CONSULTATION LOG

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TABLE 1. RESPONSE TO COMMENTS ON THE DRAFT LICENSE APPLICATION

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Table 2. Response to Comments on Technical Reports

Comment Number	Stakeholder	Comment	Applicant Response
1	USFS	**Exhibit E** In some other proceedings, Forest Service study proposals, additional information requests or recommendations for clarification have been denied by a Licensee, with some denials upheld by FERC. When later decisions were needed for those resources where the Forest Service felt there was insufficient information, we relied on our best professional judgment. In some of those cases the Licensee stated that there was insufficient data for Forest Service decisions based on professional judgment. This circular disagreement has resulted in hearings, disputes and other untenable situations. We state for the record that if Forest Service-requested information or clarification is not provided by the Licensee and we later use professional judgment to interpret the limited information, we do not believe the Licensee can use "lack of information" as a reasonable justification for disagreeing with Forest Service proposed mitigations.	Comment noted. However, no position taken by the Licensee or any other participant in a relicensing proceeding before FERC can bypass the statutory requirement that all agency decisions be supported by substantial evidence and avoid results that are arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with the law.
2	USFS	**Exhibit A** The text states that, Project operation and maintenance activities use existing gravel access roads at Saddlebag Dam (2.05 acres) and Tioga Dam (0.52 acres). These roads are included in the proposed FERC Project Boundary. The Forest Service notes that Poole Powerhouse Road is not included in this description, though it serves as the only road access route to the Poole Powerhouse and was originally constructed to build and operate powerhouse. The FLA should reflect this use and need as a project road. The Forest Service supports the road's inclusion as part of the proposed FERC project boundary. Further the FLA should discuss how this road is maintained to ensure access to the facility. Lastly, this road can contribute sediment directly to Lee Vining Creek below Poole Powerhouse and measures to reduce this impact should be discussed.	Poole Powerhouse Road is not an exclusive Project road; there are five USFS-managed campgrounds along the road, prior to reaching the powerhouse. This shared road is maintained year-round by Mono County. This additional information has been added to Exhibit E, Section 6.11, *Land Use*, of the FLA.
3	USFS	**Exhibit E** The soils description in the first two paragraphs restate the same descriptions and can likely be condensed.	This text has been condensed in the FLA.
4	USFS	**Exhibit E** Fecal coliform readings for 9/15/2022, ranging from 49-350 MPN/100 mL are significantly higher (by 1-2 orders of magnitude) than samples taken on days close to this event. We suggest that the FLA and or water quality study provide additional discussion or explanations for this higher detection event.	High fecal coliform levels could be from animals, humans, or laboratory analysis error. The high fecal coliform levels may be associated with runoff during storm events preceding the sampling. The first major rainfall since May 2022 was recorded between July 31 and August 10, 2022, with regional cumulative totals between 1.4 and 2.5 inches (USC00044881 Lee Vining and USS0019L13S Virginia Lakes). Fecal coliform was abandoned as an indicator because of the non-human sources that can occur, and *E. coli* was added to be more human specific. *E. coli* results indicate no issue. FLA Exhibit E, Section 6.4.1.7 was updated to include potential causes of elevated fecal coliform bacteria.
5	USFS	**Exhibit E** This section states that, Under the No Action, SCE would continue to operate and maintain the Project in accordance with the terms and conditions of the existing FERC license. No effects on vegetation communities as a result of Project O&M have been identified relative to baseline conditions…The No Action is consistent with the USFS desired conditions described in Section 6.7.2.4, Consistency with Current Resource Management Objectives, relative to vegetation communities… Project operations would not affect vegetation communities within and surrounding the Project because routine operations and maintenance do not involve expanding maintenance sites into native habitats. The conclusion that continued or future operation of the Project would have no effect on vegetation communities and be consistent with vegetation management objectives is predicated upon various assumptions: 1) that vegetation communities will remain unchanged in the future, 2) management objectives will correspondingly not update or adapt to future needs or conditions, and 3) Project maintenance or operational effects cannot result in potential new effects to surrounding vegetation communities. While current surveys demonstrate that the vegetation communities surrounding the Project remain similar to those surveyed during the current license term, they do not acknowledge that these communities have and will continue to change in the future. Periodic monitoring and vegetation management to prevent invasive introduction or spread through O&M activities will be needed as part of a new license to ensure that vegetation management objectives are me.	The *Resource Management Plan* (PME-3) includes discussion of measures to prevent the spread and introduction of invasive plant species. Botanical surveys conducted as part of the relicensing identified only one invasive plan species (cheat grass) in the Project Area, and all populations are in disturbed areas. In addition to the measures outlined in PME-3, *Resource Management Plan*, SCE is proposing to monitor the three existing populations of cheat grass located at Poole Powerhouse every 3 years, beginning the first year of license issuance (PME-4, *Invasive Species Monitoring*). As the commenter points out, current surveys demonstrate that the vegetation communities surrounding the Project remain similar to those surveyed during the current license term. For these reasons, SCE is not proposing any additional vegetation monitoring.

