United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer to:
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2014-F-0433

JUN 20 2014

Memorandum

To: Park Superintendent, Yosemite National Park, National Park Service, Yosemite, California (Attn: Acting Branch Chief of Compliance Lisa Acree)

From: Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Biological Opinion on the Tuolumne Wild and Scenic River Plan, Yosemite National Park, California and the Threatened Yosemite Toad and the Endangered Sierra Nevada Yellow-legged Frog

This is in response to your June 5, 2014, request for formal consultation with the U. S. Fish and Wildlife Service (Service) for the Tuolumne Wild and Scenic River Plan. At issue are the adverse effects on the threatened Yosemite toad (*Anaxyrus canorus*) and the endangered Sierra Nevada yellow-legged frog (*Rana sierrae*). Your letter was received by the Service on June 5, 2014. This biological opinion is issued under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)(Act).

This biological opinion is based on: (1) letter from the National Park Service to the Service dated June 5, 2014; (2) *Attachment A: Relationship of projects in the Tuolumne River Plan/EIS (Preferred Action – Alternative 4) to suitable habitat for the Yosemite toad and the Sierra Nevada yellow-legged frog* (Attachment A) that was prepared by the National Park Service; (3) *Attachment B: Mitigation measures applicable to protection of wildlife species* (Attachment B) that was prepared by the National Park Service; (4) *Tuolumne Wild and Scenic River Final Comprehensive Management Plan and Environmental Impact Statement* dated February 2014 (Biological Assessment) that was prepared by the National Park Service; (5) *draft Status of the Mountain Yellow-legged Frog, Yosemite Toad and Pacific Chorus Frog in the Sierra Nevada , CA* dated April 2011prepared by the U.S. Forest Service; (6) *Appendix H: Ecological restoration planning for the Tuolumne Wild and Scenic River Comprehensive Plan* dated 2014 that was prepared by the National Park Service; (7) *Habitat Definitions for the USFS Programmatic Biological Assessment* (draft) undated, but received from the Forest Service on June 3, 2014; (8) other information available to the Service.

On March 5, 2014, during the consultation period, Service staff sent an electronic mail message to the National Park Service stating that for the purposes of the Record of Decision on the proposed action, the Tuolumne Wild and Scenic River Management Plan is not likely to adversely affect federally listed species. The electronic mail message stated there was not enough level of detail in the proposed action to consult on all potential effects and that future consultation may be required. Since that time the Service developed new habitat definitions that recommend at least three surveys within the last ten years have been conducted by qualified biologists to determine the habitat utilization of the site by the Sierra Nevada yellow-legged frog, Northern Distinct Population Segment of the mountain yellow-legged frog, and the Yosemite toad. The Tuolumne Wild and Scenic River Management Plan area is located within the known distribution of the Sierra Nevada yellow-legged frog, suitable habitat is present, which, based on the new *Habitat Definitions for the USFS Programmatic Biological Assessment (draft)*, is categorized as "utilization unknown," and three surveys for the animal have not been conducted by qualified biologists in the last ten years. Your June 5, 2014, letter included your determination that the proposed project is not likely to adversely affect the Sierra Nevada yellow-legged frog. According to your June 5, 2014, letter, and the Biological Assessment, the species was not detected during surveys in Tuolumne Meadows in 2000, 2001 and 2012. The most recent extant observation of this amphibian was made in this area in 1995 in the scenic river segments of the Tuolumne River corridor, where most project actions would take place. Given that three surveys have not been conducted within the last ten years, the Service cannot concur with your determination and we have included the Sierra Nevada yellow-legged frog in this biological opinion.

Consultation History

June 2006	The National Park Service requested a list of threatened and endangered species that may be found within the action area from the Service.
March 5, 2014	The Service sent an email to the National Park Service regarding the potential effects of the project on the Yosemite toad and the Sierra Nevada yellow-legged frog.
March 20, 2014	The National Park Service sent the Biological Assessment to the Service.
May 29, 2014	The National Park Service and the Service discussed the proposed project on the telephone.
June 5, 2014	The National Park Service sent the Service a letter and associated information requesting formal consultation on the project.
June 9, 2014	The National Park Service and the Service discussed the proposed project in a telephone conversation.
June 10, 2014	The National Park Service and the Service discussed the proposed project in a telephone conversation.
June 18, 2014	The National Park Service and the Service discussed the proposed project in a telephone conversation.

BIOLOGICAL OPINION

Description of the Proposed Action

The National Park Service is proposing to implement the Tuolumne Wild and Scenic River Comprehensive Management Plan (Plan). The Plan is intended to preserve the Tuolumne River in free-flowing condition, and protect water quality and other values. The Tuolumne Wild and Scenic River includes 54 miles of the Tuolumne River in Yosemite National Park, excluding the Hetch Hetchy Reservoir. The Tuolumne River originates high in the Sierra Nevada on the eastern side of Yosemite National Park and flows westward across the park for 62 miles before it continues into Stanislaus National Forest. The Dana Fork and the Lyell Fork converge at the eastern end of Tuolumne Meadows, one of the largest subalpine meadows in the Sierra Nevada. The Tuolumne River meanders through Tuolumne Meadows, and then cascades through the Grand Canyon of the Tuolumne before it enters the eastern end of Hetch Hetchy Reservoir, which is within the Park, but not part of the Wild and Scenic Rivers System. Below O'Shaughnessy Dam, the river again is included in the Wild and Scenic Rivers System as it continues through a low-elevation meadow and rocky gorge to the Park boundary.

The Tuolumne Wild and Scenic River Comprehensive Management Plan will (1) review and update river corridor boundaries and segment classifications; (2) prescribe a process for the protection of the river's free-flowing condition; (3) identify and document the conditions of the river's outstanding remarkable values; (4) establish management standards for river values and a monitoring program for ensuring the standards are met; (5) identify management actions needed to protect and enhance river values; and (6) define visitor use and user capacity for the river corridor. The preferred alternative is *Alternative 4 Improving the Traditional Tuolumne Experience*. The Plan is intended to guide the management of the Tuolumne Wild and Scenic River for the next 20 or more years.

There are seven segments comprising the Tuolumne Wild and Scenic River Comprehensive Management Plan. There are no activities that could result in adverse effects to the Yosemite toad or Sierra Nevada yellow-legged frog proposed for Segments 1, 2, 5, 6, and 7. Lyell Fork (Segment 1), and Upper Dana Fork (Segment 2), and the canyon habitat between Tuolumne Meadows and Hetch Hetchy Reservoir (Segments 5, 6, and 7), will remain undisturbed with the exception of very localized, minor disturbances, such as occasional noise, human presence, and some modification to habitat from vegetation loss and soil compaction along trail corridors. According to the Biological Assessment, Segment 3 (Lower Dana Fork) and Segment 4 (Tuolumne Meadows) have recent records of the Yosemite toad, and/or contain suitable habitat for these species, and activities are proposed that will affect the animals.

A key management concern within the Tuolumne River corridor relates to the susceptibility of the subalpine meadows to impacts associated with historic uses, including livestock grazing and road building; ongoing impacts associated with heavy foot traffic and localized livestock use; and potential impacts of Global Climate Change. Although the meadows remain highly productive and support a great diversity of species, they may be transitioning toward ecological communities that tolerate drier conditions, compared to the communities believed to have existed in prehistoric times. In addition, widespread parking along Tioga Road and associated social trailing in the Tuolumne Meadows area have resulted in effects to meadow and riparian communities, archeological resources, and scenic values. Increasing visitor use in this area now requires the National Park Service to consider alternatives to the current management of allowing generally unrestricted access to the river at Tuolumne Meadows and along wilderness trails with trailheads on Tioga Road.

At the time of the designation of the Tuolumne as a Wild and Scenic River in 1984, the portion of the subalpine meadow and riparian complex in the Tuolumne Meadows segment likely was experiencing a shift in vegetation associated with historic livestock grazing and disruptions to meadow hydrology caused by historic road-building and drainage projects. Stresses on meadow processes are now being increased by visitor foot traffic, which is creating informal trails across the meadow and causing habitat fragmentation. These problems will be addressed in the Plan by a comprehensive program of ecological restoration and management of visitor use and development. Ecological restoration will include actions to restore riparian vegetation along riverbanks, restore more natural meadow hydrology, and continue research into possible additional restoration of historic vegetation communities. Management of visitor use and development will include the elimination of roadside parking to reduce informal trailing and removal of facilities from riverbanks and wet areas. These actions are expected to enhance the meadow and riparian complex and allow for its long-term management in a condition equal to or better than the management standards.

An ongoing program of monitoring and continuing study will be continued to ensure that the subalpine meadow and riparian complex are returned to and remain in good condition over the life of the Plan. A suite of three indicators will be used to track the health and potential for impacts to the Tuolumne River. The monitoring program will include triggers that will identify any decline from good condition under any of the three indicators well before an adverse impact occurs.

Most of Tuolumne Meadows consists of subalpine meadow vegetation with pockets of subalpine forest dominated by lodgepole pine. The existing plant communities are influenced by hydrologic and climatic conditions as well as past activities, such as intensive livestock grazing, fire suppression, tree removal, and current human activities such as tree removal, infrastructure, fire suppression, and trampling. Changes in hydrology caused by a variety of perturbations including ditching, road and trail building, water diversions, livestock grazing, visitor foot traffic, fire suppression, and imbalances in the mammal-herbivore populations, have altered the plant and animal communities that once occupied the meadow (National Park Service 2010). These disturbances alter hydrologic conditions including water delivery, primarily through channelization rather than sheet flow, sediment dynamics, lowered groundwater levels, and changes in the amount and timing of ground and surface water availability for plants (Loheide and Gorelick 2007).

Of the eight meadows in Yosemite National Park surveyed by Ballenger and Acree (2008), only Tuolumne Meadows had areas dominated by large sagebrush shrubs. Related meadow studies have found that expansion of sagebrush into meadows may be caused by livestock grazing-related disturbances, which can compact soil, increase the aridity of soils, and cause changes in meadow hydrologic processes, such as stream incision (Vavra *et al.* 1994, Magilligan and McDowell 1997). Berlow *et al.* (2002) found that intact moist meadow vegetation effectively prevents sagebrush germination and subsequent seedling survival, while small disturbances, such as gopher activity, can decrease competition with other vegetation and promote sagebrush invasion. The domination of areas of Tuolumne Meadows by large sagebrush is an indication that the biological integrity of this site is in a compromised ecological state (Ballenger and Acree 2008).

Conifer encroachment into subalpine meadows has been observed and researched for nearly a century in the mountains of western North America. Several studies focused on the Sierra Nevada, including Tuolumne Meadows, and documented changes in ecological integrity, exemplified by expanding areas of bare ground, atypical plant species, conifer encroachment, and diminished willow vegetation along riverbanks, (Cooper *et al.* 2006). The disruption of ecological processes resulting from historic sheep grazing, coupled with the stress of Global Climate Change and more frequent periods of low precipitation, is being exacerbated by heavy foot and livestock traffic in sensitive meadow habitats, heavy browsing of the few remaining willows by deer, and a high level of ground disturbance by gophers and voles (Cooper *et al.* 2006; Ballenger *et al.* 2010).

