFECTS ANALYSIS

Effects Analysis Methodology

Assumptions Specific to Aquatic Species

In the post-fire environment, most of the sediment from hillslope erosion is assumed to end up in a stream. This assumption is more valid for high soil burn severity areas on steep slopes that are close to streams. High-severity areas typically have no beneficial ground cover and have water-repellent layers that allow sediment to be eroded. Roughness in topography, downed wood, rocks, and stump holes all have the potential to

trap sediment being transported downslope and the assumption of 100 percent sediment routing to stream channels is an overestimation.

Regardless of the level of project-related activity, changes in sediment from project-related activity at the 5th Level Hydrologic Unit Code (HUC) watershed scale are assumed to be relatively minor when compared to post-fire sedimentation. For example, the amount of post-fire sediment delivered to the Clavey River may have small, localized consequences, but at the point of confluence with the Tuolumne, there would be too little sediment to impair biological functions. Further, there would be very little detectable change in most aquatic habitats when the total amount of project-related sediment is added to the post-fire sediment. This is because large bedrock rivers are very effective at storing and transporting fine sediments.

Water quality best management practices (BMPs) and management requirements that are intended to minimize sedimentation are assumed to be implemented effectively.

Data Sources

Most of the data sources used are corporate spatial data layers (used in ArcMap 10.1), data generated during the post-fire evaluation period (Burned Area Emergency Response (BAER) reports), or were generated during the planning process for the EIS. The corporate layers include the Stanislaus National Forest basemap, watersheds delineated at multiple scales (Hydrologic Unit Codes 5-8), stream gradient layer, the Stanislaus National Forest aquatic survey database (Aquasurv), and the California Natural Diversity Database. The data sources used from the planning process include erosion and sediment modeling, and project-related activities by action. The hydrology, soils, and geology BAER reports for the Rim Fire stated anticipated changes in stream runoff and hillslope erosion, and the potential for debris flows and landslides to occur.

Aquatic Species Indicators

The indicators used for the analysis of potential impacts to aquatic species include the amount of species-specific buffer affected by project activities and proportion of watershed affected by project activities. Specific indicators are:

- percentage of CRLF aquatic breeding, non-aquatic breeding, and upland habitat affected by project activities
- percentage of SNYLF buffer affected by project activities

Aquatic Species Methodology by Action

For CRLF, areas were identified as suitable for the species if they occurred at or below 4,000 feet in elevation and contained breeding habitat identified as streams with 1) low gradient (<4%), 2) presence of pools holding water for 20 weeks during timing of egg and tadpole development, 3) absence of high stream flow during the breeding period which could wash egg masses or tadpoles downstream or ponds large and deep enough to hold water for 20 weeks during egg and tadpole development. Non-breeding aquatic habitat was identified as any water bodies within 1 mile of potentially suitable breeding habitat, while upland habitat consists of terrestrial areas within 1 mile of suitable

breeding habitat. Dispersal habitat includes any upland, riparian, or aquatic habitat accessible and contiguous between suitable breeding habitats, within 1 mile of each other.

For CRLF the spatial extent of the cumulative effects analysis occurred at the extent of the suitable upland habitat (one mile from breeding habitat), and the extent of the watersheds to determine potential sediment input.

With these upland areas established, the activities proposed were placed over the upland areas, or an intersection was created, to estimate the amount of area impacted by each activity for each species.

The temporal boundary established for all species for cumulative effects analysis was ten years from present, a date commensurate with the Cumulative Watershed Effects (CWE) modeling completed for the project (see Watershed Report). The reason this time frame was chosen is related to the modeling approach using a threshold of concern (TOC) for watersheds. When a watershed exceeds the TOC, there is an increased risk that a variety of watershed processes may not occur as they would when a watershed functions below the threshold. An example of a watershed process that may not function normally when the TOC is exceeded is the stability of the stream within its channel. When the TOC is exceeded there is the risk that the streambanks will become unstable and bank erosion can occur. This can lead to increased sedimentation in the channel, reduction in deep water habitat volume, reduction in interstitial spaces in the streambed, higher turbidity during high stream flow, and reduced primary and secondary productivity. These changes in the aquatic system can affect reproduction, ability to avoid predation, and the availability of food resources. The CWE model includes recovery times for certain actions, like logging, or events, like wildfire, whose effects diminish over time. When a watershed returns below a TOC, natural processes in the stream system are expected to dominate and the stream should regain a high degree of stability over time. The CWE modeling indicated all streams (at 6th and 7th level HUC scale) would recover to near pre-fire levels within this time frame. It should be noted that some elements of the cumulative effect analysis, such as the long term recruitment of large woody debris, may extend 100 or more years into the future, but this timeframe could not be applied in the context of reasonably foreseeable future.

The analysis of effects for this project was exceptionally difficult due to the uncertainties about the precipitation patterns the first several years following the fire. Exceptionally wet or intense winter storms, especially rainfall dominated storms, can result in extreme runoff, streamflow, sediment delivery, and modification of aquatic and riparian habitats. As of the date on this document (March 2016), precipitation was considerably below average for the water years 2013-2014 and 2014-2015, while 2015-2016 is closer to average. This lack of rain also affected the “spring green up” period, a time when the seed bank germinates and re-sprouting vegetation emerges. The precipitation year is likely to be classified as a “critically dry” year. This suggests that soil moisture may not be maintained long enough to support the extensive establishment of new vegetation, especially in areas affected by high soil burn severity. As such, the extent of ground cover in the two post-fire growing seasons may be less than expected, if we were to

expect a "normal" or average precipitation years. Even with the dry winters, field observations in 2015 identified that extensive shrub growth has occurred in many areas in the two post-fire growing seasons.

Because ground cover is an important factor in post-fire erosion rates, the low ground cover conditions that are likely over the next few years may not be adequate to naturally mitigate erosion rates. If the 2015-2016 precipitation year is near average post-fire watershed responses may be higher than they were in 2013-2014 or 2014-2015. Therefore, there is a degree of uncertainty in watershed response and assumptions about vegetative recovery and ground cover made in the analyses that this report relies upon (watershed and soils) may not be completely accurate.

Management Requirements (Conservation Measures)

Numerous "standard" management requirements and BMPs (e.g., equipment exclusion zone of 15-50+ feet along streams, retention of all existing riparian vegetation) that reduce effects to the aquatic environment are described in Chapter 2 of the EIS (see Appendix B tables for summary). In combination, these requirements are expected to substantially reduce negative effects to the aquatic environment and support species effects determinations. Requirements specific to non-federally listed species are included since they may provide additional protection for listed species and their habitat. The following additional project-specific management requirements (conservation measures) were developed for the project and are an important part of analysis assumptions and estimates of effects risk and magnitude:

1. Limited Operating Periods (LOPs):
    a. Prohibit mechanical operations and herbicide applications within 1 mile of areas identified as suitable California red-legged frog (CRLF) breeding habitat during the wet season (the first rainfall event depositing more than 0.25 inches of rain on or after October 15 until April 15).
    b. Within 300 feet of occupied WPT habitat, prohibit all project activities between May 15 and July 15.
    c. Prohibit equipment operations within 300 feet of Abernathy Meadow and Big and Little Kibbie Ponds from June 1 through July 15 and during periods when these features have no standing water.

2. Aquatic Habitat:
    a. Do not locate burn piles within 100 feet of suitable CRLF breeding habitat or occupied WPT habitat, or within 50 feet of CRLF non-breeding aquatic habitat.
    b. Within 1 mile of suitable CRLF breeding habitat and 300 feet of occupied WPT habitat, ignite all burn piles on only one side, not to exceed half the circumference of the pile, on the side furthest from the nearest aquatic feature.
    c. Do not deep till within 100 feet of aquatic features occupied by WPT unless reviewed by an aquatic biologist.

d. Use screening devices on water drafting pumps and use pumps with low entry velocity to minimize impacts to aquatic species. A drafting box measuring 2 feet on all sides covered in a maximum of 0.125 inch screening is required.