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6	USFS	**Exhibit E** The DLA states that: [Whitebark Pine (Pinus albicaulis)] Recovery is expected if land managers facilitate the increase in pest resistance; climate change resilience; the free flow of genetic material, and manage wildfire (Environment and Climate Change Canada, 2017; Keane et al., 2012). The citations provided do not support the claim that recovery is expected if only these actions are followed, nor should they be represented as a recovery plan, rather the citations provide a framework for restoration actions that could contribute to improving conditions for Whitebark Pine populations. The current approved conservation strategy for this species can be found at: https://www.fws.gov/sites/default/files/documents/California%20Whitebark%20Pine%20Conservation%20Strategy%20508.pdf and should be referenced in the FLA.	The approved conservation strategy has been included in the FLA.
7	USFS	**Exhibit E** This Figure appears to be missing occurrences of Whitebark Pine. Four instances (dots) are shown, though Table 6.9-1 has 14 populations listed, including in locations not shown on map. The FLA should reconcile the figure with the data it was drawn from.	The figure has been updated in the FLA to include all occurrences of whitebark pine observed during the botanical surveys. The botanical mapbook included with the TERR-1 Technical Report (included as Volume III of the FLA) includes the sightings as well.
8	USFS	**Exhibit E** In this section of the DLA, SCE describes the presence and proximity of Yosemite toads to the FERC project. It also references the TERR-2 Final Technical Report which includes Yosemite Toad surveys for this project. Unlike other sections of the DLA, this section does provide conclusions as to whether SCE believes the Project has any effects on Yosemite Toads. While Yosemite Toads were discovered in surveys and are presumed to be present within the FERC Project area in other areas, the TERR-2 surveys were insufficient to fully characterize baseline information or use patterns. Longer-term surveys will be necessary to confirm species presence, use, distribution, and any potential effects of Project operations.	The Yosemite toad studies performed in support of the relicensing were performed over a 3-year period both within and adjacent to the FERC Project Boundary. These studies confirmed the presence of one known population and discovered two additional populations that were previously unknown, all located outside the FERC Project Boundary and outside the influence of Project-related water. SCE believes these studies are more than sufficient to inform the relicensing process and to make a determination of Project effects to these populations. These studies, combined with the information obtained from the literature, provide excellent baseline information on the Yosemite toad in the Project Area, and long-term studies are not needed to determine Project effects.
9	USFS	**Exhibit E** The text in this section incorrectly describes Whitebark Pine's conservation status, it is listed as an ESA Threatened species and not an Inyo National Forest SCC species.	This text has been corrected in the FLA.
10	USFS	**Exhibit E** This Section states that the Project and O&M, have no adverse effects on the spatial distribution of existing whitebark pine present in the area surrounding the Project. The status of the Whitebark Pine population surrounding the Project is not necessarily static. While both the 2022 and 2023 surveys found this species near the Project, future surveys may find changes in recruitment and population. Future project operations, including regular O&M and vegetation management could affect the distribution and health of Whitebark Pines near the Project. It should be noted that any future Project O&M including any vegetation actions will address Whitebark Pine conservation status and needs.	Typical O&M activities are not anticipated to involve removal of trees. As stated in the *Resource Management Plan* (filed with Appendix E.1 in Volume II of the FLA), tree removal performed at Project facilities is focused on hazardous trees. While SCE is in the process of removing conifers around Poole Powerhouse to support wildfire prevention, this is done in consultation with agencies, and whitebark pine has not been observed at that location. As stated in the *Resource Management Plan*, pre-activity surveys would be performed for routine and non-routine O&M activities that could affect special-status plants; this would include surveys for whitebark pine. Avoidance and mitigation measures are also included.
11	USFS	**Exhibit E** The DLA states that there are no Project effects to recreation. SCE reaches this conclusion based upon its determination that no recreation facilities are associated with the Project, and because SCE has not proposed any recreation related measures. The Forest notes that the existing license includes requirements to manage the lake levels to address recreation and visual needs and that SCE provides funding to stock fish at its reservoirs for recreational enjoyment. Regarding the statement that no recreation facilities are associated with the Project, no official determination has been made regarding facility use and recreational needs for his project. The Inyo NF asserts that there is a clear nexus to several recreation facilities immediately adjacent to the Project boundary – including those that provide public facilities at the Project reservoirs. Furthermore, REC-1 has not been completed which will provide additional insight into the recreational use of the Project via the adjacent campgrounds, day use sites, and trails. Therefore, SCE cannot conclude that there are no potential recreation effects and issues associated with the Project and by extension there is no need for recreation PM&E measures.	Study REC-1 was completed in early November 2024, after the filing of the DLA. Data from the study were distributed to stakeholders on December 23, 2024. The Draft REC-1 report was distributed to stakeholders for a 60-day review on January 20, 2025, and is being filed with the FLA. There are no recreation facilities currently associated with the Project, and data from Study REC-1 support this continued approach. A meeting to discuss the report is being planned for early March 2025; SCE looks forward to discussing the report and study findings with the USFS and other Stakeholders at that time.

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12	USFS	**Exhibit E** This section reads, As part of the wild and scenic rivers classification system, 4.13 miles of Lee Vining Creek are listed as scenic, with 1.63 listed as wild, and 8.98 as recreational (USFS, 2024). The 2019 Inyo National Forest LMP (USFS, 2019) also identified over 75 miles of river in the Mono Basin as eligible for inclusion in the National Wild and Scenic Rivers System, including all of Lee Vining Creek (Section 6.10, Recreation). This section could be misinterpreted or misread to imply that Lee Vining Creek is a designated Wild and Scenic River; it is not. The INF LMP identifies the creek as an eligible WSR and lists the potential classification of creek segments as scenic, wild, and recreational. The FLA should clarify this distinction.	This text has been modified for clarity in the FLA.
13	USFS	**Appendix E.1: PMEs** This section states that, Herbicide usage (chemical control) is not permitted within the Inyo National Forest. This statement is incorrect. Herbicide utilization for invasive plant management can be applied with INF approval under specific conditions, and consistent with the Forest-wide Invasive Plants Treatment Project EA (2019). The listed BMPs in this section do not constitute sufficient management for invasive plant management control. The FLA should describe or propose that SCE will develop an invasive weed management plan that will include among other things, the BMPs listed in this section as well as other actions as discussed and approved by the INF to address the control and spread of potential invasive plant species arising from Project activities.	Measures to prevent spread and introduction of invasive plant species are discussed in the Resource Management Plan. Revisions have been made in the Invasive Plant Management section of the Resource Management Plan.
14	CDFW	**Initial Statement** Pursuant to 16 U.S.C. § 808(e) any license issued by FERC shall be for a term of no less than 30 years and no more than 50 years from the date the license is issued. CDFW's understanding is that FERC generally issues new licenses for more than 30 years if significant changes in Project operations, new construction, and/or other large capital expenditures are proposed. The information provided by SCE thus far to RP's and FERC, including the Pre-Application Document (PAD) and DLA, does not indicate that any major operational changes, new construction, or expenditures are proposed by Licensees for the Project at this time. Thus, CDFW recommends FERC issue the shorter 30-year license term to Licensees for the Project.	In 2017, FERC refined its policies for establishing the length of license terms. As part of FERC's policy change, it established 40 years as the default length of license terms on relicensing. See Policy Statement on Establishing License Terms for Hydroelectric Projects, 161 FERC ¶ 61,078 (2017). SCE is seeking the default, 40-year license term in the relicensing of the Lee Vining Project.
15	CDFW	**Initial Statement** CDFW recommends the addition of applicable Game Code (FGC) section to this part of the DLA. CDFW recommends the addition of: FGC §5937 which states the following: "Sufficient Water for Fish Existing Below Dams – The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam. During the minimum flow of water in any river or stream, permission may be granted by the department to the owner of any dam to allow sufficient water to pass through a culvert, waste gate, or over a or around the dam to keep in good condition any fish that may be planted or exist below the dam, when, in the judgment of the department, it is impracticable or determinant to the owner to pass the water though the fishway."	Section 4.51(a)(5)(i) requests that the Licensee provide the statutory or regulatory requirements of the state in which the project is located that affect the project as proposed, with respect to bed and banks and to the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purposes of the license under the Federal Power Act. In SCE's judgement, Fish and Game Code § 5937 does not relate to the appropriation, diversion, and use of water for power purposes. It is for this reason that it is not included in the Initial Statement.
16	CDFW	**Exhibit E** There are seven gages recording streamflow and reservoir stage for Project Operations, including four in stream gages, and three reservoir gages. The DLA states that the United States Geological Survey (USGS) reviews and publishes these records to satisfy the existing FERC license requirements but the frequency at which the data is available is not discussed. As of November 18, 2024, the last update USGS made to these gages was on September 30th, 2023, over a year ago. These gages are required by the 4(e) Conditions 4-6 set by the United States Forest Service (USFS) in the previous license to ensure that streamflow and reservoir level requirements are in compliance. The substantial delay in publicly available data hinders any stakeholders from reviewing compliance with these conditions or providing a timely identification and resolution to any issues. CDFW recommends that SCE work with USGS and the California Department of Water Resources to add daily storage and streamflow information from this project to the California Data Exchange Center and the USGS National	SCE will work with relicensing participants to develop a proposed license measure to provide daily reservoir storage and streamflow information (data) from the Project. The data will be provided via the internet and may be posted directly from SCE or through a third party. The data will be provided on a 7-day lag to avoid potential market manipulation. Reservoir storage information will be the water level measurement collected at midnight, and streamflow information will be the 24-hour average flow measured from midnight of one day to midnight of the next day. The data will not have been checked for accuracy and will be labeled with the following, or similar, language: "These provisional reservoir storage and stream flow data have not been reviewed or edited for accuracy and may be subject to significant change."