Concentrations of visitor use and heavy foot traffic have created some disturbed areas along the Dana and Lyell Forks and Tuolumne Meadows. These areas are highly susceptible to impacts on vegetation, soils, and soil organisms associated with foot traffic (Holmquist and Schmidt-Gengenbach 2008). Several areas experience high levels of human trampling resulting in vegetation loss, soil compaction and impacted meadow habitat. Several of these areas are adjacent to trailhead parking, shuttle bus stops and visitor facilities such as the Visitor Center, Tuolumne Meadows Store and Grill and the gas station. The meadow adjacent to these high use areas is characterized by a high proportion of bare ground, different vegetation communities than observed in undisturbed portions of the meadow that are dominated by dead or damaged vegetation, compacted soils, and disrupted hydrologic function such as headcutting. Because of the high level of visitor use in the Tuolumne Meadows area, allowing dispersed use only increases the area of vegetation damage. Human trampling also may, via soil compaction and bare soil exposure, contribute to the lodgepole pine encroachment apparent in Tuolumne Meadows (Vale and Vale 1994). Based on a recent study of the effects of tramping on subalpine meadow habitat, Tuolumne Meadows is very sensitive to trampling impacts and is very slow to recover from damage and degradation (Holmquist 2008).

Limited visitor parking in the Tuolumne Meadows area puts enormous pressure on the existing parking areas. These areas exhibit parking lot "creep," and continue to expand as more and more drivers try to find parking. Areas around the parking areas exhibit damaged vegetation, bare ground and many informal trails. This also impacts cultural resources and archeological sites. The most impacted areas include the Cathedral Meadow Trailhead, the Soda Springs trailhead and the Lembert Dome/Glen Aulin Trailhead.

Because culverts force previously dispersed runoff into localized channels, downcutting has occurred downstream of many of the culverts, particularly in the west end of Tuolumne Meadows. This downcutting results in levee formation and accumulations of soils with greater permeability than surrounding meadow soils. These areas experience isolated prolonged inundation in the channel surrounded by higher elevation areas with little to no inundation. Surface water inflows, in particularly Unicorn and Budd Creek, provide groundwater recharge to the meadows, resulting in locally higher water levels near the streams. Downcutting may decrease recharge from surface water to meadow groundwater since it lowers the water table in the downcut streams and limits overbank flow (Cooper *et al.* 2006).

In addition, many of the culverts along Tioga Road are lower or higher than the surface level of the Tuolumne Meadows. This increases downcutting, headcutting, and ponding, producing lower water availability and concomitant changes in species composition. In general, additional, larger and better-placed culverts could mitigate many of these impacts. Placement of culverts will depend on surface levels of the meadow to minimize downcutting, headcutting and ponding effects. Once culverts are enhanced and replaced, work to restore the contours adjacent to existing culverts will help reduce the impacts and likelihood of further downcutting, channeling and ponding on the meadow vegetation and groundwater level.

There are miles of both formal and informal trails throughout the Tuolumne Meadows area. Some of these trails exhibit heavier use just in the past decade, as they become more defined from constant foot traffic. Trails through meadows can affect hydrology, compact soils, reduce vegetation cover and impact scenic views. In general, multiple rutted trails are common in meadows because as the ruts deepen they are subject to more saturation and inundation, causing visitors to move to drier areas adjacent to the trail, thus creating a new trail that also will become rutted. In some areas of frequent saturation, the trail may be built up to keep the tread dry but this impacts hydrology by obstructing sheet flow and by acting as a dam. Most of the formal trails in the Tuolumne Meadows area lie within the footprint of the Great Sierra Wagon Road. There also are heavily used trails along the Dana and Lyell Forks of the Tuolumne River. Sections of these trails also exhibit braiding, rutting and widening. High concentrations of informal trails exist adjacent to the Tuolumne Store and Grill, at the Soda Springs trailhead, around the Soda Springs area, along the Cathedral Peak parking area and along the banks of the Tuolumne River.

The Tuolumne Meadows Campground has seven loops and 329 campsites. While most of the campground is within lodgepole pine forest, the A loop is very close to the riparian corridor of the Lyell Fork of the Tuolumne River. This loop road experiences ponding and flooding in the early part of the season. At the end of the A loop, flooding in 1997 washed out some of the road, prompting park mangers to lay riprap to harden the riverbank. Riprap can be effective in protecting infrastructure from further flood exposure, but it decreases the free flow of the river, compromising channel morphology and altering scour and deposition dynamics. There are many informal trails along this section of riverbank as well. The access road, campsites and other hardened areas concentrate water flow and sediment movement.

The Tuolumne Wild and Scenic River Comprehensive Management Plan includes the following activities which are primarily intended to enhance, restore and protect natural ecosystems and habitats, including those inhabited and utilized by the Yosemite toad and the Sierra Nevada frog:

Activity	Approximate Start date	Location	No Effect on Suitable Habitat	Suitable Habitat		
				Utilized	Utilization Unknown	Utilized Potential
Implement the Ecological Restoration Plan for Tuolumne Meadows						
Restore riparian vegetation along riverbanks	2014	Corridor-wide		YT	SNF	
Enhance hydrologic flows and restore meadow habitat adjacent to the historic Great Sierra Wagon Road/Trail by enlarging and replacing culverts and removing parallel unnecessary foot trails.	2014	Tuolumne Meadows		YT	SNF	
Stabilize the road cut east of Tuolumne Meadows along Tioga Road to reduce cutbank erosion into the Dana Fork	2019	Tioga Road east of Tuolumne Meadows		YT	SNF	
Modify the Tuolumne River bridge and abutments to mitigate the unnatural ponding effect in adjacent meadows.		Tuolumne Meadows		YT	SNF	
Remove boulder riprap from approximately 150 feet of riverbank near the campground A-loop road and restore to natural conditions.		Tuolumne Meadows Campground		YT	SNF	
Remove non-historic structures inappropriately sited near riverbanks or in wet areas	2021	Tuolumne Meadows		YT	SNF	
Expand designated parking and eliminate undesignated roadside parking.						

Activity	Approximate Start date	Location	No Effect on Suitable Habitat	Suitable Habitat		
				Utilized	Utilization Unknown	Utilized Potential
Construct a new Cathedral Lakes trailhead, and parking and trail segment to connect the main trail to the new trailhead. Restore the existing Cathedral Lakes trailhead to natural conditions.	2016	Tuolumne Meadows		YT	SNF	
Demolish the historic public fuel station/mountaineering shop building; redevelop the site for day parking in the same footprint.	2018	Tuolumne Meadows		YT	SNF	
Widen the road between the turnoff to the stable and the stable to accommodate designated parking.	2018	Tuolumne Meadows		YT	SNF	
Expand parking at the Wilderness Center into upland forested habitat.	2019	Tuolumne Meadows		YT	SNF	
Expand parking at the Dog Lake/JMT trailhead in upland forested habitat.	2020	Tuolumne Meadows		YT	SNF	
Formalize parking at Pothole Dome: Designate day parking with trailhead on north side of road; improve trail to Pothole Dome; construct new parking area east of Pothole Dome.		Tuolumne Meadows		YT	SNF	
Prohibit parking along Tioga Road; add roadside curbing or other barriers to prevent illegal parking; construct approximately four viewing turnouts (four vehicles each; no parking).	2021	Tuolumne Meadows		YT	SNF	
Construct a foot trail paralleling the south side of Tioga Road.	2020	Tuolumne Meadows		YT	SNF	
Upgrade utilities						
Upgrade the wastewater treatment plant.	2015	Tuolumne Meadows		YT	SNF	
Implement water conservation measures, including installation of low-flow figures.		Tuolumne Meadows	YT SNF			
Repair/replace water and wastewater lines		Tuolumne Meadows		YT	SNF	
Convert pit toilet for winter skiers to a vault toilet.		Tuolumne Meadows	SNF	YT		
Upgrade ventilation systems in the existing vault toilets at Lembert Dome		Tuolumne Meadows	YT SNF			
Replace vault toilets at Lembert Dome with flush toilets if water capacity is available after campground rehabilitation and water –conserving actions.		Tuolumne Meadows		YT	SNF	
Upgrade restroom at commercial service core		Tuolumne Meadows	SNF	YT		
Reduce localized impacts associated with the Glen Aulin High Sierra Camp.						
Reduce the capacity and levels of service at the High Sierra Camp to reduce water use and number of resupply trips.		Glen Aulin High Sierra Camp	YT SNF			
Modify Glen Aulin utilities: Replace all flush toilets with composting toilets; replace the composting toilet at the backpacker campground; relocate the water intake to its previous locations inside the camp boundary; upgrade the water treatment system; remove the water line and water tanks serving the corrals.	2015	Glen Aulin High Sierra Camp		YT	SNF	
Move the employee tent nearest Conness Creek to be more than 100 feet from the creek	2015	Glen Aulin		YT	SNF	
Rehabilitate the Tuolumne Meadows campground						
Rehabilitate campground, provide better site delineation, improve campground roads, rehabilitate and add restrooms, upgrade the wastewater collection system if necessary, repairing or replacing leaking water and wastewater lines, and install low-flow fixtures.	2017	Tuolumne Meadows		YT	SNF	

Activity	Approximate Start date	Location	No Effect on Suitable Habitat	Suitable Habitat		
				Utilized	Utilization Unknown	Utilized Potential
Relocate campground entrance road and kiosk out of floodplain	2017	Tuolumne Meadows		YT	SNF	
Realign the campground A-loop road and relocate the 21 campsites that are currently within 100 feet of the Lyell Fork to areas within the existing campground boundaries.		Tuolumne Meadows		YT	SNF	
Construct a new short trail from the campground to the store.	2019	Tuolumne Meadows		YT	SNF	
Formalize the trail connection from the campground to the John Muir Trail.		Tuolumne Meadows		YT	SNF	
Improve the Tuolumne Meadows Lodge at its current capacity and protect river values.						
Relocate three guest tent cabins and possibly the dining hall/kitchen to a location more than 150 feet from the river; upgrade the shower house.	2021	Tuolumne Meadows Lodge		YT	SNF	
Relocate/upgrade/expand the concessioner employee housing north of the lodge, consolidating all concessioner employee housing at this location.	2021	Tuolumne Meadows Lodge		YT	SNF	
Relocate the visitor contact station to improve the visitor experience.						
Construct new visitor contact station, picnic area, trailhead for Parsons Memorial Lodge, and day parking on south side of Tioga Road.	2021	Tuolumne Meadows		YT	SNF	
Expand and rehabilitate NPS employee housing.						
Replace non-historic NPS employee housing at Ranger Camp and Bug Camp with hard-sided structures.	2014	Tuolumne Meadows		YT	SNF	
Renovate or replace historic tent cabins at Ranger Camp		Tuolumne Meadows		YT	SNF	
Provide additional NPS employee housing at stable site, if needed; retain and adaptively use the historic stable structures if possible.		Tuolumne Meadows		YT	SNF	
Construct employee campground at Gaylor Pit	2021	Gaylor Pit		YT	SNF	
Construct additional housing and renovate housing at Road Camp, if needed.		Tuolumne Meadows	YT SNF			
Construct bunkhouse at site of existing NPS stable		Tuolumne Meadows		YT	SNF	
Provide administrative facilities at Tuolumne Meadows needed to support visitor use and protect river values.						
Rehabilitate the historic ranger station.		Tuolumne Meadows		YT	SNF	
Convert CCC mess hall building to administrative use.	2021	Tuolumne Meadows	SNF	YT		
Co-locate the NPS stable with the concessioner stable; provide parking for up to two private or commercial stock trailers at the stables.	2021	Tuolumne Meadows		YT	SNF	
Add aboveground administrative fuel tanks near the wastewater treatment plant.		Tuolumne Meadows		YT	SNF	
Manage visitor use						
Allow limited recreational whitewater boating on portions of the river to provide opportunities for people with expert paddling skills to experience and connect with the Tuolumne in a uniquely adventurous pursuit.		Between Pothole Dome and Pate Valley		YT	SNF	
Manage day use levels along wilderness trails to achieve specific trail standards		Corridor-wide	YT SNF			
Discontinue concessioner stock day rides into wilderness to reduce stock impacts on trails used by hikers; limit overnight saddle trips passing through Glen Aulin to 80 riders and 120 packstock per season.		Corridor-wide		YT	SNF	
Allow commercial use in wilderness, with restrictions on types and levels of use based on a determination of extent necessary.		Corridor-wide		YT	SNF	