3. Herbicide Operations:

a. Do not refill individual herbicide backpacks within 50 feet of any stream with surface water.

b. Do not use stream water for mixing herbicides or for rinsing equipment or containers that have contained herbicide mix.

c. Do not apply herbicide formulations within 50 feet of Eleanor Creek or the two ponds on Kibbie Ridge.

d. Between June 1 and September 1, avoid herbicide applications within 100 feet of habitats known to be occupied by Western Pond Turtle (WPT).

e. Do not apply herbicide formulations within 25 feet of streams with known occurrences of foothill yellow-legged frogs unless approved by an aquatic biologist.

f. Do not apply herbicide within 107 feet of suitable aquatic habitat of Sierra Nevada yellow-legged frogs or California red-legged frog. Follow USFWS guidance regarding exception for treatment of specific noxious weeds within 107 feet of aquatic habitat.

g. Restrict herbicide type in upland (greater than 107 feet from aquatic habitat) for California red-legged frog suitable habitat complexes; permitted herbicides include aminopyralid and glyphosate (aquatic formulation) only.

DIRECT AND INDIRECT EFFECTS

The table below estimates project treatment within/adjacent to suitable terrestrial habitat (no project treatment within aquatic habitat) for the analysis species. For analysis simplification, and due to the adaptive component of project design, it is assumed that multiple treatments (e.g., tilling, thinning, masticating, prescribed fire, etc.) could be implemented within the total estimated acreage. It should be noted that treatment adjacent to SNYLF aquatic habitat is "negligible" in quantity, with only about 2 acres proposed within the 82-foot analysis zone/buffer. For California red-legged frog habitat areas in relation to project treatment, see maps in Appendix A.

Table 6 - CRLF and SNYLF Direct and Indirect Effect Indicators.

Indicator	Area/miles
California red-legged frog	
Miles of stream habitat within units	12.4
Acres of breeding ponds within units	0
Acres of habitat within units – all treatment types[1]	4,044.0 (18.7%)
Herbicide use for noxious weeds[2]	577.9
Sierra Nevada yellow-legged frog	
Miles of suitable breeding /non-breeding stream within units	0.4
Acres of breeding/non-breeding ponds within units	0.8
Acres of upland habitat within units – all treatment types	2.0 (<1%)

Indicator	Area/miles
Herbicide (within 107 feet) near-stream for reforestation or noxious weeds	0

[1] Includes near-aquatic and upland habitat combined. Percents represent the percent of the total in the Rim Reforestation project area.

[2] Majority (>90%) of acreage overlaps with reforestation units, where only glyphosate is proposed for treatment. Only glyphosate and aminopyralid are allowed in California red-legged frog terrestrial habitat, with no application within 107 feet of aquatic habitat.

General Effects Common to California red-legged frog and Sierra Nevada yellow-legged frog

Mortality and Injury

The use of heavy equipment, application of herbicides and implementation of prescribed fire all have the potential to directly injure or kill aquatic organisms, particularly those occupying upland habitats. While most organisms close to water would be expected to escape into the water, equipment can run over individuals that fail to flee or are unable to move, and prescribed fire can injure or kill organisms that remain onsite. As stated previously, both California red-legged frogs and Sierra Nevada yellow-legged frogs are likely absent from the project area; therefore, the risk of harm/harassment is very low for all action types.

Herbicide Application

Four herbicides are proposed for site preparation and release (glyphosate only) and noxious weed eradication (glyphosate, clethodim, aminopyralid and clopyralid). "Hazard quotient" represents the ratio of toxicant exposure to a reference value that corresponds to a threshold of toxicity; a hazard quotient of "1" is the level at which adverse effects could occur. The SERA risk assessments prepared for the project indicate a hazard quotient of "1" is not expected to be exceeded for amphibians for any of the chemicals applied at specified application rates; sensitive fish were used as a proxy for amphibians when data was lacking. In most cases, hazard quotients were at least an order of magnitude less than 1. Under the unlikely event of "acute accidental" exposure, clethodim exceeds a hazard quotient of 1 for sensitive fish, with a value of 1.5; however, management requirements (e.g., refilling backpack sprayers away from water) are expected to reduce this risk to a very low level.

Within aquatic habitat, where both analysis species tend to reside the majority of the time, actual herbicide concentrations would be much less than those predicted by the SERA risk assessments; this is because the risk assessments do not account for the 107-foot no herbicide buffer that would be used adjacent to suitable aquatic habitat for both analysis species. Though certain noxious weeds can be treated within 107 feet, recent guidance from USFWS regarding buffers and herbicide type would be followed, and very few noxious weed areas are proposed for treatment within 107 feet of suitable habitat.

Physical Disturbance

Heavy equipment use or forest workers close to a stream could affect the behavior of aquatic organisms that are in the terrestrial environment. The typical response is for an individual to flee into water. Individuals typically hide under streambanks, rocks or logs for up to 30 minutes and then return to the edge of the stream. They seek refuge if disturbed again and typically stay submerged longer or move away from the disturbance. Physical disturbance may interrupt basking, sleeping, or foraging, creating the potential to affect physical well-being. A single instance of disturbance may have negligible or no

effect on an individual, but repeated disturbance has the potential to affect the physiological fitness of individuals (Rodriguez-Prieto and Fernandez-Juricic 2005).

Modification of Habitat

The primary impact to habitat expected from the proposed activities is an increase in sediment delivery caused by equipment operations on fire-affected soils; to a lesser extent, sediment increases can occur through hand methods (e.g., manual grubbing), prescribed fire, and the use of herbicides (e.g., slightly increased soil exposure to precipitation events from leaf loss). The operation of heavy equipment (e.g., deep tilling) on fire-impacted soils and in near stream environments can result in ground disturbance capable of mobilizing susceptible soil types. Numerous project units coincide with areas of moderate and high burn severity, conditions that are more sensitive to disturbance. These areas typically have alterations in soil structure that make them more vulnerable to erosion and lack beneficial ground cover which can reduce erosion rates; numerous protective measures are in place to minimize these potential effects (Chapter 2 of EIS).

Excess sediment can cause a reduction of deep water habitats (pools and runs), loss of microhabitat complexity and filling the streambed with fine sediment. Pool and run habitats can be filled by excess sediment, especially in low gradient (less than 2%) reaches. The energy of water in higher gradient reaches (greater than 5%) tends to have enough erosive force to keep pools scoured and deep water maintained, but the overall pool volume may be reduced in low energy sites as sediment accumulates at the edges and tail of the pool. Excess sediment also reduces microhabitat complexity and the spaces between streambed substrates by filling the streambed with finer sized sediments (silts and sands). In lower gradient streams, the overall depth of the stream is typically reduced as the streambed fills with sediment and the water spreads out in a thin layer across this sediment. The loss of the small changes in streambed depth reduce microhabitat elements by eliminating velocity refuges and filling the spaces between larger substrates (gravel, cobble, and boulder) that are used by some species for breeding, foraging, and hiding. The change in streambed also influences the production of aquatic insects that use, including very specialized use, microhabitats in otherwise unimpaired streams. Aquatic insects play key roles in the breakdown of organic matter entering streams, nutrient cycling, and as sources of food for many aquatic and terrestrial species. Project protective measures are expected to reduce the risk and magnitude of these potential effects to low levels. Sediment would be expected to return to natural levels within a few years after project implementation.

The Watershed Erosion Prediction Project (WEPP) model was used to estimate soil mobilization as a result of project treatment. Sample sites were selected that were, 1) adjacent to suitable habitat and, 2) would be treated with a higher disturbance treatment type (deep tilling). It is assumed that the majority of units would produce less sediment than those modeled with WEPP due to greater distance from aquatic habitat and/or lower impact treatment types.

Table 7 - WEPP sediment modeling results.

	Unit/site	Sediment (tons/acre)

Species suitable habitat		Deep- tilling 2- year return interval	Deep- tilling 10- year return interval	Deep- tilling **average annual**	No treatment (control) **average annual**
SNYLF	N019/1	0	.720	.151	.009
SNYLF	CC001/2	.163	.703	.267	.018
CRLF	X028	0	.165	.049	.022
CRLF	V012	.607	1.486	.641	.076

The WEPP results show measurable, though relatively low-magnitude, sediment increases are expected when soil-disturbing treatment is implemented near aquatic habitat. For comparison, post-fire sediment rates can commonly be orders of magnitude higher (e.g., 10-20 tons/acre) than those resulting from mechanical treatment with implemented management requirements. It is unlikely that these relatively small increases in sediment would meaningfully reduce aquatic habitat suitability for either analysis species.