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		Water Information System (NWIS). If there is a concern regarding market manipulation, a time lag from a day to a week could be added to address this issue. This is important for runoff tracking, downstream Los Angeles Department of Water and Power (LADWP) operations, restoration, and monitoring license requirements, as well as public recreation.	
17	CDFW	**Appendix E.1: PMEs** Section 1.0 Environmental Measures and Plans states that the measures described in this document are proposed as a result of consultation with stakeholders and agencies. The RPs have been having ongoing discussions related to the Project PM&E Measures with SCE but the PM&E measures included in the DLA are carried over from the previous license and do not include the recommendations made from stakeholders or commitments made by SCE during the ongoing discussions.	At the time of filing the DLA, no new PME measures had been adopted, so this was an accurate statement; the text in Appendix E.1, *Protection, Mitigation, and Enhancement Measures* (Volume II of the FLA) has been updated to include the new PME measures developed with Atakeholders.
18	CDFW	**Appendix E.1: PMEs** CDFW appreciates the ongoing discussions and SCE's consideration of the concerns raised during the ongoing PM&E meetings. Specifically, CDFW supports modifying PME-1 Minimum Instream Flow Requirements and PME-2 Reservoir Level Requirements for Recreation to allow for a more natural hydrograph with higher spring flows and filling the reservoirs more slowly, while maintaining dam safety. CDFW is also supportive of the continued effort to use the Operations Model to develop realistic minimum instream flows that do not require frequent variance requests.	PME measures are included in Appendix E.1 of the FLA (Volume II).
19	CDFW	**Appendix E.1: PMEs** CDFW also appreciates the ongoing discussions and SCE's consideration of changing the structure of PME-3, Fish Stocking in Ellery Lake, to a set weight/number of fish that SCE is responsible to stock annually, with the location and timing of stocking determined through annual consultation with CDFW.	PME measures are included in Appendix E.1 of the FLA (Volume II).
20	CDFW	**Appendix E.1: PMEs** Project operations have the potential to affect populations of invasive aquatic algae in Project-affected stream reaches. Didymo (Didymosphenia geminata), an invasive algal species, was historically observed in Project-affected stream reaches (Rost and Fritsen, 2014). The Aquatic Invasive Plants (AQ-4) Study did not observe didymo in any Project-affected stream reaches during 2023, but this was due to an extremely high water year. Given previous observations of didymo in the Project affected reaches, SCE should assume presence. Stakeholders and agencies have expressed concerns during PM&E discussions regarding the spread of didymo and CDFW requests that SCE address this issue in the FLA by drafting a comprehensive aquatic invasive management and monitoring plan, as discussed during the third PM&E Meeting on August 1, 2024.	Throughout Exhibit E, Section 6.5 of the DLA, SCE acknowledges the history of Didymo in the basin. Although no invasive aquatic algae or plant species were documented during the 2023 surveys, Section 6.5.2.2 of the DLA indicates that high flows in 2023 may have removed masses of previously observed Didymo. Findings of this study suggest that Didymo populations are episodic in the Lee Vining Creek Watershed. Specific control measures are not warranted given the current lack of a Didymo issue and the lack of Project nexus. Based on the fact that Didymo is both episodic and exists elsewhere in the Mono Lake basins, it is clear that the Project is not the source of nor likely to contribute to the introduction or spread of Didymo.
21	CDFW	**Exhibit E** Impacts on water quality from Hydro-resource Optimization Comment: Section 6.4.2.3 evaluates the Project's consistency with current resource management objectives set in the Forest Plan and Basin Plan. The DLA evaluates the effects of Hydro-resource Optimization by assessing turbidity data collected as part of the WQ-1 Water Quality TSR, concluding "The observed increases in turbidity did not exceed natural levels and were well below the range of natural variability observed during the 2022 to 2023 monitoring period." In Volume III of the DLA, the final AQ-1 Water Quality TSR acknowledges that turbidity increases were observed coincident with Hydro-resource Optimization and figure 4.3-2 is a graph of data collected between July 17th and 20th, 2022 showing how turbidity increases from a baseline of 0.5 to 4 NTUs at the monitoring site LVC-DSPP2 near the Lee Vining Campground. Appendix D of WQ-1 Hydro-resource Optimization Event Turbidity Data contains the full record of turbidity data related to Hydro-resource Optimization events. From June through December of 2022, turbidity data shows distinct significant increases in turbidity coincident with Hydro-resource Optimization events, with turbidity values frequently reaching 20 NTU above stable turbidity values of around 1 NTU.	Please see response to comment 22 for more information regarding Hydro-resource Optimization and turbidity.

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22	CDFW	**Exhibit E** The Basin Plan objective for turbidity states “Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent” (LRWQCB, 2019). The conclusion made in Section 6.4.3 that “The observed increases in turbidity [related to Hydro-resource Optimization events] did not exceed natural levels and were well below the range of natural variability observed during the 2022 to 2023 monitoring period” should be reassessed and the FLA should disclose the potential adverse effects Hydro-resource Optimization events can have on water quality and aquatic ecosystems as well as address these impacts by developing a PM&E measure to limit the impacts of Hydro-resource Optimization.	To assess the Project’s consistency with the Water Quality Control Plan for the Lahontan Region, an assessment of natural background turbidity levels must be made. Data collected during the WQ-1 Water Quality study indicate that natural background turbidity levels in Lee Vining Creek and other streams in the watershed are variable, with turbidity values reaching 200 NTU in lower Lee Vining Creek and over 400 NTU in Warren Creek during peak snowmelt run-off in 2023 (Site LV-WCT in WQ-1 Technical Report). This is unsurprising, as watersheds fed by glacial melt often have high turbidity levels when compared to other stream systems (Lloyd et al. 1987). Hydro-resource Optimization events in lower Lee Vining Creek correlated with turbidity increases of up to ~20 NTU, as seen in August and September of 2022 at Site LVC-DSPP2 (Appendix D of the Water Quality Technical Report); however, during many other periods of the study, these peaks associated with Hydro-resource Optimization were approximately 2–5 NTU. Turbidity peaks of ~20 NTU were also seen in these months during time frames that do not correlate with Hydro-resource Optimization releases. Aquatic resources in lower Lee Vining Creek are accustomed to a high natural variation in turbidity and flow, and there is no indication that beneficial uses in the reach are being negatively impacted by Hydro-resource Optimization. Furthermore, most laboratory studies on the toxicology of turbidity in salmonids describe the onset of harmful effects related to suspended sediment at turbidity levels of 25–50 NTU, so it is unlikely that the turbidity peaks of ~20 NTU seen in lower Lee Vining Creek would have a notable negative effect on salmonids there (Bash et al. 2001). The resident brook, rainbow, and brown trout populations in lower Lee Vining Creek had high nutritional states (k-values ranging from 0.99 to 1.15) in 2022 surveys, indicating that benthic macroinvertebrate populations are providing sufficient nutrition. Since Hydro-resource Optimization events do not elevate turbidity levels beyond the peaks of naturally occurring turbidity in Project streams, a less-than-significant effect is expected on the aquatic environment in lower Lee Vining Creek.
23	CDFW	**Exhibit E** Impacts on Stream Fish Populations from Hydro-resource Optimization Comment: The fry/young of the year (YOY) periods displayed in Table 6.5-1 are incorrect. The DLA contradicts this table stating in section 6.5.2.1 that, “reductions in streamflows, like those that occur during Hydro-resource Optimization at Poole Powerhouse, have the potential to strand emergent life stages of naturally reproduced brown and brook trout in lower Lee Vining Creek during spring months (February through May) when their swimming abilities are most limited.” The fry/YOY period should start sometime in December and run through March or April, depending on the species. CDFW requests that the information in this table be reviewed and corrected, as appropriate.	Table 6.5-1 has been updated in the FLA to reflect corrected species-specific spawn timing, time from fertilization to emergence, and time from emergence to juvenile life stage.
24	CDFW	**Exhibit E** The stream reach potentially impacted by Hydro-resource Optimization is Lee Vining Creek between Poole Powerhouse and the pool upstream of the LADWP Diversion Dam (LLVC-F1). The Stream Fish Populations TSR (AQ-2) surveyed this reach in 2022. Fish Captured in this reach included brown trout (salmo trutta), brook trout (Salvelinus fontinalis), rainbow trout (Oncorhynchus mykiss), and cutbow (Oncorhynchus clarkii × mykiss). Brown trout were the most abundant and ranged from YOY to the 4+ age class, brook trout ranged from YOY to the 3+ age class, and the two rainbow trout and one cutbow were within 4+ and 5+ age classes based on scale analysis. Brown trout and brook trout spawn in the fall and winter, most commonly in November and December (Moyle, 2002). Spawning sites are selected by the female, and site selection occurs once water temperatures drop to 6 to 10°C. Eggs are fertilized and buried in redds and incubate through the winter months (Moyle, 2002). Natural streamflows are low and steady during winter months and disturbance and destruction of the redds can occur is the sediment in the channel becomes mobilized. As part of the relicensing process, SCE conducted the Lower Lee Vining Creek Channel Morphology TSR (AQ-6) to assess how Project operations have the potential to affect fluvial processes and channel morphology in lower	Limited mobilization of sediment (i.e., no net aggradation or incision of the channel) can and does occur in lower Lee Vining Creek from multiple sources, including natural peak flows, warm winter storms, and hydropeaking. Whether associated redd scour occurs is dependent on a number of factors, including the timing, duration, and magnitude of the flow event, the flow conditions at the time of redd construction, and microhabitat conditions at the redd. Sediment mobilization does not, in and of itself, imply that redd scour or significant adverse effects on brown or brook trout are occurring. In fact, when the relatively minor changes in stage from Project operations (Table 6.5-15) are considered, along with the physical configuration of the stream channel (page 6-122 of the DLA) and its low susceptibility to stranding, and the robust recruitment of young brown and brook trout (Tables 6.5-10 and 6.5-11), a reasonable conclusion based on the site-specific data is that hydropeaking is not having a significant adverse effect on the fish population.