Activity	Approximate Start date	Location	No Effect on Suitable Habitat	Suitable Habitat		
				Utilized	Utilization Unknown	Utilized Potential
If park visitation and demand for day parking in the Tuolumne Meadows area continues to increase, implement a parking reservation system in the future.		Tuolumne Meadows	YT SNF			
Implement a wilderness day-use permit system if necessary to ensure that use remains within the standard.		Corridor-wide		YT	SNF	

Conservation Measures

The National Park Service proposes to avoid and minimize adverse effects to Yosemite toad and Sierra Nevada yellow-legged frog by implementing the following measures:

Conservation or Mitigation Measure	Responsibility	Critical Milestones
CONSTRUCTION MITIGATION MEASURES		
Prevent the introduction of exotic species in the project area and staging areas. Prior to entry into the park, steam-clean heavy equipment to prevent importation of non-native plant species. Tighten hydraulic fittings, ensure hydraulic hoses are in good condition (and replace if damaged), and repair all petroleum leaks. Ensure all earth moving equipment enters the Park free of dirt, dust, mud, seeds, and other potential contaminants. Ensure the park inspects all heavy equipment entering the park prior to commencing work.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Inspect project boundaries to ensure that impacts stay within the project area and do not escalate beyond the scope of the environmental impact statement. Ensure that the project conforms with applicable permits or project conditions. Store all construction equipment within the delineated work limits.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Implement compliance monitoring to ensure that the project remains within the parameters of National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) compliance documents.	Yosemite National Park, Contractor	Concurrent with project activities
Provide a project orientation for all construction workers to increase their understanding and sensitivity to the challenges of the special environment in which they will be working.	Yosemite National Park	Prior to and concurrent with project activities
Prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) for construction activities to control surface run-off, reduce erosion, and prevent sedimentation from entering water bodies during construction, if required by federal and State permits. If prepared by a contractor, submit the SWPPP for park review and approval prior to construction. The plan will: Include measures to control erosion, sedimentation, and compaction, and thereby reduce water pollution and adverse water quality effects. Use silt fences, sedimentation basins, etc. in construction areas to reduce erosion, surface scouring, and discharge to water bodies. To the extent possible, schedule the use of mechanical equipment during periods of low precipitation to reduce risk of accidental hydrocarbon leaks or spills. When mechanical equipment is necessary outside of low precipitation periods, use NPS– approved methods to protect soil and water from contaminants. Dispose of volatile wastes and oils in approved containers for removal from construction sites to avoid contamination of soils, and drainages. Inspect equipment for hydraulic and oil leaks prior to use on construction sites, and implement inspection schedules to prevent contamination of soil and water Keep absorbent pads, booms, and other materials on site during projects that use heavy equipment to contain oil, hydraulic fluid, solvents, and hazardous material spills.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Develop and implement a comprehensive Spill Prevention/Response Plan that complies with federal and state regulations and addresses all aspects of spill prevention, notification, emergency spill response strategies for spills occurring on land and water, reporting requirements, monitoring requirements, personnel responsibilities, response equipment type and location, and drills and training requirements. Submit the spill prevention/response plan to the park for review/approval prior to commencement of construction activities.	Contractor	Prior to project activities

Conservation or Mitigation Measure	Responsibility	Critical Milestones
Prepare a construction work schedule that minimizes effects on wildlife in adjacent habitats, and avoids periods of time with high levels of visitation. Submit the work schedule for park review and approval prior to construction.	Contractor	Prior to and concurrent with project activities
Supervisory construction personnel shall attend an Environmental Protection briefing provided by the park prior to working on site. This briefing is designed to familiarize workers with statutory and contractual environmental requirements and the recognition of and protection measures for archeological sites, sensitive habitats, water resources, and wildlife habitats.	Contractor	Prior to and concurrent with project activities
HYDROLOGY AND WATER QUALITY		
Where working areas are adjacent to or encroach on live streams, construct barriers to prevent the discharge of turbid water in excess of specified limits.	Contractor	Prior to and project activities
Stabilize all disturbed soil and fill slopes in an appropriate manner.	Contractor	Prior to and concurrent with project activities
Store equipment and materials away from all waterways.	Yosemite National Park, Contractor	Concurrent with project activities
Clearly delineate construction limits in the vicinity of wetlands with construction fencing	Contractor	Prior to and concurrent with construction activities
Ensure that waters are free of changes in turbidity that cause a nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits, as described in *The Water Quality Control Plan* by the Central Valley Regional Water Quality Control Board (2011): Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20%. Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs. Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10%. In determining compliance with the limits above, apply appropriate averaging periods if necessary, provided that beneficial uses are fully protected.	Contractor	Prior to and concurrent with project activities
Contain wastewater contaminated with silt, grout, or other by-products from construction activities in a holding or settling tank to prevent contaminated material from entering watercourses.	Contractor	Concurrent with project activities
Remove hazardous waste materials generated during implementation of the project from the project site immediately.	Contractor	Concurrent with project activities
Dispose of volatile wastes and oils in approved containers for removal from the project site to avoid contamination of soils, drainages, and watercourses. Keep absorbent pads, booms, and other materials onsite during projects that use heavy equipment to contain oil, hydraulic fluid, solvents, and hazardous materials spills.	Contractor	Concurrent with project activities
Use silt fencing at drainages to prevent construction materials from escaping work areas.	Contractor	Concurrent with project activities
Incorporate trench plugs into new and abandoned utility corridors through meadow and wetland areas to prevent formation or continuation of groundwater conduits.	Yosemite National Park, Contractor	Concurrent with project activities
Design surface drainage facilities to transport runoff in a non-erosive manner.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Structure or fill must be properly maintained so as to avoid adverse impacts on aquatic environments or public safety.	Yosemite National Park, Contractor	Prior to, concurrent with and following project activities
Collect and cover material from construction work, and avoid depositing it where it could be eroded and carried to tributaries or the river by surface runoff or high stream flows.	Contractor	Concurrent with project activities
Minimize disturbance area at the banks of drainages. Salvage excavated materials for replacement after construction. The banks of drainages will be restored to their pre-existing contours.	Contractor	Concurrent with project activities
At utility corridors, provide adequate drainage to prevent surface water or subsurface seepage from saturating the subgrade utility corridor.	Contractor	Concurrent with project activities

Conservation or Mitigation Measure	Responsibility	Critical Milestones
Drain and flush all pumps, tanks, live wells, buckets and other containers that might carry water contaminated with exotic plants and animals, such as the zebra mussel, prior to bringing equipment into the park.	Contractor	
VEGETATION AND WETLANDS (INCLUDING SPECIAL STATUS PLANTS)		
Employ measures to prevent or control spills of fuels, lubricants, or other contaminants from entering the waterway or wetlands (see Construction, above). Ensure all actions are consistent with state water quality standards and Clean Water Act Section 401 certification requirements.	Yosemite National Park, Contractor	Prior to project activities
Avoid heavy equipment use in wetlands to the extent possible. Place heavy equipment used in wetlands on mats, or take other similar measures to minimize soil and plant root disturbance and to preserve the preconstruction topography of the wetland.	Yosemite National Park, Contractor	Prior to concurrent with project activities
Whenever possible, place excavated material on an upland site. When this is not feasible, stockpile excavated material on a temporary basis on filter cloth, mats, or other semi-permeable surface, or take comparable measures to ensure that underlying wetland habitat is protected. Stabilize material with straw bales, filter cloth, or other appropriate means to prevent reentry into the waterway or wetland.	Yosemite National Park, Contractor	Concurrent with project activities
Remove temporary soil stockpiles in wetlands in their entirety as soon as practicable. Wetland areas temporarily disturbed by stockpiling or other activities during construction must be returned to their pre-existing topography and soil configurations. Restore wetland soil, hydrology, and native vegetation as soon as practicable.	Yosemite National Park, Contractor	Concurrent with project activities
Ensure that a Park Botanist oversees placement of construction fencing to avoid impacts to sensitive plants and wetlands.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Conduct preconstruction surveys to identify special status species within the construction disturbance zone. If special-status plant species are identified within the construction disturbance zone, the project manager will work with the Park Botanist to avoid impacts.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Delineate, clearly mark, and ensure all wetland-related permits are in place prior to work. Perform activities in wetlands in a cautious manner to prevent damage caused by equipment, erosion, siltation, etc.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Minimize shade impacts to the extent practicable when designing boardwalks and similar structures.	Yosemite National Park, Contractor	Prior to concurrent with project activities
Ensure that all earth moving equipment and hand tools enter the park free of mud or seed-bearing material to prevent the introduction of non-native plants. The NPS will inspect all equipment prior to use on the project. Map and treat noxious weeds prior to construction. Certify all seeds and straw material as weed-free. Ensure that imported top-soil is weed-free. The NPS will approve sources of imported fill material that will be used within the top 12 inches of the finished grade. Monitor and treat invasive plants for three years post-construction.	Yosemite National Park, Contractor	Prior to, concurrent with and following project activities
Install temporary fencing (black silt fencing or orange construction fencing) around the entire project area to protect natural surroundings (including trees, and root zones) from damage. Avoid fastening ropes, cables, or fences to trees.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Use native seed mix or seed-free mulch to minimize surface erosion and the introduction of noxious weeds.	Contractor	Concurrent with project activities
Where actions could impact wetlands, wetland restoration proposals must, at a minimum, provide one-for-one (1:1) wetland function replacement (i.e., no net loss of wetland functions).	Yosemite National Park	Prior to project activities
Delineate wetlands in project areas of Lyell Canyon prior to implementation of the TRP.	Yosemite National Park	Prior to project activities
WILDLIFE (INCLUDING SPECIAL STATUS WILDLIFE)		
General: Provide information to the contractor regarding protection of special status species wildlife at the project briefings and provide contractor specifications and Best Management Practices to avoid activities that are destructive to wildlife and habitats. Project Manager will consult with the park biologist to schedule construction activities with seasonal consideration of wildlife lifecycles to minimize impacts during sensitive periods. Construction personnel will adhere to park regulations concerning food storage and refuse management. All food will be properly stored during the work day and will be removed from the site at the end of each work day.	Yosemite National Park, Contractor	Concurrent with and following project activities