Though observable direct effects to aquatic species are not expected to occur from herbicide use, effects to habitat are expected. The primary effect would be the reduction of terrestrial vegetation cover (mostly shrubs) in the short-term, while more rapid growth and distribution of tree-type vegetation is anticipated in the longer term. Most of this reduction is expected to occur away from waterbodies, as existing riparian vegetation would be left intact. Vegetation recovery would be variable in both spatial and temporal contexts, as multiple herbicide applications could occur in some areas. Indirect effects are also possible as a result of changes to aquatic and terrestrial food sources. For example, macrophytes, algae, and some invertebrates could be affected by herbicide use, as they are generally much more sensitive to herbicide effects (risk assessment worksheets) than vertebrate species. In the absence of an “accidental acute” exposure scenario, these potential effects would likely be limited to a very small percentage of project waters due to multiple management requirements that limit treatment near water and existing riparian vegetation.

LWD plays very important roles in the development of habitat complexity and sediment retention in a stream (USDA 1988; Montgomery et al. 1996; May and Gresswell 2003). It may take several centuries (greater than 300 years) for some portions of the forest to regrow large trees. The project is designed to hasten the growth of trees as compared to natural recovery rates, reducing the time necessary to create LWD for recruitment to aquatic habitats.

California Red-legged Frog

Direct and indirect effects to individual California red-legged frog individuals include disturbance, injury or mortality, and reduced fitness as a result of repeated disturbance or a reduced food supply. Because California red-legged frog is considered to be extirpated from the Tuolumne River basin (USFWS 2002) these effects are discountable. However,

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because extensive surveys to confirm this have not been completed for the frog within the project area and suitable physical habitat exists, these potential effects will be discussed.

Direct and indirect effects to habitat include a reduction in shade that can result in increased water temperatures; reduction in large downed wood recruitment that can alter stream form and limit creation of downstream habitat (pools) and reduce cover in upland areas; streambank damage from operation of equipment; a risk of chemical contamination from herbicide use, and increased sedimentation as a result of mechanical operations. As stated previously, numerous protective measures (e.g., BMPs, project management requirements) are in place to minimize or prevent these effects.

Effects to individuals are mainly associated with the operation of equipment, presence of forest workers in suitable habitats for the frog, prescribed fire, and potential water drafting. If equipment operates in suitable habitat, there is the risk of injury or mortality when the disturbance is initiated. As activities move further from aquatic habitat the risk is reduced, although California red-legged frogs can be found in the upland habitat for extended periods in rodent burrows or under available cover (moist vegetation and downed wood). Any frogs in the upland habitat could be vulnerable to crushing if the equipment hits or runs over the cover object. As the amount of activity in the upland habitat increases, so does the risk. Because red-legged frog are considered extirpated from the Tuolumne River basin, this risk is expected to be very low. The amount of are proposed for treatment within upland habitat is used as an indicator of risk.

As stated above, physical disturbance is also a direct impact to individuals and is associated with equipment operation and forest workers in close proximity to suitable habitats. Red-legged frog are generally associated with aquatic habitats, but can be found in upland habitats for extended times. Many overland movements of red-legged frogs are associated with the wet season when implementation activities are stopped. Because the risk of direct impact is highest when equipment works in close proximity to the water, the amount of potentially suitable habitat near water and overlapping proposed activities is used as an indicator of risk. Table 3.03-5 identifies the number of miles and acres for each species.

Indirect impacts to individuals can occur when excessive sedimentation modifies habitat. When excess sediment is supplied to a stream, deep water habitat can be reduced, the spaces between and under stream substrates (interstitial spaces) are filled in, and sediment covers suitable foraging substrates. Depth reduction of deep water habitats (pools and runs) can affect availability of breeding habitat. If the reduction of depth persists over many years, there could be population level impacts because reproductive success would be periodically reduced or eliminated. Excessive sedimentation also can fill in interstitial spaces and reduce the instream overhead cover available to all life stages. Red-legged frog tadpoles typically retreat to deep water and have also been observed burrowing in to sediment to escape (Bobzein and Didonato 2007). An increase in predation could result if these refuge habitats are limited. California red-legged frog tadpoles feed on algae and adult frogs feed on macroinvertebrates (Federal Register 2010). In stream habitats the larger substrates provide the algal resources. As excessive sedimentation begins to cover the streambed, the substrates used for foraging can also be covered, thereby resulting in decreased opportunities for feeding. The consequences of reduced food supply for tadpoles means slightly longer developmental time to

metamorphosis and reduced size at metamorphosis. Longer developmental times could increase predation risk as metamorphosis occurs and tadpoles are less mobile due to presence of legs and the physiological cost of transforming the body. Smaller size at metamorphosis could affect individual survivorship over winter. Project management requirements are expected to reduce potential impacts (Chapter 2.02 of EIS).

Herbicide use within potential habitat, both near aquatic and upland (up to 1 mile from suitable breeding sites), is restricted to glyphosate and aminopyralid formulations. These two herbicides are commonly used near aquatic habitat due to their lower toxicity to aquatic organisms. Risk assessments for this project show low risk to individual amphibians under the expected exposure scenarios. As stated previously, risk is further reduced because it is unlikely this species are present.

Effects to habitat should be mostly limited to a short-term reduction in vegetative cover in the upland terrestrial environment, most of which will be located a substantial distance from aquatic habitat due to project protective measures (Chapter 2); riparian impacts, such as temperature change due to near-water vegetation removal are not expected to occur due to these protective measures. The operation of equipment and use of herbicides can potentially damage cover in upland habitats as vehicles crush vegetation and displace large woody debris. The loss of cover could negatively impact the ability of red-legged frogs to forage or hide from predators. Equipment could also crush partially decayed logs and reduce potential refuge habitat under the log, though much of this cover type was lost in the fire. The consequences of the loss of cover provided by riparian vegetation would be very minor, because the extent of habitat loss would be limited to the few areas where equipment operation would occur in suitable habitat, and temporary, because the near-ground vegetation would likely regrow within a few years. The project is expected to increase the rate of tree growth, both for planted conifers and most remaining native tree species, the majority of which would occur outside areas where riparian vegetation is re-establishing naturally.

An increase in the rate of sediment delivery to streams following deep tilling, machine piling, pile burning, and to a lesser extent, herbicide use and manual release methods could occur. These activities create soil disturbance and compaction that can lead to increased erosion and sedimentation. Vegetation removal has a potential for increasing sediment delivery to aquatic systems because ground based equipment creates soil disturbance, some of which may be mobilized during precipitation events. However, the potential for biologically important levels of sedimentation is low because the area affected represents a very minor percentage of total near-water area. Pile burning also creates the potential for slight increases in sediment because the burn piles can cause localized soil hydrophobicity under the fire due to high temperatures and relatively long residence time. The potential for extensive off site soil movement is low because the piles tend to be small (20 to 50 square feet), but machine piles can have a much larger footprint (1,000 to 5,000 square feet).

Herbicide use for site preparation, release and noxious weed abatement would reduce near-ground cover for a period of a few years. Noxious weed treatments would only treat the targeted invasives, allowing for an increase in native vegetation within a few years, an outcome that is assumed to be beneficial to native amphibians.

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LWD should not be displaced in near-water habitat during mechanical site preparation treatments. Only small diameter trees would be piled and this would only occur in a minority of these areas.

Water drafting is required by the project for dust abatement on roads when thinning existing plantations. Drafting has the potential to suck in tadpoles (entrainment) or other small life stages as the pump pulls water from a stream. Entrainment and passage through the pump could be fatal to individuals or if the water is dispensed on a road or during fuels management activities (pile burning) in an upland area, mortality would likely result. The operation of the drafting pumps generate noise and workers attending to the pumps also create a source of physical disturbance. To mitigate the potential for entrainment, the management requirement applied to drafting operations includes use of low intake velocity pumps and a screening device placed around the pump intake.

Birch and Mud Lakes

No activities are proposed in the immediate vicinity of Mud Lake and all proposed activities occur downstream and/or downslope of the breeding habitat. No risk of injury or disturbance at the breeding habitat exists. No risk of increased sediment reaching the ponds due to project activities exists, or in reduced shading and an associated increase in temperature. The habitat suitability of the ponds would remain low post-implementation.

About 0.8 miles of non-breeding stream habitat overlaps proposed reforestation units. Minor quantities of sediment may enter the non-breeding aquatic habitat due to reforestation treatments.