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		Lee Vining Creek. This study area included Lee Vining Creek downstream of Rhinedollar Dam to the LADWP diversion. This reach is composed of predominately plane bed and pool-riffle morphology with large wood throughout that influence channel morphology and sediment dynamics. Section 6.3.2.2 of the DLA states, "Results from the AQ-6 Study suggest that… the channel bed is relatively mobile, there is no evidence of systematic aggradation or incision, and the channels are not incised, providing connection with the floodplain during floods." As part of the relicensing process, SCE also conducted the Aquatic Habitat Mapping and Sediment Characterization TSR (AQ-3) to assess the quality and quantity of spawning gravel in the Project-affected reaches. Table 3.1-2 of the TSR in Volume III of the DLA defined spawning gravel for trout species to include a "sediment size composition between 0.2 and 3.9 inches located in an area with adequate water depth and velocity (i.e., greater than 9.4 inches and 15.7 to 35.8 inches per second, respectively) during flows with a recurrence interval of up to 1.5 years." The TSR found that spawning gravel in lower Lee Vining Creek decreased in abundance from upstream to downstream, but the quality was lower in the upstream section of the reach, with Figure 4.2-4 classifying the quantity and quality of spawning gravel as "good" to "poor." The TSR also states that "gravel deposits in lower Lee Vining Creek were primarily semiactive." Table 6.4-3 of Volume III of the DLA provides Hydro-resource Optimization event duration, magnitude, and frequency by season, from 2015 to 2023, with the highest frequency occurring during the winter. AQ-3 has demonstrated that the gravels within lower Lee Vining Creek are mobilized during Hydro-resource Optimization events and AQ-3 has also documented that there is suitable spawning gravels within the reach. This evidence suggests that there are potential impacts to spawning brook and brown trout redds from sediment mobilization and scouring of redds during Hydro-resource Optimization events in the winter months. CDFW disagrees with the conclusion in Section 6.5.2.3 that there are no adverse effects on fish and wildlife resources under the Proposed Action and requests that SCE address these impacts by developing a PM&E measure to limit the impacts of Hydro-resource Optimization.	
25	CDFW	**Exhibit E** Potential impacts to fish populations from Hydro-resource Optimization events were discussed in section 6.5.2.1. of Volume III of the DLA. Part of the Lower Lee Vining Creek Channel Morphology TSR (AQ-6) assessed changes in stage to assess the potential for stranding fish due to rapid changes in flows. Rapid decreases in instream flows have the potential to strand fish and other aquatic life, leading to direct mortality or predation. Areas of a channel that are alternately wet and dry may create habitat that would not support the macroinvertebrate communities important as food for fish. Juvenile fish are especially vulnerable as they often prefer to reside in shallow waters along stream margins. The primary risks from changes in flows from Hydroresource Optimization are disruption of breeding, scouring, and stranding. Stranding risk is highest when reductions in water surface elevations (stage) are rapid, shoreline slopes and stream gradient are shallow, and topographic depressions create isolated pools and substrate is heavily structured (e.g., cobble and boulder dominated substrate with larger interstitial space). Substrate composition is most structured and poses the greatest stranding risk in the upper section of the reach near Big Bend Campground where gravel, cobble, and boulder substrates dominate, compared to downstream where smaller substrates of sand and gravel are more common.	The data do not suggest that stranding occurs at a level that results in significant adverse effects on fisheries resources. The channel configuration does not typically lend itself to high risks, the level of flow fluctuation is relatively small, and the biological data do not suggest excess mortality of the youngest life stages. As described in Section 6.5.2.1 of the FLA, several empirical data sources (e.g., physical stream and habitat, biological, and hydraulic) were considered in the evaluation of stranding potential, in addition to anecdotal observations made during hydropeaking events while conducting a suite of studies over two years. It is therefore reasonable to conclude that there are no significant stranding effects from current Project operations based on the current studies and empirical, site-specific data.
26	CDFW	**Exhibit E** CDFW disagrees with the conclusions made from the results of AQ-6 in Section 6.5.2 Potential Adverse Effect and Issues and believes that these results indicate that Hydroresource Optimization has the potential to strand fish and other aquatic life. SCE includes in the DLA that "no stranding has ever been documented by SCE or by any of the agencies or other stakeholders in reference material compiled in the pre-application document." Hydropeaking normally occurs in the evening hours and into the night and thus it would be very unlikely and difficult to document stranding occurring. This statement is misleading and should not be used to justify that the Proposed Action has no adverse effects and CDFW requests that SCE address these impacts by developing a PM&E measure to limit the impacts of Hydro-resource Optimization.	As described in Section 6.5.2.1 of the FLA, several data sources (e.g., physical stream and habitat, biological, and hydraulic) were considered in the evaluation of stranding potential, in addition to anecdotal observations made during hydropeaking events by qualified staff who were conducting a suite of studies over two years. At issue, however, is whether there is a significant adverse effect from stranding, and the data on channel configuration, stage changes, and young-of-year productivity suggest there is not. The mere theoretical potential for stranding does not justify a PME measure or elevate the effect to a level of significance.