Conservation or Mitigation Measure	Responsibility	Critical Milestones
For the Federally-listed Sierra Nevada yellow-legged frog and Yosemite toad: Proposed Critical Habitat (PCH) exists for Yosemite toads (Unit 5 Tuolumne/Cathedral), and Sierra Nevada yellow-legged frogs (SNYLF Subunit 2N Unicorn Peak) in the Tuolumne Meadows area based on suitable habitat and prior observations confirming species presence. Due to the recent listings (U.S. Fish and Wildlife Service 2014) of these species and their associated PCH, a qualified wildlife biologist will review existing proposed projects within these PCH units prior to project implementation.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
Conduct pre-work surveys to identify areas that toads may occupy such as mammal burrows, cover areas under rocks within the project area, and flag areas in advance to be avoided. Minimize potential impacts by delaying the project start dates until toad breeding is nearly complete (typically two weeks from the start of breeding), if necessary, per wildlife biologist guidance.	Yosemite National Park, Contractor	Prior to and concurrent with project activities
For mountain beaver and Sierra Nevada red fox (Note: also will conserve or mitigate effects to the Sierra Nevada yellow-legged frog and Yosemite toad): Adhere to 401/404 permits to prevent increased turbidity in the creek from occurring during construction activities. Design water outputs to dissipate water slowly, and avoid concentrated outflows to the meadow or tributaries. Maintain continuous water flows and water quality for tributaries of the wild and scenic river. Only minimal and temporary holding or diversion of water for immediate and specific construction work will be allowed. If water is retained during construction, the containment will include wildlife escape ramps and the containment will be inspected in the morning before beginning work and at the end of the day to ensure that no animals have become trapped.	Yosemite National Park	Prior to and concurrent with project activities
FEDERAL AND STATE PERMIT REQUIREMENTS		
Apply for and comply with all federal and state permits required for construction-related activities, including the California Regional Water Quality Control Board and the U.S. Army Corps of Engineers.	Yosemite National Park	Prior to project activities

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area includes all lands associated with the proposed Tuolumne Wild and Scenic River Comprehensive Management Plan in Yosemite National Park subject to project-related construction, habitat restoration, removal of trails, roads, and campsites, trail use, camping, and associated activities.

Status of the Species and Environmental Baseline

Yosemite Toad

The Yosemite toad was listed as a threatened species on April 29, 2014, under the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 2014).

The Yosemite toad is a moderately sized amphibian, with the adults ranging in size from 1.2 inches to 2.8 inches from the tip of their snout to their urostyle, a bony structure at the posterior end of the spinal column (Karlstrom 1962; Dodd 2013a; Lannoo 2005). A thin mid-dorsal stripe is present in juveniles of both sexes. The stripe disappears or is reduced with age; this process takes place more quickly in males (Dodd 2013a; Lannoo 2005). The iris of the eye is dark brown with gold iridophores (Dodd 2013a). The large paratoid glands are rounded to slightly oval in shape.

Male Yosemite toads are smaller than the females, and they have less conspicuous warts (Stebbins 1951, 2003; Stebbins and McGinnis 2012; Dodd 2013a; Green *et al.* 2014; Lannoo 2005). Differences in coloration between males and females are more pronounced in the Yosemite toad than in any other North American frog or toad (Stebbins 1951). Females have black spots or blotches edged with white or cream set against a grey, tan, or brown background color (Jennings and Hayes 1994). Males have a nearly uniform dorsal coloration of yellow-green to olive drab to darker greenish brown (Dodd 2013a; Green *et al.* 2014; Lanoo 2005).

The Yosemite toad was originally described as *Bufo canorus* by Camp (1916), who gave it the common name of Yosemite Park toad. Grinnell and Storer (1924) referred to it as the Yosemite toa when the species' range had been found to extend beyond the boundaries of Yosemite National Park. Subsequently, Frost *et al.* (2006) divided the paraphyletic genus *Bufo* into three separate genera, assigning the North American toads, including the Yosemite toad, to the genus *Anaxyrus*.

Feder (1977) found Yosemite toads to be the most genetically distinct member of the *boreas* group based on samples from a limited geographic range. However, Yosemite toads hybridize with western toads in the northern part of their range (Karlstrom 1962; Morton and Sokolski 1978). Shaffer *et al.* (2000) analysed a segment of mitochondrial DNA from 372 individuals from Yosemite National Park, and Sequoia-Kings Canyon National Parks. They concluded there are significant genetic differences in Yosemite toads between the two National Parks. The genetic divergence in animals from regionally proximate populations of this species was high, implying low rates of genetic exchange.

The Yosemite toad in the Sierra Nevada is restricted to the Sierra Nevada in California from the Blue Lakes region north of Ebbetts Pass in Alpine County to just south of Kaiser Pass in the Evolution Lake/Darwin Canyon area in Fresno County (Green *et al.* 2014; Dodd 2013a; Lannoo 2005; Stebbins and McGinnis 2012; Jennings and Hayes 1994). Yosemite toad historically inhabited elevations ranging from 4,790 to 11,910 feet (Stebbins 2003; Stephens 2001). The current range of the Yosemite toad in terms of overall geographic extent, remains largely similar to its historical range (U.S. Forest Service *et al.* 2009). However, within this area, its habitats have been degraded and may be decreasing in size as a result of conifer encroachment and livestock grazing. The vast majority of the Yosemite toad's range is within Federal land.

Yosemite toads inhabit wet meadow habitats and lake shores surrounded by lodgepole or whitebark pines (Camp 1916; Dodd 2013a; Stebbins and McGinnis 2012; Lannoo 2005). They are most often found in areas with thick meadow vegetation or patches of low willows (Dodd 2013a; Mullally 1953). Liang (2010) observed Yosemite toads most frequently associated with, in order of preference: wet meadows, alpine-dwarf scrub, red fir, water, lodgepole pine, and subalpine conifer habitats.

Habitat and Life History

Yosemite toads are found as often at large as at small sites (Liang 2010), indicating that this species is capable of successfully utilizing small habitat patches. Liang (2010) found that population persistence was greater at higher elevations, with an affinity for relatively flat sites with a southwesterly aspect. These areas receive higher solar radiation and are capable of sustaining hydric, seasonally ponded, and mesic breeding and rearing habitat. The Yosemite toad is more common in areas with less variation in mean annual temperature, or more temperate sites with less climate variation (Liang 2010).

Adults likely have a long life span, and this allows their persistence in variable conditions and marginal habitats where only periodic good years allow high reproductive success (USFS *et al.* 2009). Females have been documented to reach 15 years of age, and males as many as 12 years (Kagarise Sherman and Morton 1993); however the average longevity of the Yosemite toad in the wild is not known. Jennings and Hayes (1994) indicated that females begin breeding at ages four to six years, while males begin breeding at ages three to five years. Adults tend to breed at a single site and appear to have high site-fidelity (Liang 2010), although individuals will move between breeding areas (Liang 2010).

Males exit burrows first, and spend more time in breeding pools than females, who do not breed every year (Kagarise Sherman and Morton, 1993). Higher lipid storage in females, which enhances overwinter survival, also may preclude the energetic expense of breeding every year (Morton 1981). The Yosemite toad is a prolific breeder, laying many eggs immediately at snowmelt. This is accomplished in a short period of time, coinciding with water levels in meadow habitats and ephemeral pools they use for breeding. Female toads lay approximately 700–2,000 eggs in two strings (one from each ovary) (U.S. Forest Service *et al.* 2009). Females may split their egg clutches within the same pool, or even between different pools, and eggs may be communally laid with other toads (U.S. Forest Service *et al.* 2009).

The eggs hatch within 3–15 days, depending on ambient water temperatures (Kagarise Sherman 1980 Jennings and Hayes 1994). Tadpoles typically metamorphose around 40–50 days after fertilization, and are not known to overwinter (Jennings and Hayes 1994). Tadpoles have also been observed in shallow ponds and shallow areas of lakes (Mullally 1953). Tadpoles are black in color, tend to congregate together (Brattstrom 1962) in warm shallow waters during the day (Cunningham 1963), and then retreat to deeper waters at night (Mullaly 1953). The completion of metamorphosis takes approximately 5–7 weeks after eggs are laid (U.S. Forest Service *et al.* 2009).

Adult Yosemite toads are most often observed near water, but only occasionally in water (Mullally and Cunningham 1956). Moist upland areas such as seeps and springheads are important summer non-breeding habitats for adult toads (Martin 2008). The majority of their life is spent in the upland habitats proximate to their breeding meadows. They use rodent burrows for overwintering and probably for temporary refuge during the summer (Jennings and Hayes 1994), and they spend most of their time in burrows (Liang 2010). They also use spaces under surface objects, including logs and rocks, for temporary refuge (Stebbins 1951; Karlstrom 1962). Males and females also likely inhabit different areas and habitats when not breeding, and females tend to move farther from breeding ponds than males (U.S. Forest Service *et al.* 2009).

Yosemite toads extensively utilize upland habitat and individuals have been recorded moving 0.78 mile from their breeding meadows, with an average movement of 902 feet (Liang 2010). The average distance traveled by females is twice as far as males, and home ranges for females are 1.5 times greater than those for males (Liang 2010). Movement into the upland terrestrial environment following breeding does not follow a predictable path, and toads tend to traverse longer distances at night, perhaps to minimize evaporative water loss (Liang 2010). The only long-term, site-specific population study for Yosemite toads documented a dramatic decline over 2 decades of monitoring. Kagarise Sherman and Morton (1993) studied the species at Tioga Pass Meadow from 1971 through 1991, with the most intensive monitoring through 1982. They documented a decline in the average number of males entering the breeding pools from 258 to 28 during the mid-1970s through 1982. During the same time period, the number of females varied between 45 and 100, but there was no apparent trend in number observed. During the 1980s, it appeared that both males and females continued to decline, and breeding activity became sporadic. By 1991, they found only one male and two egg masses. A similar population decline was recorded in local nonbreeding habitat.

Population Estimate and Status

Kagarise Sherman and Morton (1993) conducted occasional surveys of six other populations in the eastern Sierra Nevada. Five of these populations showed long-term declines that were evident beginning between 1978 through 1981, while the sixth population held relatively steady until the final survey in 1990, at which time it dropped. In 1991, Karlstrom revisited the site where he had studied a breeding population of Yosemite toads from 1954 to 1958 just south of Tioga Pass Meadow within Yosemite National Park, and found no evidence of toads or signs of breeding (Kagarise Sherman and Morton 1993).

The Forest Service conducted a comprehensive study of the Yosemite toad's population status and trends (Brown *et al.* 2011). It was designed to provide statistical comparisons across 5-year monitoring cycles with at 134 watersheds (Brown *et al.* 2011). Trends could be assessed for the entire range of the species, rather than year-to-year comparisons at limited survey sites. The results of the study indicated the Yosemite toad has declined from historical levels, with the animal occurring in only 12 percent of watersheds where they existed prior to 1990. Breeding was found to be occurring in an estimated 22 percent of watersheds within their current estimated range. In addition, breeding was occurring in 81 percent of the watersheds that were occupied from 1990–2001, suggesting that the number of locations where breeding occurs has continued to decline (Brown *et al.* 2011). Moreover, overall abundances in the intensively monitored watersheds were very low with fewer than 20 males per meadow per year, relative to other historically reported abundances of the species (Brown *et al.* 2011). Brown *et al.* (2011) suggest that populations currently are now very small across the range of the species. Only 18 percent of occupied survey watersheds rangewide had "large" populations over the past decade - more than 1,000 tadpoles or 100 of any other lifestage detected at the time of survey.