Removal of small quantities of small diameter trees is not expected to reduce shade to an extent that would lead to increased water temperatures. LWD recruitment would not be affected along the non-breeding stream segments.

Approximately 10% of available upland habitat would be treated mechanically and with herbicide (glyphosate). These activities can decrease post-fire re-growth that has occurred in the short-term; an increase in conifer re-growth is expected in the longer term, while existing riparian vegetation is expected to remain largely unaffected. There are no activities proposed within the dispersal habitat between Birch and Mud Lakes.

Drew Creek

The breeding habitat along Drew Creek is not included within any proposed reforestation units and no risk of disturbance to breeding habitat exists. Only a few acres of reforestation treatments are proposed along non-breeding stream habitat. The small area of anticipated disturbance is not expected to result in detectable sediment above the background of the post Rim Fire erosion.

The proposed activities would not measurably alter stream shading. There is very little activity proposed in this habitat area adjacent to streams.

Noxious weed treatment would occur along about 0.56 miles of non-breeding stream, and within 120 acres (less than 5% of total upland habitat). Glyphosate and aminopyralid are proposed in this area. Near-ground cover would be reduced for a few years after application of glyphosate, but aminopyralid would only be applied to the noxious weeds and would have little effect on native plants. Native plant species would re-colonize and

occupy the majority of treated areas post-treatment, which is assumed to be a benefit for all native amphibian species.

If any California red-legged frogs are in the upland habitat at the time of activities, they would be at risk for disturbance or injury. Dispersal in the habitat occurs along Drew Creek and proposed activities would have no effect on the existing habitat.

Harden Flat Ponds

No reforestation treatments are proposed near the ponds and no risk of injury or disturbance at the breeding habitat. No risk of increased sediment reaching the ponds exists and the habitat suitability of the pond would remain unchanged.

About 0.25 miles of non-breeding stream habitat and 300 acres (less than 50% of available habitat) of upland habitat overlap proposed reforestation units. It is possible that implementation activities could result in some erosion and small quantities of sediment delivery to the stream. Removal of generally small diameter trees is not expected to reduce shade to an extent that would lead to increased water temperatures. LWD recruitment would not be effected. Reforestation activities can decrease cover and set back vegetative regrowth by a few years.

About 2 acres of available upland habitat is proposed for noxious weed treatment. Risk assessments indicate that herbicide concentrations would remain below levels capable of directly affecting amphibians; the risk assessments do not consider project management requirements (e.g., application buffers), which are expected to further reduce/prevent the risk of herbicide contamination. Some near-ground cover would be reduced for a few years after application, but noxious weed applications target the invasive species specifically and should not impact most other plants in the area. Presumably, native plant species would occupy the majority of these areas post-treatment, which is assumed to be a benefit for all native amphibian species. Both glyphosate and aminopyralid are proposed for noxious weed eradication, while reforestation treatments are only proposing glyphosate.

Homestead Pond

No reforestation units are located near Homestead pond. No risk of injury or disturbance at the breeding habitat or impact to habitat suitability of the pond would occur.

About 0.36 miles of non-breeding stream habitat and 285 acres (less than 20% of available habitat) of upland habitat overlap proposed reforestation units. It is likely that implementation activities would result in some erosion and there would be some sediment delivery to the stream. Removal of generally small diameter trees is not expected to reduce shade to an extent that would lead to increased water temperatures. Reforestation activities can further decrease cover from the effects of the fire, and can set back vegetative regrowth by a few years. If any California red-legged frogs are in the upland habitat at the time of reforestation activities, they would be at risk for disturbance or injury.

About 300 acres of available upland habitat is proposed for noxious weed treatment, with 0.36 miles of stream habitat contained within these areas. The majority of this acreage overlaps with the 285 acres of reforestation units. One unit is located approximately 100 feet west of Homestead pond; this distance is expected to be sufficient in preventing any

herbicide contamination. Risk assessments indicate that herbicide concentrations would remain below levels capable of directly affecting amphibians; the risk assessments do not consider project management requirements (e.g., application buffers), which are expected to further reduce/prevent the risk of herbicide contamination. Near-ground cover would be reduced for a few years after application. Native plant species would re-colonize and occupy the treated areas and this is assumed to be a benefit for all native amphibian species. Both glyphosate and aminopyralid could be used for eradication treatments, while reforestation only proposes the use of glyphosate.

Hunter Creek and Ponds

No reforestation units are located near the ponds. There is no risk of injury or disturbance at the breeding habitat. There is no risk of increased sediment reaching the ponds due to project activities, or in reduced shading and an associated increase in temperature. The habitat suitability of the ponds would remain the same.

About 11 miles of stream habitat (2 miles are potential breeding habitat), and 3,000 acres (less than 35%) of upland habitat overlap proposed reforestation units. It is likely that implementation activities would result in some erosion and there would be some sediment delivery to the stream. Removal of generally small diameter trees is not expected to reduce shade to an extent that would lead to increased water temperatures. LWD recruitment may be slightly reduced along the non-breeding stream segments, but most would be small diameter. Reforestation activities can decrease cover and can set back vegetative regrowth by a few years. If any California red-legged frogs are in the upland habitat at the time of reforestation activities, they would be at risk for disturbance or injury.

About 150 acres of available upland habitat is proposed for noxious weed treatment, with 2.5 miles of stream habitat contained within these units. Risk assessments indicate that herbicide concentrations would remain below levels capable of directly affecting amphibians; the risk assessments do not consider project management requirements (e.g., application buffers), which are expected to further reduce/prevent the risk of herbicide contamination. Near-ground cover would be reduced for a few years after application. Presumably, native plant species would re-colonize and occupy the majority of treated areas post-treatment, which is assumed to be a benefit for all native amphibian species. Both glyphosate and aminopyralid could be used in noxious weeds units, while reforestation units without noxious weeds would be treated with glyphosate only.

Sierra Nevada Yellow-legged Frog

Despite extensive surveys of suitable habitat no SNYLF have been found within the project area and most habitat is of relatively low quality. Because occupancy is not definitively known in all areas, effects to individuals are considered.

Proposed activities overlap 0.4 miles of stream and 0.8 acres of pond habitat (Table 6). Survey efforts at the Kibbie Ponds have been adequate to determine the ponds are unoccupied and therefore no impacts to individuals are expected to occur.

About 2 acres of treatment are proposed within 82 feet of potential habitat along the Middle Fork Tuolumne River at the border with Yosemite National Park. These units are proposed for thinning only. Direct impacts to individuals from tree felling could

theoretically occur, though the likelihood is low because these large streams are atypical of SNYLF habitats on the forest and have self-sustaining populations of fish. In addition, occupancy is very unlikely at these sites and the risk to individuals is very low. SNYLF hiding in burn piles could be killed, injured, or disturbed if they are present when piles are ignited. Project management requirements ensure burn piles are located a minimum of 50 feet from perennial and intermittent streams and other special aquatic features to mitigate this risk.

Due to the very small quantity of upland treatment (2 acres) habitat effects are expected to be very minimal. Herbicide effects should be absent since none are proposed for use within 107 feet of suitable SNYLF habitat. No measureable change to habitat suitability is expected.

CUMULATIVE EFFECTS

The primary pathways considered for cumulative effects to the CRLF and SNYLF are; 1) the potential risk of directly impacting individuals or their habitats, and 2) the risk of increased sedimentation in the habitats.

The Cumulative Watershed Effects analysis for the project provides a general view of treatment effects as compared to the total from this project and all other actions listed in Appendix B of the EIS. Calculations for five sub-watersheds (7th field HUC) indicated that total effects, expressed as Equivalent Roaded Acres (ERA), are highly variable. In the first few years of treatment, the project would likely contribute between 10 to 50% of total effects, depending on sub-watershed.

Vegetation management on private lands and livestock grazing were the two types of cumulative effects considered for SNYLF and CRLF; these effects are discussed qualitatively, as the quantity of these action types are not well known on private lands. These two types of actions are considered to have the most detectable influence on aquatic systems, especially in the post-fire environment. The impact of post-fire logging was discussed earlier in this document and this activity has the highest potential to increase erosion and sedimentation rates in a watershed. Livestock grazing is also discussed because the impact of concentrated livestock use in riparian areas (made more sensitive by moderate and high soil burn severity conditions) may have localized impacts to streambanks and the reestablishment of riparian vegetation.