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27	CDFW	**Exhibit E** As discussed during the ongoing PM&E meetings, CDFW would like the FLA to include a PM&E measure that addresses the impacts Hydro-resource Optimization has on the aquatic environment. A rate of 1 inch per hour is generally within the range of natural rates of stage reductions in unregulated rivers (Olson and Metzgar 1987), while Higgins and Bradford (1996) state that maximum recommended stage reduction levels of regulated rivers are typically 2.5–5 cm (1-2 inches) per hour. Recommendations described in Hunter (1992) also suggest reductions in river stage of 1-2 inches per hour are protective of fish populations.	The literature referenced by the commenter is generally focused on native, anadromous salmonids; however, salmonids present in the Project Area are non-anadromous, non-native trout species. Hunter (1992) concluded that the risk of stranding resident (non-anadromous) trout is less likely to have a population-level effect compared to anadromous salmonids. Olson and Metzgar (1987) suggested that stage change rates that minimize stranding range from 1 inch per hour up to 6 inches per hour depending on season, river stage, and time of day. This study also suggested that stranding potential needs to be evaluated on a river-by-river basis to account for differences in channel morphology, occupant species, and their life history timing. Furthermore, Bradford et al. (1995) demonstrated that a stage change of about 1 to 2 inches per hour was not protective. In lower Lee Vining Creek, river-specific analyses indicated that stage changes of stranding do not occur at a level that results in significant adverse effects on fisheries resources. The channel configuration does not typically lend itself to high risks, the level of flow fluctuation is relatively small, and the biological data do not suggest excess mortality of the youngest life stages. It is therefore reasonable to conclude that there are no significant stranding effects from current Project operations based on the current studies and empirical, site-specific data. Please also see responses to Comment 25.
28	CDFW	**Exhibit E** The current license restricts hydropeaking from Poole Powerhouse only by providing high base flows in June and July of 89 cfs versus the required 27 cfs in all other months of the year. CDFW has an interest in understanding how reducing hydropeaking, or slower ramping rates would affect SCE's power generation at this location. CDFW requests that the intraday Hydro-resource Optimization model SCE developed as part of the Operations Model TSR (AQ-5) should be used to understand implications for how much ramping rates would have to be adjusted to keep the stream reaches from experiencing less than two inches per hour of stage change. Alternatively, a higher baseflow could be provided during other months (consistent with a natural hydrograph) such that peaking would not cause such drastic stage changes in Lee Vining Creek. During the next PM&E discussions, CDFW would like to consider and understand the impacts of both slower ramping rates and higher minimum instream flows in this reach on SCE's operations through modeling scenarios. The results of these scenarios should be documented in the FLA.	Please also see responses to comments 25 and 27. Relicensing studies have not identified any significant adverse impacts as a result of hydropeaking. SCE did use the intraday model to review the potential outcomes associated with maintaining potential stage changes at or below 2 inches per hour. When looking at the receding limb of high flows at 110 cfs and then back down to low flows of 27 cfs, the model shows that it would take SCE operations approximately 7 hours to reach base flows when maintaining no more than a 2-inch-per-hour stage change. This ramping rate would not be consistent with the operational goals of the Lee Vining Project and is therefore not being considered as a viable operational change.
29	CDFW	**Exhibit E** The Reservoir Fish Populations TSR (AQ-1) documented the current fish populations within the Project reservoirs. Sampling was conducted through the deployment of gill nets and boat electrofishing. Water quality conditions had little variation between Project reservoirs and were cool with high dissolved oxygen levels throughout the study area. For Ellery Lake the results indicate that it was a small sample size (n=33) and that YOY were present, but Figures 6.5-2 and 6.5-3 in AQ-1 only show three brook trout and no brown trout as YOY, indicating that there is not a strong self-sustaining population of brook or brown trout in Ellery Lake. For Tioga Lake no brown trout were caught, no YOY brook trout were caught, and it was also a small sample size (n=42). Saddlebag also did not have YOY brook trout and only YOY Lahontan redside. The data collected in AQ-1 Reservoir Fish Populations indicates that there are low numbers of brook trout and brown trout in Project Reservoirs, with low recruitment rates. Given that the water quality conditions do not pose a limiting factor of reservoir fish populations, these results indicate that there may a high recreational fishing pressure and that these lakes need to be managed as a put and take fishery. CDFW recommends incorporating these data into the Recreation Use Assessment (REC-1) study to assess if additional stocking efforts are needed and include these results in the FLA.	To support recreational fishing opportunities, CDFW conducts annual stocking of Project Reservoirs; however, Ellery and Tioga lakes were not stocked in 2020 and 2022 and Saddlebag Lake was not stocked from 2020-2023 due to a disease outbreak at CDFW hatcheries and to the coronavirus pandemic, respectively. Because the rainbow trout stocked in Project Reservoirs are triploid (i.e., sterile) and are generally stocked to support a put-and-take fishery, it is possible the lack of rainbow trout stocking contributed to increased recreational fishing pressure on the brook and brown trout populations within Project Reservoirs. To enhance the fishery and support CDFW's concerns, SCE is proposing additional stocking of Project Reservoirs, as described in PME-2, *Enhanced Fish Stocking*.