High meadow habitat quality in the western United States, and specifically the Sierra Nevada, has been degraded by various stressors over the last century (Vale 1987; Ratliff 1985). These various stressors have contributed to erosion and stream incision, leading to meadow dewatering and encroachment by invasive vegetation (Menke *et al.* 1996). The legacy of these impacts remains extant to this day in the ecosystems of the high Sierra Nevada (Vankat and Major 1978). Given the reliance of the Yosemite toad on these high meadow habitats for breeding, and early life history stage and adult survival, the various stressors likely have had an indirect effect on the viability of their populations via degradation of their habitat.

Since high meadows in the Sierra Nevada are dependent on their hydrologic setting, most meadow degradation is due fundamentally to hydrologic alterations. There are many drivers of hydrologic alterations in meadow ecosystems. Historic water development and ongoing management has physically changed the underlying hydrologic landscape. Diversion and irrigation ditches formed a vast network that altered local and regional stream hydrology. Timber harvest and associated road construction further affected erosion and sediment delivery patterns in rivers and meadow streams. Changes in the pre-settlement fire regime, fire suppression, and an increase in the frequency of large wildfires due to excessive fuel buildup, introduced additional disturbance pressure to the meadows of the Sierra Nevada. Many meadows now have downcut stream courses, compacted soils, altered plant community compositions, and diminished wildlife and aquatic habitat. Meadow dewatering by these changes within the watershed has facilitated these shifts in the vegetative community. Finally, Global Climate Change also has played a role in the conifer encroachment.

Grazing by livestock in Sierra Nevada meadows and the rivers, streams, and adjacent upland areas that directly affect them, began in the mid-1700s with the European settlement of California (Menke *et al.* 1996). Following the gold rush of the mid-1800s, livegrazing increased to a level exceeding the carrying capacity of the available range, causing significant impacts to meadow and riparian ecosystems (Meehan and Platts 1978; Menke *et al.* 1996). By the turn of the 20th century, high Sierra Nevada meadows were converted to summer rangelands for grazing cattle, sheep, horses, goats, and pigs, although the alpine areas were mainly grazed by sheep (Beesley 1996; Menke *et al.* 1996). Stocking rates of both cattle and sheep in Sierra meadows in the late 19th and early 20th centuries were very heavy, and grazing severely degraded many meadows (Ratliff 1985,; Menke *et al.* 1996). Grazing impacts occurred rangewide, as cattle and sheep were driven virtually everywhere in the Sierra Nevada where forage was available (Menke *et al.* 1996).

Definitive data is lacking to assess the link between Yosemite toad population dynamics and habitat degradation by livestock grazing activity. However, in light of the documented impacts to meadow habitats, including effects on local hydrology, from grazing activity in general, this threat is prevalent with moderate impacts to the animal and a potential limiting factor in its recovery. In addition, given the potential for negative impacts from heavy use, and the vulnerability of toad habitat should grazing management practices change with new management plans, we expect this threat to continue into the future.

The evidence indicates that fire plays a significant role in the evolution and maintenance of meadows of the Sierra Nevada. Under natural conditions, conifers are excluded from meadows by fire and saturated soils. Small fires thin and/or destroy encroaching conifers, while large fires are believed to determine the meadow-forest boundary (Vankat and Major 1978). Fire is thought to be important in maintaining open aquatic and riparian habitats for amphibians in some systems, and fire suppression may have thereby contributed to conifer encroachment on meadows (National Park Service 2002).

Recreational activities take place throughout the Sierra Nevada, and they can have significant negative impacts on wildlife and their habitats. Recreation can cause considerable impact to Wilderness Areas and National Parks in the western United States even with light use, with recovery only occurring after considerable periods of non-use (U.S. Forest Service *et al.* 2009). Heavy foot traffic in riparian areas tramples vegetation, compacts soils, and can physically damage streambanks. Trails utilized by human hikers, horses, bicycles, or off-highway motor vehicles, may result in compaction of the soil, displacement of vegetation, and increased erosion.

Although not all the vectors have been confirmed in the Sierra Nevada, introduced fishes, humans, pets, livestock, packstock, vehicles, and wild animals may all act to facilitate disease transmission between amphibian populations. Infection of both fish and amphibians by a common disease has been documented with viral (Mao *et al.* 1999) and fungal pathogens in the western United States (Blaustein *et al.* 1994b). Mass die-offs of amphibians in the western United States and around the world have been attributed to chytrid fungal infections of metamorphs and adults (Carey *et al.* 1999), *Saprolegnia* fungal infections of eggs (Blaustein *et al.* 1994), ranavirus infections, and bacterial infections (Carey *et al.* 1999).

There have been die-offs in Yosemite toad populations caused by diseases. However, no single cause has been validated by field studies. Tissue samples from dead or dying adult Yosemite toads and healthy tadpoles were collected and analyzed for disease during a die-off at Tioga Pass Meadow and Saddlebag Lake (Green and Kagarise Sherman 2001). Six infections were found in the adults, including infection with chytrid, red leg disease (bacillary bacterial septicemia0, a fungus (*Dermosporidium*), parasitic cnidarians (myxozoa spp.), parasitic roundworms (*Rhabdis*), and several species of parasitic trematode flatworms. However, no single infectious agent was found in more than 25 percent of individuals, and some dead toads showed no signs of infection to explain their death. Further, no disease agent was found in tadpoles. A meta-analysis of red-leg disease also revealed that the disease is a secondary infection that may be associated with a suite of different pathogens, and the actual causes of decline in these instances were ambiguous (Kagarise Sherman and Morton 1993). The die-off likely was caused by suppression of the immune system caused by an undiagnosed viral infection or chemical contamination that made the toads susceptible to the variety of diagnosed infections.

Until recently, the effect of chytrid to Yosemite toad population declines was relatively unknown. Although the animal is hypothetically susceptible due to their co-occurrence with the Northern Distinct Population Segment of the mountain yellow-legged frog and Sierra Nevada yellow-legged frog, it is suspected that the spread and growth of Bd in the warmer pool habitats, occupied for a much shorter time relative to the frog, renders individuals less prone to epidemic outbreaks (USFS *et al.* 2009). Fellers *et al.* (2011) documented the occurrence of Bd infection in Yosemite National Park toads over at least a couple of decades, and they note population. Dodge and Vredenburg (2012) reported the first presence of Bd infection in Yosemite toads beginning in 1961, with the pathogen becoming highly prevalent during the recorded declines of the late 1970s, before it peaked in the 1990s at 85 percent positive incidence. In live specimen sampling, Dodge and Vredenburg (2012) collected 1,266 swabs of Yosemite toads between 2006 and 2011, and found Bd infection intensities at 17–26 percent, with juvenile toads most affected. The results from these studies support the hypothesis that chytrid have played an important role in Yosemite toad population dynamics over the period of their recent recorded decline.

Trampling and collapse of rodent burrows by hikers, livestock, pack animals, pets, or vehicles could lead to direct injury or death of the Yosemite toad. Recreational activity may also disturb toads and disrupt their behavior (Karlstrom 1962). Recreational anglers may be the transport mechanism of introduced pathogens and parasites, and they have been observed using toads and tadpoles as bait (U.S. Forest Service *et al.* 2009). However, Kagarise Sherman and Morton (1993) did not find a relationship between the distance from the nearest road and the declines in Yosemite toad populations, suggesting that human activity was not the cause of decline.

According to the Biological Assessment, the Yosemite toad is known to occur from approximately 17 sites within the Tuolumne River corridor. In 2012, tadpoles of this species were found in a meadow adjacent to the Tuolumne Meadows ranger station.

The Yosemite toad occurs within the action area as demonstrated by: (1) recent observations of the species within the Tuolumne River corridor; (2) the biology and ecology of the animal, especially the ability of individuals to move distances and their ability to spend the dry months of the year in upland habitats with suitable environmental conditions; and (3) the action area contains physical features that provide refuge, forage, and dispersal habitat for the amphibian.

Sierra Nevada Yellow-legged Frog

The Sierra Nevada yellow-legged frog was listed as a threatened species on April 29, 2014, under the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 2014).

The mountain yellow-legged frog was originally described as a subspecies of the foothill yellow-legged frog (*Rana boylii*). Populations in the Sierra Nevada were considered to be subspecies *sierrae*, and populations inhabiting three mountain ranges in southern California were thought to represent subspecies *muscosa*. Later analysis of additional morphological data indicated *sierrae* and *muscosa* were subspecies of *Rana muscosa* (Zweifel 1955). Macey *et al.* (2001) conducted a phylogenetic analysis of mitochondrial deoxyribonucleic acid (DNA) sequences of the mountain yellow-legged frog and concluded the species consisted of two major genetic lineages comprised of three distinct groups in the Sierra Nevada, and a fourth distinct group in the mountains of southern California.

Based on mitochondrial DNA, morphological information, and acoustic studies, Vredenburg *et al.* (2007) determined the mountain yellow-legged frog in the Sierra Nevada consists of two distinct species - *Rana muscosa* and *R. sierrae*. *Rana sierrae*, or the Sierra Nevada yellow-legged frog, inhabits the Sierra Nevada north of the South Fork of the Kings River watershed and over the eastern crest of the Sierra Nevada into Inyo County at its most southern extent; and *Rana muscosa*, or the Northern Distinct Population Segment of the mountain yellow legged frog, occurs in the southern portion of the Sierra Nevada within the South Fork of the Kings River and Kern River watersheds to the west of the Sierra Nevada crest, and some of the mountain ranges in southern California (Vredenburg *et al.* 2007).

Many of the published peer-reviewed papers and unpublished reports on the Sierra Nevada yellow-legged frog and the Northern Distinct Population Segment of the mountain yellow-legged frog were issued prior to the analysis and taxonomic reclassification by Vredenburg *et al.* (2007). These two species have similar morphologies, behaviors, biologies, and ecologies, and within this biological opinion when this information applies to both animals, they will be collectively referred to as "mountain yellow-legged frog" or "mountain yellow-legged frog species complex."

The body length (snout to vent) of the mountain yellow-legged frog ranges from 1.5 to 3.25 inches (Dodd 2013b; Stebbns and McGinnis 2012; Lanoo 2005; Green *et al.* 2014; Jennings and Hayes 1994; Vredenburg *et al.* 2005). Females average slightly larger than males, and males have a swollen, darkened thumb base (Wright and Wright 1949; Stebbins 1951; Vredenburg *et al.* 2005; Zweifel 1955; Zweifel 1968). Dorsal (upper) coloration in adults is variable, exhibiting a mix of brown and yellow, but also can be grey, red, or green-brown, and is usually patterned with dark spots (Dodd 2013b; Lanoo 2005; Jennings and Hayes 1994; Stebbins 2003). These spots may be large (0.25 inch) with a few, smaller and more numerous spots, or a mixture of both (Zweifel 1955). Irregular lichen- or moss-like patches may also be present on the dorsal surface (Zweifel 1955; Stebbins 2003). The Sierra Nevada yellow-legged frog and the Northern Distinct Population Segment of the mountain yellow-legged frog can be distinguished from each other physically by the ratio of the lower leg (fibulotibia) length to snout vent length. Typically, this ratio is greater than or equal to 0.55 inch for the northern Distinct Population Segment of the mountain yellow-legged frog and less than 0.55 inch for the Sierra Nevada yellow-legged frog. In addition, the Northern Distinct Population Segment of the mountain yellow-legged frog has longer limbs (Vredenburg *et al.* 2007).