Streambanks are more sensitive post-fire than in unburned conditions because much of the vegetation has been burned and there is little root holding capacity to resist shearing by hooves. This is especially true in low gradient reaches (less than 2%) where alluvial (or depositional) banks dominate. In steeper gradient reaches, the streambanks tend to be more armored by larger diameter substrates (rocks like cobble and boulder) and resistant to bank shear. These localized areas of streambank disturbance may not have much of an effect at larger watershed scales, but they can influence sedimentation at locally important scales. If livestock are allowed to graze portions of the allotments, a small increase in sedimentation would be expected along low gradient reaches with no discernible increase along higher gradient sections. However, any impact in watersheds with high levels of project actions could cumulatively contribute to degradation of aquatic habitat. The duration of this combined reduction in habitat suitability would be

two to three years. After this period, hillslope erosion rates would quickly decrease and habitat suitability would increase to moderate levels.

Another impact associated with livestock is the potential impaired recovery of riparian vegetation because livestock can affect the recovery of obligate woody and herbaceous riparian species. The rapidly re-growing riparian vegetation is always a good food source, but especially late in the season when other forage options may have decreased in palatability. The proximity of this forage to water, another critical resource need for livestock, suggests livestock may congregate in sensitive post-fire riparian areas. Project activities would minimally affect riparian vegetation, so very little cumulative effect to riparian recovery is expected.

California Red-legged Frog

Livestock grazing in close proximity to streams has the potential to impact streambank stability through trampling and chiseling of the banks by cow hooves. Overall, the effect of livestock grazing relative to sedimentation is considered to be minor and is expected to recur on an annual basis. The minor amount of sediment attributable to grazing would potentially combine with sediment associated with implementation of this project. Combined, the sediment could impact slow water habitats and may be observable as a light dusting of silt in slow water habitats or small pockets of fine sands accruing behind larger stream substrates (cobbles and boulders) and in the slowest velocity areas of pools. This type of sediment impact is not expected to significantly reduce pool volume or the spaces between streambed substrates where individuals could seek refuge from predation. This type of sedimentation pattern would not impair foraging habitat for tadpoles to the extent that growth and development are impacted.

Livestock grazing could also limit the regrowth of obligate riparian species (e.g., willows, alders, aspen) that were impacted by the fire. If the fire effectively killed the above ground portions of these types of riparian vegetation, the plant responds by sending up new growth from the roots or root crown. These new shoots capitalize on the extensive root system that was developed by the plant by growing rapidly and re-establishing riparian cover in the long-term. Cattle do browse this new growth because it is very nutritive, but they tend to preferentially graze these plants late in the season when other upland forage (especially sedges) has lost its nutritional value. If the livestock greatly reduce the amount of re-growing vegetation, the shading and leaf fall provided by these plants would be reduced. The CRLF can be found in full sun habitats, but a mix of shaded conditions allows the animal to effectively control body temperature while not moving great distances to find a satisfactory resting place. The annual leaf fall by obligate riparian plants also provides a beneficial resource to streams through nutrients dissolved in the water and organic matter added to the stream. Primary productivity, the growth of algae and other biological films forming on streambed substrates, is greatly influenced by the nutrients dissolved from the leaves. These biological films are very important food sources for the frog at the tadpole stage since they are algal grazers. The organic material provided by the leaves is also used by many species of aquatic insects that either ingest portions of the leaves or use the leaves in other ways (for example, caddisfly cases). The adult forms of these aquatic insects are seasonally important food sources for post-metamorphic frogs. Excessive impacts to regrowing riparian vegetation

would have moderate impacts on stream shading in the short- to mid-term (3-10 years) and a very minor impact on aquatic insect and primary productivity.

In the Hunter Creek habitat unit, private lands are present to the north and east. The majority of these lands are located away from water. Timber harvest and other ground-disturbing activities could contribute to project effects through vegetation removal and sediment increase, but are unlikely to contribute substantial effects due to the relatively small percentage of total habitat affected.

Sierra Nevada Yellow-legged Frog

Ground disturbance from implementation of the Rim Fire Restoration Project is expected to occur adjacent to the Kibbie Ridge ponds. Project management requirements are expected to minimize habitat effects near aquatic habitat, and would roughly equate to those effects expected from this project. Private lands are not present near SNYLF habitat within the project area, so no cumulative effects are expected from this source.

VI. CONCLUSION AND DETERMINATION OF EFFECTS

Because the project area lies outside the geographic and/or elevational range of the species, it is my determination that the Rim Fire Reforestation Project will not affect the Yosemite toad.

DETERMINATIONS FOR THE CALIFORNIA RED-LEGGED FROG AND SIERRA NEVADA YELLOW-LEGGED FROG

California Red-legged Frog

Project implementation would pose a very low risk to individual CRLF, since the species is likely absent within the project/analysis area. If this species were to migrate to the area during the analysis timeframe, there would be a risk of injury, mortality, or behavioral disturbance. However, the risk would be low since aquatic habitat would be minimally affected, and seasonal restrictions would limit risk in upland areas.

Suitable habitat would be affected, primarily in upland areas. A long-term benefit may occur due to an expected decrease in noxious weeds, with a corresponding increase in native vegetation. Upland habitats have the greatest proportion of overlap with project activities, where vegetation modification or loss would occur for a period of years. An increase of sediment/turbidity in breeding and non-breeding habitat could occur within CRLF aquatic habitats. Small increases in sediment are unlikely to be meaningful since this species is known to reside in habitat with abundant find sediment.

Therefore, due to effects to suitable habitat, the following determination applies: “May affect, likely to adversely affect” California red-legged frog. The determination of “may affect, likely to adversely affect” is limited to 7 locales. These are: Drew Creek, Hunter Creek and ponds or impoundments on streams (Birch Lake, Mud Lake, Homestead Pond, Harden Flat ponds, Hunter Creek area ponds).

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Sierra Nevada Yellow-legged Frog

Possible direct effects to individuals include injury, mortality, or behavioral disturbance, though the risk is very low due to the likely absence of this species from the analysis area, and the very small quantity (few acres) of terrestrial habitat proposed for treatment.

Direct effects to aquatic habitats are not expected to occur because management requirements prohibit operations within and adjacent to aquatic features. The upland habitat would be at greater risk of direct effects in comparison to the breeding and non-breeding aquatic habitats, although in comparison to CRLF, the upland habitat of SNYLF are less important to their overall survival because of their close affinity to water, and the lack of habitats in close enough proximity to one another that would favor overland movements. An increase of sediment/turbidity in breeding and non-breeding habitat could occur within SNYLF aquatic habitats. Small increases in sediment are unlikely to be meaningful since this species is known to reside in habitat with abundant find sediment.

Therefore, due to effects to suitable habitat, the following determination applies: "May affect, likely to adversely affect" Sierra Nevada yellow-legged frog. This determination is applicable to two analysis areas: Big and Little Kibbie Ponds, and the Middle Fork Tuolumne River near the Yosemite National Park boundary.