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Comment Number	Stakeholder	Comment	Applicant Response
30	CDFW	**Exhibit E** The General Wildlife Resources Survey TSR (TERR-2) documented Yosemite toad (Anaxyrus canorus) breeding along the southern boundary of Tioga Lake within and adjacent to the FERC Project Boundary. Section 6.6.2.2 Effects of Dispersed-Use Recreational Activities on Terrestrial Wildlife Resources acknowledges that "recreational activities that occur within their FERC boundary most commonly coincide with the edge of waterlines (i.e., along the shorelines of Tioga and Saddlebag Lakes). Trampling of small, slow-moving wildlife (such as Sierran tree frog juveniles) and associated habitat may occur as a result of these activities." CDFW requests that this statement be revised to include potential impacts to the mapped Yosemite toad breeding habitat along Tioga Lake and that SCE consult with the USFS, United States Fish and Wildlife Service (USFWS), and CDFW to minimize Project impacts to Yosemite toad.	A Draft Biological Assessment will be filed with the FLA to analyze potential effects to Yosemite toads associated with the Lee Vining Project, and SCE continues to discuss Yosemite toads with the USFWS under Section 7 of the Endangered Species Act. While there is potential for Yosemite toad habitat to be trampled during dispersed recreation, dispersed recreation in the Project Area is operated and maintained by USFS, not SCE. Further, the USFS and the USFWS have a signed a Multiforest Biological Opinion that addresses recreational impacts to the Yosemite toad.
31	CDFW	**Exhibit E** CDFW supports SCE's plan to continue implementing an Avian Protection Plan (APP), to adhere to a Nesting Bird Management Guide, and to conduct pre-activity nesting bird and raptor surveys. Although CDFW has not reviewed the specifics of these plans, CDFW believes that any buffers for special-status birds should be determined through collaborative discussion between SCE, CDFW, USFS, and USFWS. The General Wildlife Resources Survey (TERR-2) documented bald eagle (Haliaeetus leucocephalus), golden eagle (Aquila chrysaetos), peregrine falcon (falco peregrinus), and olive-sided flycatcher (Contopus cooperi) within the Project area. Willow flycatcher (Empidonax traillii), although not observed during the survey, also has potential to occur within the Project area. CDFW considers special-status bird species to include species State listed as endangered, threatened, or candidates for these listings; Federally listed as endangered, threatened, or proposed for these listings; State fully protected species; State Species of Special Concern, watch list species; and Forest Service sensitive species.	Text has been adjusted in the *Resource Management Plan* (attached to Appendix E.1 in Volume II of the FLA).
32	CDFW	**Exhibit E** This report states that weighted usable area as a function of streamflow over time would be evaluated in this report. However, the resultant habitat time series plots show monthly values, and are presented separated out by water year type. This is an inappropriate way to present a habitat time series analysis as habitat bottlenecks throughout time may be obscured. CDFW recommends the following changes should be made to this analysis for presentation in the FLA: This analysis should not be presented by stacking all wet/normal/dry years together in plots to look like they present time series information. Figures 1-5 in this report present habitat available over time in non-successive similar-grouped water year types. There is no need to split these charts out by water year type, as this obscures seasons in particular water years where habitat bottlenecks may be illustrated and addressed with license conditions. Habitat time series should be presented using daily values, not monthly averages. Monthly averages obscure times when low flows would limit habitat available to fish species. Habitat time series analyses should not be presented for the reach between Lower Lee Vining Creek between Poole Powerhouse and the LAWDP Diversion Dam (Figures 1-14 through 1-16). This is a peaking reach, and unless intra-daily plots are prepared, presenting these plots based on average daily, or average monthly values severely obscures times when fish habitat is limited at low flows.	The intention of the habitat time series analysis is to generally describe seasonal and annual fluctuations in habitat availability over the existing period of record. Because minimum flows are prescribed by water year type, viewing habitat availability at this temporal scale is appropriate. Nevertheless, figures reflecting the daily average habitat by year have been added to Appendix E.3 (Volume II of the FLA).
33	CDFW	**Exhibit E** Although an operations model has been calibrated to meet the stated study plan goal: The intent of the operations model is to measure the ability of the Lee Vining system to meet flow targets that may be beneficial as determined by studies conducted in support of the licensing process. The operations model and Hydro-resource Optimization model still do not contain any way to output the results of various scenarios' impact on SCE's power generation, both peaking capability and annual generation. SCE staff and consultants stated in the October 22, 2024 meeting that they intend to continue to discuss alternate instream flow releases in the next few months, but it is unclear what metrics will be used determine impact to power generation in those	As discussed in the responses to comments 22 through 27, relicensing studies have indicated no significant adverse effects associated with hydropeaking at the Project. For that reason, SCE does not believe it is necessary to integrate generation information into the models developed for the Project. Further, SCE believes it is appropriate to evaluate PMEs based on the resource need as supported and identified by the studies as they relate to direct Project impacts. Exhibit D does identify impacts to generation from changes to the proposed MIFs from Saddlebag and Tioga.

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		scenarios based on the most-recently provided operations model version. Additionally, in response to the State Water Resources Control Board's comments regarding the maximum peak modeled in the Hydro-resource Optimization model, SCE commented that additional flows will be modeled to capture more typical peaks that occur (up to 100 to 110 cfs). This study and any analysis of measures based on results of this study should be considered incomplete until adequate peaking and power generation impacts are documented in the FLA. Table 2.8-2. (Study Implementation Status for the Project) in the DLA should also be updated to indicate that this study is incomplete until the information discussed above is complete.	As explained in Exhibit E of the FLA (Section 1.1.2), the Poole Powerhouse is used to respond to the ISO demands for power. Demands can be market driven (i.e., energy needs and renewable load) or used to stabilize the grid. The financial impact of this mode of operation is indirect to Edison and extremely difficult to quantity on an event-by-event basis.
34	CDFW	**Exhibit E** This section does not provide any Cumulative Effects Analysis and states that, "Cumulative effects will be fully described in the FLA," but Section 8.4. Finding of No Significant Impact states that "Continuing to operate and maintain the Project with the recommended environmental measures (including management and monitoring programs) included under the proposed Action would not be a major federal action significantly affecting the quality of the environment." This Finding of No Significant Impact should not be made without adequately disclosing and analyzing the cumulative effects of the Project.	Because FERC staff does not issue a Scoping Document for projects undergoing relicensing through the traditional licensing process (TLP), FERC has not yet identified what resources, if any, may be cumulatively affected by the presence of the Project. FERC's NEPA analysis of the Proposed Action will address cumulative effects. Nevertheless, SCE has included a discussion of Cumulative Effects in Exhibit E, Section 7.0 of the FLA.
35	SWRCB	**Exhibit A** The minimum flow requirements description states that flows are dependent on water year types, but does not state what stations or datasets are used to determine water year types. State Water Board staff request that SCE include which stations and precipitation datasets are used to calculate water year types in its Final License Application.	Water year type is determined using Dana Meadows snow course measurement on (or about) April 1. Through discussions with stakeholders, SCE is proposing to modify the process for determining water year types as described below and in Exhibit B. • Dry years are defined as those in which the water availability as of April 1 is representative of the water available on April 1 in the lowest 30% of the previous 30 years. • Wet years are defined as those in which the water availability as of April 1 is representative of the water available on April 1 in the highest 30% of the previous 30 years. • Normal years are defined as those that cannot be classified as either dry or wet years, per the above definitions.
36	SWRCB	**Exhibit A** The current minimum instream flow description for Saddlebag Dam appears incomplete as it is missing language from the 1997 FERC license which states: "It shall be the objective of the Licensee to maintain the flow regimes established by one of the two methods described above. However, in no case shall the Licensee release a minimum, continuous flow of less than 60% of the flow regime to be established for any given month per either of the methods described above." Amended Article 405 also requires that between October 15 and April 1, SCE may not vary flow below Saddlebag Dam by more or less than 10 cfs from the average daily inflow calculated between October 1 and October 14. This incomplete listing occurs in other areas of the DLA (e.g., Exhibit E, Table 3.5-1). State Water Board staff request SCE include all flow provisions of its FERC license when discussing current flow regimes in its FLA.	This text has been updated and moved to Exhibit B.
37	SWRCB	Exhibit A Tioga Dam and Auxiliary Dam section states that only the top 5 feet of the dam is visible due to backfill; please clarify whether the backfill is intentional or due to sediment accumulation and whether the area being described is the impoundment or downstream side of the dam.	Exhibit A has been updated to clarify that backfill is intentional, this is how the dam was designed, and backfill is present on both the impoundment and downstream sides of the dam.
38	SWRCB	**Exhibit A** Storage Capacity of Reservoirs section states that Saddlebag and Tioga Lakes are historically drawn down in winter "to provide storage capacity for spring run-off", but does not describe that SCE is contractually obligated to release most water stored by the Project annually, for potential use by the Los Angeles Department of Water and Power (LADWP) downstream. State Water Board staff request SCE include in its FLA, all water storage release requirements when discussing its current license terms.	Text has been modified throughout the FLA (Exhibit B and Exhibit E Section 1.0) to include water release obligations for use by LADWP.