The belly and undersurfaces of the hind limbs of the mountain yellow-legged frog are yellow or orange colored, and this pigmentation may extend forward from the abdomen to the forelimbs (Wright and Wright 1949; Stebbins 2003; Vredenburg *et al.* 2005). The adults may produce a distinctive mink or garlic-like odor when disturbed (Wright and Wright 1949; Stebbins 2003). Although these two species lack vocal sacs, they can vocalize in or out of water, producing what has been described as a flat clicking sound (Zweifel 1955; Stebbins 2003). Mountain yellow-legged frogs have smoother skin, generally with heavier spotting and mottling dorsally, darker toe tips (Zweifel 1955), and more opaque ventral coloration (Stebbins 2003) than the foothill yellow-legged frog, which is a conspecific species in some portions of the Sierra Nevada.

Mountain yellow-legged frogs deposit their eggs in globular clumps, which are often somewhat flattened and roughly 1 to 2 inches in diameter (Stebbins 2003; Vredenburg *et al.* 2005). When the eggs are close to hatching, egg mass volume averages 78 cubic inches (Pope 1999). Eggs have three firm, jelly-like, transparent envelopes surrounding a grey-tan or black vitelline (egg yolk) capsule (Wright and Wright 1949). The clutch size varies from 15 to 350 eggs per egg mass (Livezey and Wright 1945; Vredenburg *et al.* 2005). Egg development is temperature dependent. In laboratory breeding experiments, egg hatching time ranged from 18 to 21 days at temperatures of 41 to 56 degrees Fahrenheit (Zweifel 1955).

The tadpoles of the mountain yellow-legged frog generally are mottled brown on the dorsal side with a faintly yellow venter or underside (Zweifel 1955; Stebbins 2003; Vredenburg *et al.* 2005). Total tadpole length reaches 2.8 inches, the body is flattened, and the tail musculature is wide at 1 inch or more before tapering into a rounded tip (Wright and Wright 1949). The mouth has a maximum of eight labial tooth rows (Stebbins 2003). Tadpoles may take more than 1 year (Wright and Wright 1949), and often require 2 to 4 years, to reach the metamorphosis stage in which they transform from tadpoles to frogs (Cory 1962b; Bradford 1983; Bradford *et al.* 1993; Knapp and Matthews 2000; Vredenburg *et al.* 2005), depending on local climate conditions and site-specific variables.

The time required to reach reproductive maturity in mountain yellow-legged frogs is thought to vary between 3 and 4 years post-metamorphosis (Vredenburg *et al.* 2005; Zweifel 1955). This information, in combination with the extended amount of time as a tadpole before metamorphosis, indicates that it may take 5 to 8 years for mountain yellow-legged frogs to begin reproducing. Longevity of adults is unknown, but under normal circumstances, adult survivorship from year to year is very high, so mountain yellow-legged frogs are presumed to be long-lived amphibians (Pope 1999a).

Habitat and Life History

Throughout their range, the mountain yellow-legged frog historically inhabited lakes, ponds, marshes, meadows, and streams at elevations ranging from 4,500 feet to 12,000 feet (California Department of Fish and Game = California Department of Fish and Wildlife 2014a, 2014b). The two species are highly aquatic; they are generally not found more than 3.3 feet from water (Stebbins 1951; Mullally and Cunningham 1956; Bradford *et al.* 1993). Adults typically are found sitting on rocks along the shoreline, usually where there is little or no vegetation (Mullally and Cunningham 1956). Although mountain yellow-legged frogs may use a variety of shoreline habitats, both tadpoles and adults are less common at shorelines that drop abruptly to a depth of 2 feet than at open shorelines that gently slope up to shallow waters of only 2 to 3 inches in depth (Mullally and Cunningham 1956; Jennings and Hayes 1994).

The mountain yellow-legged frog is most abundant in high-elevation lakes and slow-moving portions of streams (Vredenburg *et al.* 2005; Zweifel 1955; Mullally and Cunningham 1956). The borders of alpine ponds, lakes, and meadow streams above the tree line used by mountain yellow-legged frogs are frequently grassy or muddy. At lower elevations within their historical range, these animals are known to be associated with rocky streambeds and wet meadows surrounded by coniferous forest (Vredenburg *et al.* 2005; Zweifel 1955; Zeiner *et al.* 1988). Streams utilized by adults vary from streams having high gradients and numerous pools, rapids, and small waterfalls, to streams with low gradients and slow flows, marshy edges, and sod banks (Zweifel 1955). Aquatic substrates vary from bedrock to fine sand, rubble consisting of rock fragments, and boulders (Zweifel 1955). Mountain yellow-legged frogs appear absent from the smallest creeks, possibly because these creeks have insufficient depth for adequate refuge and overwintering habitat (Jennings and Hayes 1994). Sierra Nevada yellow-legged frogs do use stream habitats, especially the populations in the northern part of their range.
Adult mountain yellow-legged frogs breed in the shallows of ponds or in inlet streams (Vredenburg *et al.* 2005). They emerge from overwintering sites immediately following snowmelt, and will move over ice to reach breeding sites (Pope 1999; Vredenburg *et al.* 2005). The females deposit their eggs underwater in clusters, which they attach to rocks, gravel, or vegetation, or under banks (Wright and Wright 1949; Stebbins 1951; Zweifel 1955; Pope 1999).

Lake depth is an important attribute defining habitat suitability for mountain yellow-legged frogs. The tadpoles overwinter multiple years before metamorphosis, and successful breeding sites are located in or connected to lakes and ponds that do not dry out in the summer, and also are deep enough that they do not completely freeze or become oxygen depleted or anoxic in winter. Adult, subadult, and tadpole mountain yellow-legged frogs overwinter for up to 9 months in the bottoms of lakes that are at least 5.6 feet deep; however, overwinter survival may be greater in lakes that are at least 8.2 feet deep (Bradford 1983; Vredenburg *et al.* 2005).

Bradford (1983) found that mountain yellow-legged frog die-offs sometimes result from oxygen depletion during winter in lakes less than 13 feet in depth. However, tadpoles may survive for months in nearly anoxic conditions when shallow lakes are frozen to the bottom. More recent investigations reported populations of mountain yellow-legged frogs overwintering in lakes less than 5 feet deep that were assumed to have frozen to the bottom, and healthy frogs emerged the following July (Matthews and Pope 1999; Pope 1999). Radio telemetry indicated that the frogs were utilizing rock crevices, holes, and ledges near shore, where water depths ranged from 0.7 foot to 5 feet (Matthews and Pope 1999). The granite surrounding these overwintering habitats probably insulates mountain yellow-legged frogs from extreme winter temperatures, provided there is an adequate supply of oxygen (Matthews and Pope 1999). In lakes and ponds that do not freeze to the bottom in winter, mountain yellow-legged frogs may overwinter in the shelter of bedrock crevices as a behavioral response to the presence of introduced fishes (Vredenburg *et al.* 2005).

Mountain yellow-legged frog tadpoles maintain a relatively high body temperature by selecting warmer microhabitats (Bradford 1984). During winter, tadpoles remain in warmer water below the thermocline (the transition layer between thermally stratified water). After spring overturn (thaw and thermal mixing of the water), they behaviorally modulate their body temperature by moving to shallow, near-shore water when warmer days raise surface water temperatures. During the late afternoon and evening, mountain yellow-legged frogs retreat to offshore waters that are less subject to night cooling (Bradford 1984).

The available evidence suggests that mountain yellow-legged frogs display strong site fidelity and return to the same overwintering and summer habitats from year to year (Pope 1999). In aquatic habitats of high mountain lakes, adults typically move only a few hundred yards (Matthews and Pope 1999; Pope 1999), but single-season distances of up to 2.05 miles have been recorded along streams (Wengert 2008). Adults tend to move between selected breeding, feeding, and overwintering habitats during the course of the year. Though typically found near water, overland movements by adults of over 217 feet have been routinely recorded (Pope 1999); the farthest reported distance from water is 1,300 feet (Lannoo 2005). Along stream habitats, adults have been observed greater than 71 feet from the water during the overwintering period (Wengert 2008).

Almost no data exist on the dispersal of juvenile mountain yellow-legged frogs away from breeding sites; however, individuals that may be dispersing to permanent water have been observed in small intermittent streams (Bradford 1991). Regionally, mountain yellow-legged frogs are thought to exhibit a metapopulation structure (Bradford *et al.* 1993; Drost and Fellers 1996). Metapopulations are spatially separated population subunits within migratory distance of one another such that individuals may interbreed among subunits and populations may become reestablished if they are extirpated (Hanski and Simberloff 1997).

Current Range and Distribution

Since the mountain yellow-legged frog observations made by Grinnell and Storer (1924), a number of researchers have reported disappearances of these two endangered species from significant portions of their historical ranges in the Sierra Nevada (Hayes and Jennings 1986; Bradford 1989; Bradford *et al.* 1994; Jennings and Hayes 1994; Stebbins and Cohen 1995; Drost and Fellers 1996; Knapp and Matthews 2000; Vredenburg *et al.* 2005).

The current distributions of the Sierra Nevada yellow-legged frog and the mountain yellow-legged frog are restricted primarily to publicly managed lands at high elevations, including streams, lakes, ponds, and meadow wetlands located within National Forests and National Parks. National Forests with extant populations include the Plumas National Forest, Tahoe National Forest, Humboldt-Toiyabe National Forest, Lake Tahoe Basin Management Unit, Eldorado National Forest, Stanislaus National Forest, Sierra National Forest, Sequoia National Forest, and Inyo National Forest. National Parks with extant populations of mountain yellow-legged frogs include Yosemite National Park, and Sequoia and Kings Canyon National Parks.

Population Estimates and Status

The mountain yellow-legged frog is imperiled by a variety of factors, especially invasive predatory trout, chytrid fungus, and global climate change (Bradford 1989, 1991; Bradford *et al.* 1993, 1994; Drost and Fellers 1996; Moyle *et al.* 1996; Knapp and Matthews 2000; Armstrong and Knapp 2004; Knapp 2005a, 2005b; Finlay and Vrendenburg 2007; Knapp *et al* 2007; Lacan *et al.* 2008; Pope *et al.* 2008; California Department of Fish and Wildlife 2011).

Monitoring efforts and research have documented substantial declines of mountain yellow-legged frogs in the Sierra Nevada. The number of extant populations has declined greatly over the last few decades. Remaining populations are patchily scattered throughout the historical range (Jennings and Hayes 1994; Vredenburg *et al.* 2005). In the northernmost portion of the range (Butte and Plumas Counties), only a few Sierra Nevada yellow-legged frog populations have been documented since 1970 (Jennings and Hayes 1994). Declines have also been noted in the central and southern Sierra Nevada (Drost and Fellers 1996). In the south (Sierra, Sequoia, and Inyo National Forests; and Sequoia, Kings Canyon, and Yosemite National Parks), modest to relatively large populations (e.g., breeding populations of approximately 40 to more than 200 adults) of mountain yellow-legged frogs remain; however, in recent years some of the largest of these populations have been extirpated (Bradford 1991; Bradford *et al.* 1994; Knapp 2005a).