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VIII. APPENDICES

Appendix A – California red-legged frog habitat maps

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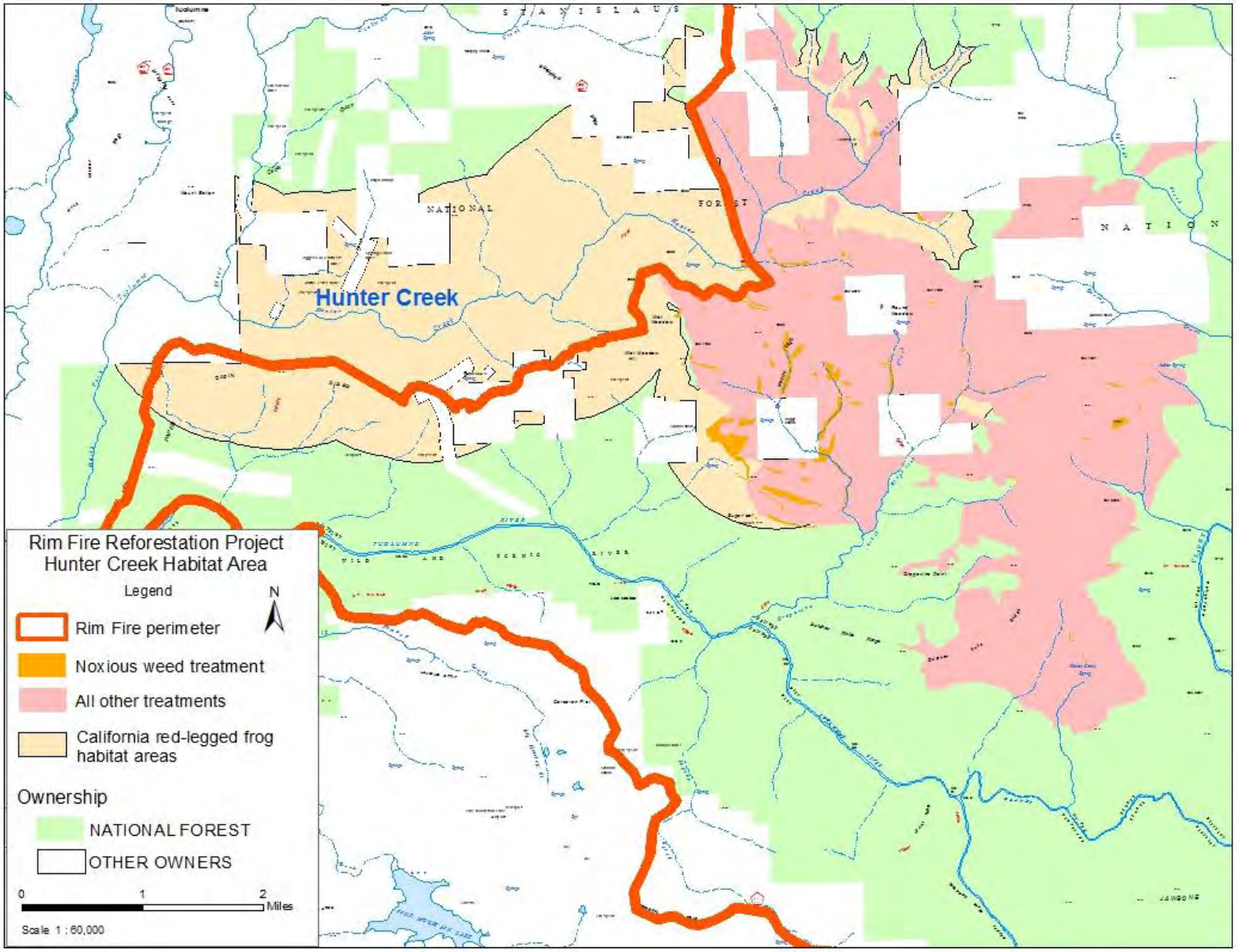
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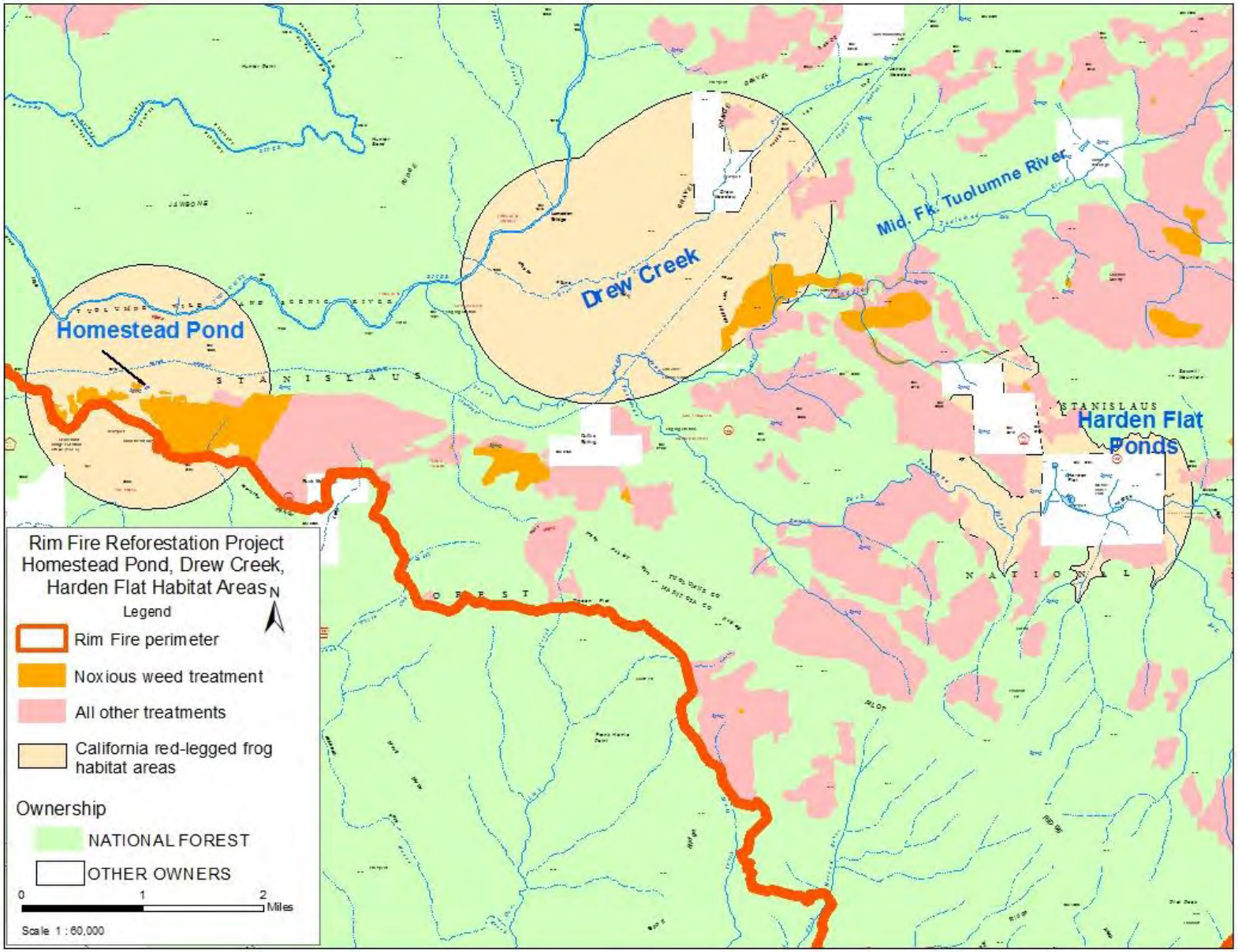
Rim Fire Reforestation Project
Hunter Creek Habitat Area
Legend
N
Rim Fire perimeter
Noxious weed treatment
All other treatments
California red-legged frog habitat areas
Ownership
NATIONAL FOREST
OTHER OWNERS
0
1
2
Miles
Scale 1 : 60,000