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39	SWRCB	**Exhibit B** Figure B-1 Trend for Inflows-Lee Vining Creek (1999-2023): State Water Board staff request that SCE clarify what data and averaging was used to develop the figure and whether the red line is intended to indicate a measurable trend over the period of record.	Data shown are actual acre-feet runoff Apr-Sep; the red line is the linear trendline since 1941. Information has been added to Exhibit B of the FLA.
40	SWRCB	**Exhibit B** Table B-3 Monthly Precipitation Totals at Ellery Lake Station: State Water Board staff request that SCE add units to this table and clarify whether it represents both rain and snow. If only rain is included in this table, a new table should be developed which includes snow to accurately reflect precipitation conditions in the Project area.	A heated tipping bucket is used, so snow is melted to measure as rain. Values are total precipitation in rainfall (water equivalent). Clarifying text has been added to the table.
41	SWRCB	**Exhibit B** Below Poole Powerhouse subsection (iii): Hydraulic Capacity, please clarify whether the statement “a minimum hydraulic capacity of approximately 6 cfs in dry periods but matches the natural inflow” is intended to mean that the actual minimum hydraulic capacity of Poole Powerhouse is the same as the lowest natural inflow during dry periods.	This text has been clarified in the FLA.
42	SWRCB	**Exhibit E** Section 3.3.1.2 Water Rights: This section states SCE worked with FERC to obtain archive records showing it possessed sufficient pre-1914 water rights for Lee Vining Creek. Table 3.3-1 does not list any pre-1914 water rights. State Water Board staff requests SCE clarify which water right it claims as pre-1914 associated with this Project.	The licenses and permits listed in Table 3.3-1 cover all water used for the operation of the Project. SCE incorporates and references its pre-1914 rights merely to make clear that SCE continues to retain and use these rights in addition to all others and has no intention to abandon them.
43	SWRCB	**Exhibit E** Section 3.1.4 Flowline/Penstock/Conveyance System: This section states the penstock’s maximum flow is 110 cubic feet per second (cfs). USGS Gage No. 10287762 (SCE Gage No. 353) data, which measures flow through Poole Powerhouse, shows instream flow has reached a maximum of between 112 and 117 cfs in the months of May, June, July, and August in 2023. Table H-3 of the DLA describes forced outages that occurred within the last five years with the penstock rupturing1 between the months of August through November. State Water Board staff request SCE include in its FLA an explanation as to why the flow through Poole Powerhouse often exceeds 110 cfs. 1 Poole Powerhouse penstock had a rupture/leak incident in late summer 2020.	Dam safety information states 110 cfs as maximum penstock capacity. Values recorded that exceed this may be due to gage inaccuracy or higher values recorded during specific conditions that may not always be present. Nominal maximum capacity is 110 cfs.
44	SWRCB	**Exhibit E** Section 3.6.4 Public Safety Plan: The section states “SCE uses signs to warn the public of hazardous areas and potentially dangerous conditions.” Figure 6.4-12 depicts discharge below Poole Powerhouse during hydroresource optimization events. In the figure, a step curve can be observed in which flow below Poole Powerhouse can suddenly increase from 6 cfs to over 100 cfs within three hours. This is more clearly represented in Figure 5.5-2. March 2017 Flow Hydrograph in the Final Operations Model Technical Report (AQ-5, DLA Volume III), which shows flows increasing from 6 cfs to approximately 60 cfs within an hour. During SCE’s May 2024 Technical Report Review Stakeholder Meeting2, State Water Board staff observed the campgrounds below Poole Powerhouse. The campgrounds were within 20 feet of Lee Vining Creek with no signs warning recreation users of sudden increases in flow. During hydro-resource optimization events maximum water depth and velocity can increase by an approximate peak of 1.5 feet and 2.5 feet per second, respectively. At maximum event flows of 110 cfs, depth and velocity are expected to increase even more drastically. These changes occur very rapidly and often take place in the late afternoon or early evening, and as such may present a safety concern to recreationists downstream, particularly near high-use recreation zones such as campgrounds. State Water Board staff recommend SCE include signage warning recreation users at both developed campground and dispersed camping areas of potential sudden increases in flows due to hydro-optimization events, and describe the measure in the FLA.	SCE conducted a wading suitability evaluation, which is included as Appendix E.5 in Volume II of the FLA. This evaluation found that, on an annual basis, only 4.3% of the time do flows exceed 110 cfs (the maximum flows released from the powerhouse), which indicates that Rhinedollar Dam is spilling. SCE found that, based on Mosely (1983), instream wading may be more difficult closer to Poole Powerhouse during hydropeaking events. However, as the flows extend downstream, even under spill conditions they are still considered "moderate" in nature. No safety-related events have been identified that involve flows being released from Poole Powerhouse; SCE is not proposing signage as part of this relicensing.

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		2 SCE held a Technical Report Review meeting for Stakeholders at the Lee Vining Community Center on May 14, 2024.	
45	SWRCB	**Exhibit E** Section 6.3.1.5 Reservoir Shoreline and Streambank Conditions: This section includes bathymetry for the Project's reservoirs. State Water Board staff requests that the FLA include the rate of sedimentation (if available) for Saddlebag, Tioga, and Ellery Lakes based on current and any historic bathymetry data.	No bathymetry was conducted as part of the suite of relicensing studies, as it was not necessary to address questions raised during the Study Plan development process, nor has SCE conducted bathymetry surveys more recently than the data provided in the referenced section. SCE has not conducted any sediment removal activities from Saddlebag Reservoir in 18 years, which suggests that sedimentation rates are low. SCE is therefore unable to determine a rate of sedimentation for Saddleback, Tioga, or Ellery lakes
46	SWRCB	**Exhibit E** Section 6.3.1.6 Erosion and Sedimentation: The section includes erosion control measures as required in the Project's current FERC license. Several of the listed measures intended to reduce erosion and sedimentation as part of ongoing Project operation and maintenance appear to be outdated. In 2022, the State Water Board issued Water Quality Order No. 2022-0057-DWQ3 updating the National Pollutant Discharge Elimination System General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (CGP). The CGP requires the use of best available technologies for selection and implementation of BMPs. The Erosion and Sediment Control Plan should be updated for the term of the new FERC license(s). State Water Board staff request that SCE include in its FLA a proposal to develop and implement a new Erosion and Sediment Control Plan with updated erosion and sediment control measures. 3 https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2022/ wqo_2022-0057-dwq.pdf	An updated Erosion Control Plan has been included with the Appendix E.1 (Volume II of the FLA).
47	SWRCB	**Exhibit E** Section 6.3.1.6 Erosion and Sedimentation states that "Sediment removal at Project impoundments is conducted on an as-needed basis". On October 3, 2017, the Executive Director of the State Water Board issued a water quality certification for Eastern Sierra Hydroelectric Power Projects Ongoing Operations and Maintenance4. The United States Army Corps of Engineers (USACE) issued a Regional General Permit (RGP) for the ongoing operations and maintenance, which has been extended through October 15, 20255. If SCE seeks a new USACE action for continued operations and maintenance activities, a new water quality certification action would be needed. The first action in applying for a new certification would be to submit a pre-filing request. Additionally, ongoing sediment removal at the Project would be addressed in a water quality certification for relicensing of the Project. 4 https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert /wqcert_notices/esp_wqc.pdf 5 https://www.spl.usace.army.mil/Portals/17/docs/regulatory/RGP/RGP97.pdf	Comment noted.
48	SWRCB	**Exhibit E** Section 6.4.2.2. Bioaccumulation of Mercury in Fish Tissue and Potential Consumption Guidelines to Avoid Human Health Risks in Project Reservoirs states that regarding mercury in trout "the consumption frequency for Project reservoirs is higher (more servings per week) than the OEHHA [Office of Environmental Health Hazard Assessment] California statewide advisory for eating fish from California's Lakes and Reservoirs without site-specific advice". While this is true for rainbow trout, brook trout are not included in OEHHA's 2022 Statewide Health Advisory and Guidelines for Eating Fish from California's Rivers, Streams, and Creeks without Site-Specific Advice6, and have no corresponding statewide advisory. State Water Board staff recommend that SCE include a measure in the FLA to notify anglers at Saddlebag Lake and Tioga Lake that consumption of brook trout should be limited, as indicated in Table 6.4-12. 6 https://oehha.ca.gov/media/downloads/advisories/fishadvisorystatewideriversreport20 22.pdf	The low DO conditions that cause methylation of mercury are not caused by Project operations (see response to comment 53). Furthermore, the California Office of Environmental Health Hazard Assessment maintains a list of fish advisories as well as a fish advisory map, notifying the public of potential health risks. For these reasons, SCE does not propose to install signs relating to fish consumption.