Davidson *et al.* (2002) reviewed 255 previously documented mountain yellow-legged frog locations based on Jennings and Hayes (1994) throughout the historical range and concluded that 83 percent of these sites no longer support extant populations. Vredenburg *et al.* (2007) compared recent survey records from 1995 to 2004 with museum records from 1899 to1994 and reported that 92.5 percent of historical Sierra Nevada yellow-legged frog populations and 92.3 percent of the historical populations of the Northern Distinct Population Segment of the mountain yellow-legged frog are now extirpated.

The California Department of Fish and Wildlife (2014a, 2014b) utilized historical localities from museum records during the same time interval (1899–1994), but updated recent locality information with additional survey data (1995–2010) to significantly increase proportional coverage from Vredenburg *et al.* (2007). These more recent surveys failed to detect any extant frog populations within 0.63 mile (a metric used to capture interbreeding individuals within metapopulations) at 220 of 318 historical Sierra Nevada yellow-legged frog localities and 94 of 109 historical mountain yellow-legged frog localities. Based on this study, the estimated loss from historical occurrences is 69 percent of the Sierra Nevada yellow-legged frog metapopulations and 86 percent of the Northern Distinct Population Segment of the mountain yellow-legged frog metapopulations.

Rangewide, declines of mountain yellow-legged frog populations were estimated at around one-half of historical populations by the end of the 1980s (Allen *et al.* 2013; Bradford *et al.* 1994). Between 1988 and 1991, Bradford *et al.* (1994) resurveyed sites known historically to support mountain yellow-legged frogs, based on surveys from 1955 to 1979. They did not detect frogs at 27 historical sites on the Kaweah River; and detected frogs at 52 percent of the historical sites within Sequoia and Kings Canyon National Parks, and at 12.5 percent of the historical sites outside of Sequoia and Kings Canyon National Parks. When both species are combined, this resurvey effort detected mountain yellow-legged frogs at 19.4 percent of historical sites (Bradford *et al.* 1994).

Available information discussed below indicates that the rates of population decline have not abated, and have likely accelerated from the 1990s to the 2000s. Drost and Fellers (1996) repeated Grinnell and Storer's early 20th century surveys, and reported frog presence at 2 of 14 historical sites. The two positive sightings consisted of a single tadpole at one site and a single adult female at another. They located 17 additional sites with suitable mountain yellow-legged frog habitat, and detected three additional populations. In 2002, Knapp (2005a) resurveyed 302 water bodies known to be occupied by mountain yellow-legged frogs between 1995 and 1997, and 744 sites where frogs were not previously detected. He found animals at 59 percent of the previously occupied sites, whereas 8 percent of previously unoccupied sites were recolonized. These data suggest an extirpation rate five to six times higher than the colonization rate within this study area. The documented extirpations appeared to occur non-randomly across the landscape, were typically spatially clumped, and involved the disappearance of all or nearly all of the mountain yellow-legged frog populations in a watershed (Knapp 2005a). The California Department of Fish and Wildlife (2014a, 2014b) assessed data from sites where multiple surveys were completed since 1995 at least 5 years apart. They found that the Sierra Nevada yellow-legged frog was not detected at 45 percent of sites where they previously had been confirmed, while the mountain yellow-legged frog throughout its range, including the Southern Distinct Population Segment of the mountain yellow-legged frog, was not detected at 81 percent of historically occupied sites.

The U.S. Forest Service conducts a long-term monitoring program for the mountain yellow-legged frog through the Sierra Nevada as part of their Sierra Nevada Amphibian Monitoring Program. This monitoring effort provides unbiased scientifically-based estimates for statistical comparisons across 5-year monitoring cycles spanning 208 watersheds (Brown *et al.* 2011). The results of this assessment indicate that breeding activity for the frogs is limited to 4 percent of watersheds rangewide, and the species have declined in both distribution and abundance from historical records. For the recent historical record - positive surveys during 1990–2002 versus 2006–2009 - breeding was found in 48 percent of the survey sites. When compared to data prior to 1990, recent frog occurrence is limited to 3 percent of watersheds for which information exists. Moreover, relative abundances were low; an estimated 9 percent of populations were large, numbering more than 100 frogs or 500 tadpoles; and about 90 percent of the watersheds had fewer than 10 adults, while 80 percent had fewer than 10 subadults and 100 tadpoles (Brown *et al.* 2011).

To summarize population trends over the available historical record, estimates range from losses between 69 to 93 percent of Sierra Nevada yellow-legged frog populations and 86 to 92 percent of the Northern Distinct Population Segment of the mountain yellow-legged frog populations. Rangewide reduction has diminished the number of watersheds that support mountain yellow-legged frogs somewhere between the conservative estimates of 44 percent in the case of Sierra Nevada yellow-legged frogs and at least 59 percent in the case of the Northern Distinct Population Segment of the mountain yellow-legged frogs, to as high as 97 percent of watersheds for the mountain yellow-legged frog complex across the Sierra Nevada. Remaining populations are much smaller relative to historical norms, and the density of populations per watershed has declined greatly; as a result, many watersheds currently support single metapopulations at low abundances.

According to the Biological Assessment, historically, there were a number of populations of the Sierra Nevada yellow-legged frog within the Tuolumne River corridor. Surveys for this species were conducted at Tuolumne Meadows in 2000, 2001, and 2012, with no detections. The most recent documentation within the Tuolumne Meadows segment of the river corridor was in 1995. There was an additional sighting of the animal outside of the Tuolumne River corridor along Delaney Creek near Pothole Dome. The Biological Assessment states that suitable habitat is present within the action area, which, based on the *Habitat Definitions for the USFS Programmatic Biological Assessment (draft)*, is categorized as "utilization unknown," and three surveys for the animal have not been conducted by qualified biologists in the last ten years. The Service generally recommends that three surveys with negative results be conducted within the last ten years to support a conclusion that the Sierra Nevada yellow-legged frog does not inhabit a location.

The Sierra Nevada yellow-legged frog likely occurs within the action area as demonstrated by: (1) the project is located within the current distribution of the species; (2) the action area contains physical features that could provide refuge, forage, and dispersal habitat for it; (3) historical records of the Sierra Nevada yellow-legged frog within and near the Tuolumne River corridor; and (4) the biology and ecology of the animal, especially the ability of individuals to move within aquatic habitats and short distances overland.

Effects of the Proposed Action

The Tuolumne Wild and Scenic River Comprehensive Plan includes an ecological restoration program that will enhance, restore, and provide for the long-term protection of the Sierra Nevada yellow-legged frog, Yosemite toad, and their habitats. However, individuals may be captured, injured, killed, harmed, and harassed during its implementation and operation. The Plan will result in adverse effects to these species: (1) within 167 acres where restoration and enhancement of their habitats will occur; (2) within 3.6 acres where trail, road, parking areas, campsites, and buildings will be removed; (3) within 28.1 acres where construction of trails, roads, parking areas, and buildings will occur; and (4) from hikers, campers, pets, horses, or pack animals capturing, harassing, injuring, or killing individuals. The Plan includes several activities that will assist in the recovery of these two listed species by: (1) reducing the current level of harassment, harm, death, and injury resulting from hikers, pack animals, horses, pets, and vehicles; (2) removing, rehabilitating, or reconstructing buildings and associated infrastructure and closing or re-routing roads, trails, and parking areas; (3) discontinuing or limiting the number of day use and overnight horses and packstock traveling into wilderness areas; and (4) providing permanent protection to these two amphibians on Segments 1, 2, 5, and 6.

There is a likelihood the animals may be affected by being entombed in their burrows, buried or crushed, hit and injured or killed by vehicle strikes, and harassed by noise and vibration. Project-related disturbances to the two listed amphibians may result from noise, vibration, or human activity. Disturbance could induce stress that may affect physiological parameters or behavior. The resulting effects may include increased energetic requirements, decreased reproductive output, altered spatial patterns, displacement, or possibly death.

Mortality, injury, or harassment of the Yosemite toad and Sierra Nevada yellow-legged frog may result from project related equipment or vehicles, construction debris, and worker foot traffic within the action area. The two listed species likely will be subject to the indirect effect of temporary loss of habitat, as a result of the removal or construction activities. Work activities, including vibration, may cause the animals to leave the work site and surrounding areas. Yosemite toads and Sierra Nevada yellow-legged frogs moving away from disturbed areas may be driven into the open where they are more susceptible to injury or mortality due to human foot traffic, vehicles, other project activities, and predators. In addition, displaced individuals may be forced into competition for food and living space with other animals in adjacent areas.

Pre-activity surveys for the Yosemite toad and Sierra Nevada yellow-legged frog may reduce adverse effects. However, unless rescued by a Park biologist, individuals could be harassed, injured, or and killed. Even with a Park biologist present at each activity and worker awareness training, animals may fall into trenches, pits, or other excavations, and risk being injured, or unable to escape and die as a result of desiccation, entombment, or starvation.

Plastic netting and similar materials that are used for erosion control and other reasons could result in the entanglement and death of Yosemite toad and Sierra Nevada yellow-legged frog, as well as birds and wildlife, due to exposure, starvation, strangulation, or predation (Stuart *et al.* 2001).

In summary, the effects associated with hikers, campers, pets, vehicles, horses, and pack animals, and the removal and/or construction of parking lots, trails, roads, buildings, pit toilets, septic systems, campsites, and a wastewater treatment plant will harass, capture injure, or kill the Yosemite toad and the Sierra Nevada yellow-legged frog. Harm will result to these two listed species through damage or elimination of vegetation or other habitat utilized for breeding, feeding, resting and other essential behaviors, filling or crushing burrows or crevices that provide habitat for aestivation or hibernation, and reducing their prey base. The actions described in the Conservation Measures of this biological opinion will reduce, but not eliminate, the potential for these effects. However, the removal, rehabilitation, relocation, or construction of the buildings, roads, and other facilities primarily will occur in previously disturbed areas, likely will have negligible short-term adverse effects and will provide long-term beneficial effects to their early life history stages, breeding, aestivation, and hibernation.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are not aware of any future non-Federal actions.

The average temperature in the United States has risen by approximately 1.5° Fahrenheit since 1895; more than 80% of this increase has occurred since 1980 (Adger *et al* 2007; Schiermier 2012; Tollefson and Monarstersky 2012; Allen *et al.* 2013; California Climate Action Team 2013; Kadir *et al.* 2013; U.S. Global Research Program 2013; Hurteau *et al.* 2014; Melillo *et al.* 2014). There is an international scientific consensus that most of the warming observed is the result of human activities (Adger *et al.* 2007; U.S. Global Change Research Program 2013; Merillo *et al.* 2014), and that it is due to increasing concentrations of greenhouse gases, including carbon dioxide, methane, and nitrous oxide, in the global atmosphere from burning fossil fuels and other human activities (Monastersky 2013; Adger *et al.* 2007). The temperatures in the United States will continue to rise, with the next few decades projected to see another 2°F to 4°F of warming in most areas. The amount of warming by the end of this Century is projected to closely correspond to the cumulative global emissions of greenhouse gases up to that time, ranging from 3°F to 10°F depending upon the level of emissions after the year 2050 (U.S. Global Change Research Program 2013). There are multiple mechanisms by which global warming may push already imperiled species closer or over the edge of extinction. Global warming increases the frequency of extreme weather events, such as heat waves, droughts, and storms (California Climate Action Team 2006; U.S. Global Change Research Program 2013). As the global climate continues to rise, terrestrial habitats are moving northward and upward, others will be eliminated, but in the near future, range contractions or extinctions of some species are more likely than simple northward or upslope shifts. Since climate change threatens to disrupt annual weather patterns, it will result in a loss of habitats, food, or increased numbers of predators, parasites, and diseases.