Homestead Pond
Drew Creek
Mid. Fk. Tuolumne River
Harden Flat Ponds
Rim Fire Reforestation Project
Homestead Pond, Drew Creek,
Harden Flat Habitat Areas
N
Legend
Rim Fire perimeter
Noxious weed treatment
All other treatments
California red-legged frog habitat areas
Ownership
NATIONAL FOREST
OTHER OWNERS
0
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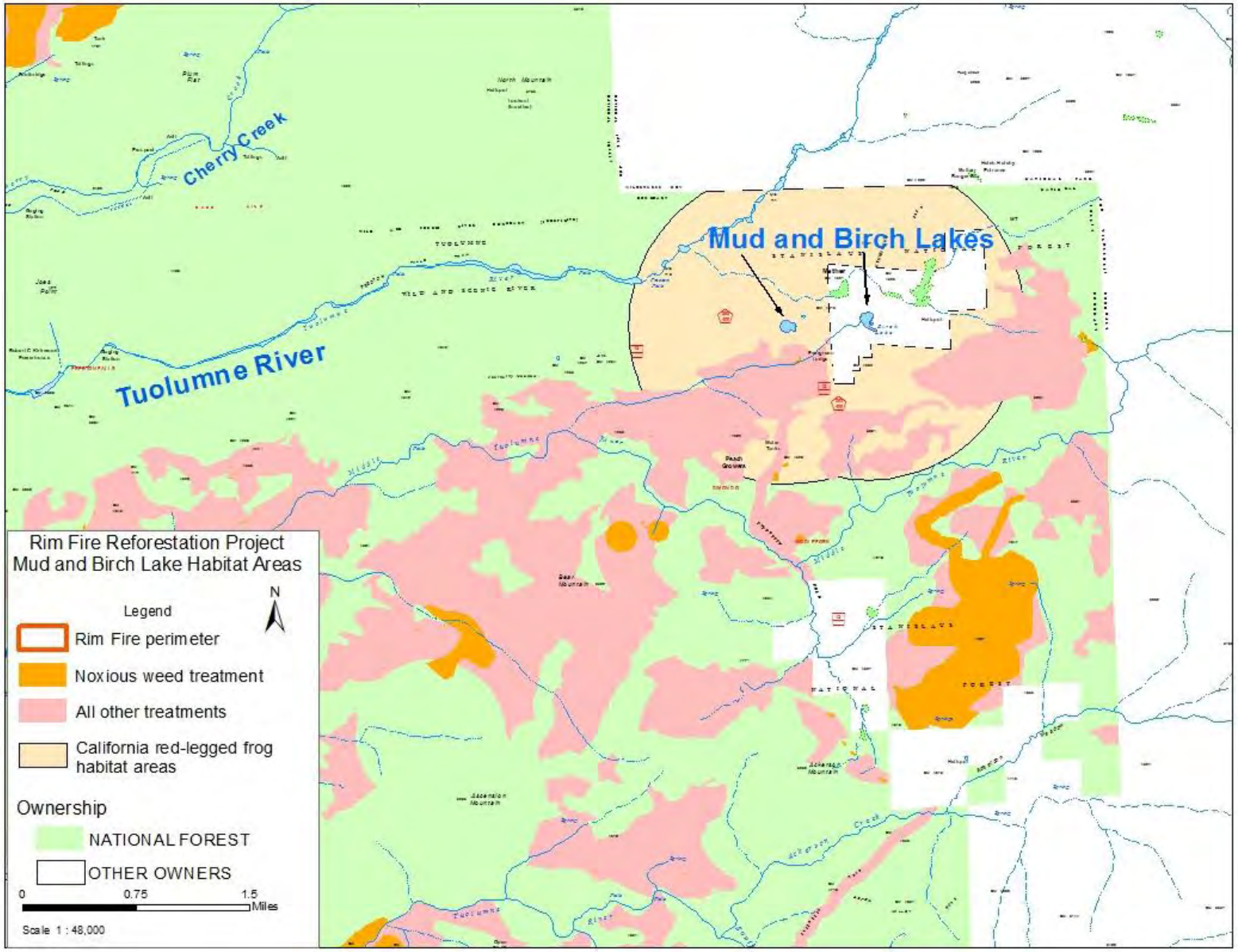
Miles
Scale 1 : 60,000


Cherry Creek
Mud and Birch Lakes
Tuolumne River
Rim Fire Reforestation Project
Mud and Birch Lake Habitat Areas
Legend
N
Rim Fire perimeter
Noxious weed treatment
All other treatments
California red-legged frog habitat areas
Ownership
NATIONAL FOREST
OTHER OWNERS
0
0.75
1.5
Miles
Scale 1 : 48,000

Appendix B – Management requirements

1. Table 2.03-1 Operating requirements for mechanized equipment operations in RCAs

Stream Type[1]	Zone	Width (feet)	MECH[2]	SKID[3]	Operating Requirements
PER/INT/SAF	Exclusion[4]	0-15	Prohibited	Prohibited	N/A
PER/INT/SAF	Exclusion	15-50	Allowed	Prohibited	N/A
PER/INT/SAF	Transition	15-50	Allowed	Prohibited	Remove operation-created debris from stream channels unless prescribed for resource benefit. Retain remaining obligate riparian shrubs and trees (e.g. willows, alder, aspen). Do not damage streambanks with equipment and retain sufficient vegetation to maintain streambank stability.
PER/INT/SAF	Transition	50-100	Allowed	Allowed	Use existing skid trails except where unacceptable impact would result. The number of crossings should not exceed an average of 2 per mile.
PER/SAF	Outer	100-300	Allowed	Allowed	Density and intensity of skid trails will gradually increase as distance increases from the Transition Zone.
INT	Outer	100-150	Allowed	Allowed	Density and intensity of skid trails will gradually increase as distance increases from the Transition Zone.
EPH	Exclusion[5]	0-15	Prohibited	Prohibited	N/A
EPH	Exclusion	15-25	Allowed	Prohibited	N/A
EPH	Transition	25-50	Allowed	Allowed	The number of crossings should not exceed an average of 3 per mile.

[1] **PER**=Perennial; INT=Intermittent; EPH=Ephemeral; SAF=Special Aquatics Features (lakes, meadows, bogs, fens, wetlands, vernal pools, and springs)
[2] **MECH**=Mechanical Harvesting or Shredding (low ground pressure track-laying machines such as feller bunchers and masticators)
[3] **SKID**=Skidding (rubber-tired skidders and track laying tractors)
[4] The exclusion zone for perennial/intermittent streams starts at: A. The edge of the active channel where slopes rise uniformly from the stream, or at the outer edge of the following features, whichever is the furthest from the stream. B. The first slope-break adjacent to the stream (e.g., stream bank, inner gorge). C. Flat or nearly flat ground adjacent to the channel (e.g., floodplain or terrace). D. Obligate riparian shrub and/or tree communities associated with any of the above. The exclusion zone for SAFs begins at: A. The outer edge of obligate trees, shrubs or herbaceous plants in wet meadows, bogs, fens and springs, or the high water line of lakes and vernal pools. B. The top of the first slope-break immediately adjacent to the special aquatic feature if further than the obligate vegetation or high water line.
[5] The exclusion zone begins at the edge of the channel where slopes rise uniformly or at the edge of the stream bank, whichever is furthest from the stream.

a. Management Requirements Incorporating BMPs and Forest Plan S&Gs: Table 2.03-2 presents management requirements pertaining to: erosion control plans; operations in RCAs; road activities; log landings; skid trails; water sources; servicing and refueling of equipment; burn piles; prescribed fire; water quality monitoring; and cumulative watershed effects.

2. Table 2.03-2 Management requirements incorporating BMPs and Forest Plan S&Gs

Management Requirements	BMPs/Forest Plan[1]/Locations
Erosion Control Plan Prepare a project area Erosion Control Plan (USDA 2011b) approved by the Forest Supervisor prior to the commencement of any ground-disturbing project activities. Prepare a BMP checklist before implementation.	**Regional BMPs** 2-13 Erosion Control Plans (roads and other activities) 1-13 Erosion Prevention and Control Measures During Operations 1-21 Acceptance of Timber Sale Erosion Control Measures before Sale Closure **National Core BMPs**