For the Sierra Nevada ecoregion, climate models predict that mean annual temperatures will increase by 3.2 to 4.3 °F by 2070, including warmer winters with earlier spring snowmelt and higher summer temperatures (Point Reyes Bird Observatory 2011). Additionally, mean annual rainfall is projected to decrease from the current average by some 3.6–13.3 inches by 2070 (Point Reyes Bird Observatory 2011). However, projections have high uncertainty and one study predicts the opposite effect (Point Reyes Bird Observatory 2011). Snowpack is, by all projections, going to decrease dramatically following the temperature rise and increase in precipitation falling as rain (Point Reyes Bird Observatory 2011). Higher winter streamflows, earlier runoff, and reduced spring and summer streamflows are projected, with increasing severity in the Sierra Nevada (Point Reyes Bird Observatory 2011). Snow-dominated elevations from 6,560–9,190 feet will be the most sensitive to temperature increases (Point Reyes Bird Observatory 2011). Meadows fed by snowmelt may dry out or be more ephemeral during the non-winter months (Point Reyes Bird Observatory 2011). This pattern could influence ground water transport, persistence of surface water, and springs may be similarly depleted, leading to lower water levels in available habitat for the early life history stages and breeding for the Yosemite toad and Sierra Nevada yellow-legged frog. Therefore, ongoing Global Climate Change is highly likely to imperil these two listed species and the resources, including the aquatic areas, necessary for their survival.

Conclusion

After reviewing the current status of the Yosemite toad and the Sierra Nevada yellow-legged frog, the environmental baseline for the action area, effects of the proposed action, and the cumulative effects, it is the Service's conclusion that the Tuolumne Wild and Scenic River Comprehensive Plan, as proposed, is not likely to jeopardize the continued existence of these two listed species. The Service reached this conclusion because the net effect of the proposed action is beneficial to the Yosemite toad and Sierra Nevada yellow-legged frog. Adverse effects associated with the proposed action are likely to be relatively small in magnitude and of short duration. This project is likely to contribute to the recovery of these listed species through the restoration, enhancement, and protection of 167 acres of their habitat, and removal, concentration, and construction of facilities and associated infrastructure on 31.7 acres. The Service anticipates that the Tuolumne Wild and Scenic River Comprehensive Plan will lead an increase in numbers of these two listed amphibians within Yosemite National Park, and throughout their ranges, as a whole.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by the National Park Service so that they become binding conditions of any grant, contract, or permit issued by the National Park Service as appropriate, in order for the exemption in section 7(o)(2) to apply. The National Park Service has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the National Park Service: (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, contract, or grant document; and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the National Park Service must report the progress of the action and its impact on the Yosemite toad and the Sierra Nevada yellow-legged frog to the Service as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Amount or Extent of Take

The Service anticipates that incidental take of the Yosemite toad and the Sierra Nevada yellow-legged frog will be difficult to detect due to their cryptic appearance and behavior; subadults and adults may be located a distance from the wet meadows and aquatic habitats where they breed and the early life history stages develop; and the finding of an injured or dead individual is unlikely because of their relatively small body size. The conservation measures described above in the Description of the Proposed Action will substantially reduce, but do not eliminate, the potential for incidental take of the Yosemite toad and Sierra Nevada yellow-legged frog. Adverse effects to these animals also may be difficult to quantify due to seasonal fluctuations in their numbers, random environmental events, or additional environmental disturbances.

The Service anticipates incidental take will result from the proposed project. Upon implementation of reasonable and prudent measure, take of the Yosemite toad in the form of capture, harm, and harassment of all life history stages inhabiting or utilizing 198.7 acres of the Tuolumne Wild and Scenic River Comprehensive Management Plan, as described in the Biological Assessment, or the injury, or death of two (2) egg masses or two (2) larvae, subadults, or adults for the duration of the project, including construction and operation of the Plan will become exempt from the prohibitions described under section 9 of the Act. Upon implementation of reasonable and prudent measure, take of the Sierra Nevada yellow-legged frog in the form of capture, harm, and harassment of all subadults and/or adults inhabiting or utilizing 198.7 acres of the Tuolumne Wild and Scenic River Comprehensive Management Plan, or the injury, or death of two (2) egg masses or two (2) tadpoles, subadults, or adults for the duration of the project, including construction and operation of the Plan will become exempt from the prohibitions described under section 9 of the Act. Therefore, reinitiation will be triggered if the amount of incidental take of either species is exceeded by the National Park Service.

Effect of the Take

The Service has determined that the level of anticipated take is not likely to result in jeopardy to the Yosemite toad or the Sierra Nevada yellow-legged frog.

Reasonable and Prudent Measure

1. The National Park Service shall minimize adverse effects of the Tuolumne Wild and Scenic River Comprehensive Management Plan on the Yosemite toad and Sierra Nevada yellow-legged frog.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the National Park Service must comply with the following terms and conditions, which implements the reasonable and prudent measure described above. These terms and conditions are non-discretionary.

1. The National Park Service shall implement the conservation measures described within the Biological Assessment and the project description of this biological opinion.

2. Tightly woven fiber netting or similar material shall be used for erosion control or other purposes at the Tuolumne Wild and Scenic River Comprehensive Management Plan site to ensure that the Yosemite toad or the Sierra Nevada yellow-legged frog do not get trapped, injured or killed. Plastic mono-filament netting or similar material must not be used at the project because individuals of these listed species may become entangled or trapped in it.

3. If appropriate, the National Park Service shall move Yosemite toads and Sierra Nevada yellow-legged frogs from within the Tuolumne Wild and Scenic River Comprehensive Management Plan site to a safe location if they are in danger.

a. Each Yosemite toad and Sierra Nevada yellow-legged frog encounter shall be treated on a case-by-case basis, but the general procedure is as follows: (1) leave the non-injured Yosemite toad or Sierra Nevada yellow-legged frog alone if it is not in danger; or (2) move the Yosemite toad or Sierra Nevada yellow-legged frog to a nearby safe location if it is in danger. These two actions are further described below.

   i. When a Yosemite toad or Sierra Nevada yellow-legged frog is encountered while implementing the actions in the Tuolumne Wild and Scenic River Comprehensive Management Plan, the first priority is to stop all activities in the surrounding area that have the potential to result in the harassment, injury, or death of the individual. Then, the situation shall be assessed by a National Park biologist in order to select a course of action that will minimize adverse effects to the individual.

   ii. Avoidance is the preferred option if a Yosemite toad or Sierra Nevada yellow-legged frog is not moving or using a burrow or other refugia. A National Park Service biologist shall inspect the area and evaluate the necessity of fencing, signage, or other measures to protect the animal.

   iii. If appropriate, the Yosemite toad or Sierra Nevada yellow-legged frog shall be allowed to move out of the hazardous situation on its own volition to a safe location. The animal may not be picked up and moved based on it not moving fast enough or it is an inconvenience for activities associated with rehabilitation or operation. This only applies to situations where a Yosemite toad or a Sierra Nevada yellow-legged frog is encountered on the move during conditions that make their upland travel feasible. This does not apply to individuals that are uncovered or otherwise exposed or in areas where there is not sufficient adjacent habitat to support the species should the animal move outside the immediate area.

   iv. The Yosemite toad or Sierra Nevada yellow-legged frog shall be captured and moved by hand only when there is no other option to prevent harassment, injury, or death. If appropriate habitat is located immediately adjacent to the capture location then the preferred option is relocation to that site. The Yosemite toad or Sierra Nevada yellow-legged frog should not be moved outside of the radius it would have traveled on its own. Under no circumstances shall a Yosemite toad or Sierra Nevada yellow-legged frog be relocated to non-National Park Service property without the landowner's written permission.

   v. Only National Park Service biologists may capture Yosemite toads or Sierra Nevada yellow-legged frogs. Nets or bare hands may be used to capture the animals. Soaps, oils, creams, lotions, repellents, or solvents of any sort cannot be used on hands within two hours before and during periods when the biologist is capturing and relocating the Yosemite toad or Sierra Nevada yellow-legged frog. If the animal is held for any length of time in captivity, they shall be kept in a cool, dark, moist environment with proper airflow, such as a clean and disinfected bucket or plastic container with a damp sponge. Containers used for holding or transporting shall not contain any standing water, or objects or chemicals that may injury or kill a Yosemite toad or Sierra Nevada yellow-legged frog.

vi. To avoid transferring disease or pathogens between sites during the course of translocating Yosemite toads or Sierra Nevada yellow-legged frogs, Park biologists shall use the following guidance for disinfecting equipment and clothing. These guidelines are adapted from the *Declining Amphibian Population Task Force's Code* which can be found in their entirety at: *http://www.open.ac.uk/daptf/*.

The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take described for the Yosemite toad and the Sierra Nevada yellow-legged frog in the Amount or Extent of Take section is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The National Park Service must provide an explanation of the causes of the take as soon as possible and review with the Service the need for possible modification of the reasonable and prudent measure.

Reporting Requirements

Injured Yosemite toads and/or Sierra Nevada yellow-legged frogs shall be cared for by a licensed veterinarian or other qualified person such as a National Park Service biologist; dead individuals must be placed in a sealed plastic bag with the date, time, location of discovery, and the name of the person who found the animal; the carcass should be kept in a freezer; and held in a secure location. The Service must be notified within one (1) working day of the discovery of death or injury to a Yosemite toad and/or Sierra Nevada yellow-legged frog that occur due to project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contact person is the Chief of the Coast-Forest Division at the Sacramento Fish and Wildlife Office also should be notified at (916) 414-6600.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and databases. The Service has the following recommendations:

1. The National Park Service should continue their efforts to eliminate trout from within the ranges of the Yosemite toad, Northern Distinct Population Segment of the mountain yellow-legged frog, and the Sierra Nevada yellow-legged frog.

2. The National Park Service should assist the Service in implementing the Conservation Strategy, and when completed, the final recovery plan for the Yosemite toad, Northern Distinct Population Segment of the mountain yellow-legged frog, and the Sierra Nevada yellow-legged frog.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, we request notification of the implementation of any of the conservation recommendations.

REINITIATION – CLOSING NOTICE

This concludes formal consultation on the effects of the Tuolumne Wild and Scenic River Comprehensive Management Plan on the Yosemite toad and the Sierra Nevada yellow-legged frog. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions about this biological opinion, please contact Chris Nagano, Senior Scientist in our Endangered Species Program at the letterhead address, email (Chris_Nagano@fws.gov), or at telephone (916) 414-6600.

cc:
Danny Boiano, Sequoia-Kings Canyon National Park, Three Rivers, California

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