Management Requirements	BMPs/Forest Plan[1]/Locations
	Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all areas where ground-disturbing activities occur.
Operations in Riparian Conservation Areas Delineate riparian buffers (Table 2.03-1) within RCAs around all streams and special aquatic features within project treatment units.. Fell trees harvested within RCAs directionally away from stream channels and SAFs unless otherwise recommended by a hydrologist or biologist. A minimum of 60% well distributed ground cover is desired within 100 feet of perennial and intermittent streams and SAFs. Project administrator shall coordinate with a hydrologist prior to operating in units BB035, BB050, and BB036 to protect the Bear Gully restoration site, the stream channel downstream of the site, and the alluvial flat. Exclude mechanized equipment between the near-stream roads that closely parallel both sides of Corral Creek in Units R037 and T005 (1N01 and 1N08 on the west, and 1N74 and 1N74C on the east) unless otherwise recommended by a hydrologist or soil scientist. Planting: For perennial and intermittent streams, do not plant within 15 feet of the streambank or 20 feet of their associated riparian vegetation, whichever is more. Exclude dozer operations within 50 feet from the start of the exclusion zone for all perennial and intermittent and SAFs and 25 feet from the start of the exclusion zone for all ephemerals.	**Regional BMPs** 1-4 Using Sale Area Maps and/or Project Maps for Designating Water Quality Protection Needs 1-8 Streamside Zone Designation 1-10 Tractor Skidding Design 1-18 Meadow Protection During Timber Harvesting 1-19 Streamcourse and Aquatic Protection 5-3 Tractor Operation Limitations in Wetlands and Meadows 5-5 Disposal of Organic Debris 7-3 Protection of Wetlands **National Core BMPs** Aq Eco-2 Operations in Aquatic Ecosystems Plan-3 Aquatic Management Zone Planning Veg-1 Vegetation Management Planning Veg-2 Erosion Prevention and Control Veg-3 Aquatic Management Zones Veg-4 Ground-Based Skidding and Yarding Operations **Forest Plan S&Gs** 193 (RCO 2) 194 (RCO 3) 194 (RCO 4) 195 (RCO 5) **Locations**: All units containing RCAs and SAFs, and specifically the portions of units mentioned in this section.
Road Construction and Reconstruction Maintain functioning erosion-control measures during road construction and reconstruction and in accordance with the erosion control plan. Stabilize disturbed areas with mulch, erosion fabric, vegetation, rock, large organic material, engineered structures, or other measures according to specifications in the erosion control plan.	**Regional BMPs** 2-2 General Guidelines for the Location and Design of Roads 2-3 Road Construction and Reconstruction 2-8 Stream Crossings 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Road-3 Road Construction and Reconstruction **Forest Plan S&Gs** 62 193 (RCO 2) 194 (RCO 4) **Locations**: all roads to be reconstructed.
Road Maintenance and Operations Maintain road surfaces to dissipate intercepted water in a uniform manner along the road by outsloping with rolling dips, insloping with drains or crowning with drains. Where feasible and consistent with protecting public safety, utilize outsloping and rolling the grade (rolling dips) as the primary drainage technique. Adjust surface drainage structures to minimize hydrologic connectivity by: discharging road runoff to areas of high infiltration and high surface roughness, armoring drainage outlets to prevent gully initiation, and increasing the number of drainage facilities within RCAs.	**Regional BMPs** 2-4 Road Maintenance and Operations 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** Road-4 Road Operations and Maintenance Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 193 (RCO 2) 194 (RCO 4) **Locations**: all roads with maintenance or project use.
Log Landings Re-use log landings to the extent feasible. Do not construct new landings within 100 feet of perennial or intermittent streams and SAFs or 50 feet of ephemeral streams. Deep till all landings when biomass operations are complete.	**Regional BMPs** 1-12 Log Landing Location 1-16 Log Landing Erosion **National Core BMPs** Veg-6 Landings

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Management Requirements	BMPs/Forest Plan[1]/Locations
	Veg-2 Erosion Prevention and Control **Forest Plan S&Gs** 194 (RCO 4) **Locations**: Biomass Removal: all landings.
Skid Trails Use existing skid trails wherever possible, except where unacceptable resource damage may result. Locate skid trails at least 50 feet from perennial and intermittent streams and SAFs and 25 feet from ephemeral streams. Install waterbars and other erosion control measures as needed on skid trails immediately following completion of biomass operations. Remove skid trails berms that concentrated flows to improve surface drainage following use.	**Regional BMPs** 1-10 Tractor Skidding Design 1-17 Erosion Control on Skid Trails **National Core BMPs** Veg-2 Erosion Prevention and Control Veg-4 Ground-Based Skidding and Yarding Operations **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all ground-based yarding system units.
Water Sources For water drafting on fish-bearing streams: do not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs); do not exceed 20 percent of surface flows below 4.0 cfs; and, cease drafting when bypass surface flow drops below 1.5 cfs. For water drafting on non-fish-bearing streams: do not exceed 350 gallons per minute for streamflow greater than or equal to 2.0 cfs; do not exceed 50 percent of surface flow; and, cease drafting when bypass surface flow drops below 10 gallons per minute.	**Regional BMPs** 2-5 Water Source Development and Utilization 2-13 Erosion Control Plans (roads and other activities) **National Core BMPs** WatUses-3 Administrative Water Developments AqEco-2 Operations in Aquatic Ecosystems **Forest Plan S&Gs** 193 (RCO 2) 194 (RCO 4) **Locations**: all water drafting sites.
Servicing, Refueling, and Cleaning Equipment and Parking/Staging Areas Allow temporary refueling and servicing only at approved sites located outside of RCAs. Rehabilitate temporary staging, parking, and refueling/servicing areas immediately following use. A Spill Prevention and Containment and Counter Measures (SPCC) plan is required where total oil products on site in above-ground storage tanks exceed 1320 gallons or where a single container exceeds 660 gallons. Review and ensure spill plans are up-to-date. Report spills and initiate appropriate clean-up action in accordance with applicable State and Federal laws, rules and regulations. The Forest Service's hazardous materials coordinator's name and phone number shall be available to Forest Service personnel who administer or manage activities utilizing petroleum-powered equipment. Remove contaminated soil and other material from NFS lands and dispose of this material in a manner according to controlling regulations.	**Regional BMPs** 2-10 Parking and Staging Areas 2-11 Equipment Refueling and Servicing **National Core BMPs** Road-9 Parking and Staging Areas Road-10 Equipment Refueling and Servicing Fac-7 Vehicle and Equipment Wash Water **Forest Plan S&Gs** 193 (RCO 1) **Locations**: designated temporary refueling, servicing and cleaning sites and parking/staging areas.
Burn Piles Place burn piles a minimum of 50 feet away from perennial and intermittent streams and SAFs and 25 feet from ephemeral streams. Locate piles outside areas that may receive runoff from roads. Avoid disturbance to obligate riparian vegetation. Do not dozer pile in sensitive watershed areas and on areas where mastication or drop and lop were prescribed under the Rim Recovery Project. Grapple piling[2] is allowed in these areas, but is subject to the mechanized equipment restrictions for RCAs. When grapple piling in sensitive watershed areas, consult a hydrologist or soil scientist if less than 70% ground cover would be retained. **Prescribed Fire** Avoid damage to obligate riparian vegetation (e.g., willows, alders, cottonwoods). Do not burn over Bear Gully restoration site (contained in parts of units BB035, BB050, and BB036). In order to maintain the wood component or temporary fences proposed under the Rim Fire Rehabilitation Project and the Rim Fire Habitat Improvement Project, coordinate with a hydrologist prior to conducting prescribed fire on the following units: M024, M021, M019, M016, R025, R033, I062, I063, I067, N019, T017, T022, S004, Y030, Y027, BB011, I131, I132, I137, M008, R041, R042, R034, Z011, AA001.	**Regional BMPs** 6-2 Consideration of Water Quality in Formulating Fire Prescriptions 6-3 Protection of Water Quality from Prescribed Burning Effects **National Core BMPs** Fire-1 Wildland Fire Management Planning Fire-2 Use of Prescribed Fire **Forest Plan S&Gs** 194 (RCO 4) **Locations**: all pile burning areas, sensitive watershed areas. All units that are planned for prescribed fire.

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Management Requirements	BMPs/Forest Plan[1]/Locations
Maintain a minimum of 60% ground cover within 100 feet of perennial and intermittent streams and 50 feet of ephemeral streams. Avoid direct ignition within RCAs, including ephemeral channels; fire may back into the riparian area as long as ground cover is maintained. Avoid constructing fire lines within RCAs unless there is no alternative. Do not construct new dozer lines within 100 feet of perennial and intermittent streams and 50 feet of ephemeral streams. Restore constructed fire lines upon completion of prescribed burning and/or prior to each winter when fire lines are exposed to the potential for erosion. Restoration should consist of water barring hand and dozer lines, re-contouring of benched trails, and deep tilling of detrimentally compacted dozer lines. No debris or soil that might impede water flow or cause stream bank degradation will be placed in any stream. Do not bulldoze the surface within SMZs or near streams. Favor hand tools and equipment on steep slopes, fragile soils and in sensitive areas such as Streamside Management Zones. Install fire lines on the contour as much as possible.	
Water Quality Monitoring Conduct implementation and effectiveness monitoring using the Best Management Practices Evaluation Program (BMPEP) (USDA 2002) and the National Core Monitoring Protocols (FS-990b) (USDA 2012).	**Regional BMPs** 7-6 Water Quality Monitoring **Locations**: Monitoring locations will be detailed in a project monitoring plan.
Cumulative Watershed Effects (CWE) Analysis CWE analysis will be conducted for the project.	**Regional BMPs** 7-8 Cumulative Off-Site Watershed Effects **Locations**: All activities within the project watersheds will be analyzed

[1] Forest Plan S&Gs indicate page number from Forest Plan Direction (USDA 2010a).

[2] Grapple piling is a site preparation technique that uses tracked excavator type equipment with an articulating arm equipped with a clam type pincher head that lifts and piles brush and logs. Usually followed by jackpot burning.

IV. LIST OF CONTACTS MADE AND PREPARERS

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