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49	SWRCB	**Exhibit E** This section concludes by stating "Based on the analysis discussed above, the results of the aquatics studies, and because the Proposed Action does not include changes to O&M activities, no adverse effects have been identified for Proposed Action." However, the DLA acknowledges that the conditions in Saddlebag and Tioga Lakes have the potential to methylate mercury, leading to the bioaccumulation of mercury in fish. Low dissolved oxygen at the sediment-water interface – one of the pathways identified in the DLA for mercury methylation – is expected to occur more frequently as climate change causes stronger thermal stratification in lakes7. Although brook trout fish tissue mercury concentrations do not currently exceed the Sport Fish water quality objective, those concentrations may increase throughout the period of a new FERC license. State Water Board staff request that SCE add a measure to monitor fish tissue mercury concentrations intermittently throughout the period of a new license, and propose actions to address exceedances should they occur. 7 Jane, S.F., Hansen, G.J., Kraemer, B.M., Leavitt, P.R., Mincer, J.L., North, R.L., Pilla, R.M., Stetler, J.T., Williamson, C.E., Woolway, R.I. and Arvola, L., 2021. Widespread deoxygenation of temperate lakes. Nature, 594(7861), pp.66-70.	The low DO conditions that cause methylation of mercury are not caused by Project operations (see response to comment 53), brook trout concentrations do not currently exceed the Sport Fish water quality objective, and SCE does not stock or manage the fish population in the reservoir; therefore, SCE does not propose a measure to monitor mercury in fish.
50	SWRCB	**Exhibit E** Section 6.4.2.1 Effects of Project Operations and Maintenance on Water Quality in Project Reservoirs and Project-Affected Stream Reaches in part states "Based on the analysis discussed above, the results of the studies, and because the Proposed Action does not include changes to O&M activities, no adverse effects have been identified for Proposed Action." Data presented in the DLA demonstrate that there may be exceedances of the Water Quality Control Plan for the Lahontan Region (Basin Plan) water quality objectives within Project waters. These issues have been described by State Water Board staff in previous comment letters, and staff have previously requested that SCE demonstrate that its Project is not the cause of these Basin Plan exceedances. In Section 6.4.2.3. Consistency with Current Resource Management Objectives (Forest Plans, Basin Plan, etc.) SCE states that there are "Some inconsistencies with applicable Basin Plan objectives" but that these inconsistencies are "naturally occurring and not associated with the Project". This statement is not supported by the available data and the DLA does not attempt to demonstrate that Project operations have no impact on the potential exceedances. Additionally, Table 6.4-13 Summary of 2022 and 2023 Water Quality Results and Comparison to Basin Plan Numeric Surface Water Quality Objectives does not list all potential exceedances that are recorded by data presented in the DLA. For pH, data collected in reservoir profiles appear to be excluded, despite pH in Tioga and Saddlebag reservoirs being substantially lower (> 0.5 standard units) than that of reservoir inflow. While it is useful to note pH exceedances by comparison of inflow to reservoir outflow as noted in Table 6.4-13, this neglects the likely cause of the exceedance occurring in, and measured in, the Project reservoirs. A high value of fecal coliform that may have exceeded the prior bacterial objective under the Basin Plan (and described below) is also not listed. The high value of fecal coliform measured in 2022 indicates that there may be high values of bacteria that could exceed the Part 3 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Bacteria Provisions and a Water Quality Standards Variance Policy (Statewide Bacterial Provisions) and that additional data are needed in dry years. Notably, SCE identifies reduced dissolved oxygen in Project reservoirs as an exceedance, unlike pH and fecal coliform. State Water Board staff request SCE include in its FLA additional information to substantiate its statements that potential exceedances of applicable Water Quality Control Plans within the Project reaches are not related to the Project and to note any such occurrences.	FLA Section 6.4 Water Resources was updated to include additional information to substantiate the statements that potential exceedances in fecal coliform, DO, and pH levels are not related to the Project Operations. See responses to comments 4, 53, 54, and 55 for additional information on these parameters.
51	SWRCB	**Exhibit E** From the information presented in Table 6.4-13, it is not clear which data were used to determine compliance with the Basin Plan turbidity water quality objective, or how data were compared to determine compliance. Table 6.4-13 provides several footnotes to explain which data were used, but these appear to conflict with each other: 1) Footnote i states that continuous data were not used to determine frequency of exceedances, but the number of measurements is listed as 846 (implying use of continuous data); 2) the table lists July 2022 as the time of data collection, but footnote f states that data in July 2022 were qualified during data review; 3) footnote h states	Table 6.4-13 footnotes were clarified and text was added to define how natural turbidity was determined. Natural turbidity levels were determined using turbidity data collected in Lee Vining Creek downstream of Poole Powerhouse during periods when Hydro-resource Optimization events were not occurring; Lee Vining Creek upstream of Poole Powerhouse; and Lee Vining Creek tributaries during spring, summer, and fall.

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		that the turbidity mean presented in the table is based on average turbidity during July 2023 prior to hydropeaking events, but the maximum value in the table is the peak observed during July 2023 hydropeaking events. The maximum value exceeds the mean by several orders of magnitude, yet no exceedances are listed in the table. Additionally, Section 6.4.2.3 further states that "The observed increases in turbidity did not exceed natural levels" – but these sections do not appear to explain how "natural levels" were determined. State Water Board staff request SCE clarify the turbidity data in 6.4-13 and explain how natural levels of turbidity were determined.	
52	SWRCB	**Exhibit E** In relation to dissolved oxygen, Section 6.4.2.3 Consistency with Current Resource Management Objectives states: "Hypolimnetic depletion of oxygen in reservoirs is a naturally occurring phenomenon in most temperate lakes with even moderate levels of algal productivity". As previously addressed in the State Water Board staff June 2024 comment letter on the 2022 – 2023 study findings, and restated below, this is not applicable to Saddlebag or Tioga Lakes as both appear to have very low levels of productivity. In addition, the statement does not distinguish between hypolimnetic oxygen depletion being a "naturally occurring phenomenon", and how reservoir construction and operation may promote conditions that allow for oxygen depletion. The DLA does not attempt to determine how Project operations may enhance hypolimnetic oxygen depletion. The DLA states that despite low dissolved oxygen in the hypolimnia of Saddlebag and Tioga lakes, there is adequate refuge for fish. However, Figure 6.5-7 Length Frequency and Age Class Distribution for Brook Trout Captured in Saddlebag Lake During 2022 Sampling indicates that for several years there has been little to no recruitment of brook trout in Saddlebag Lake, and Figure 6.5-6 indicates limited brook trout recruitment in Tioga Lake. Multiple age classes of brook trout are entirely missing from the population in Saddlebag Lake. In contrast, 2022 stream fish data reported in the DLA indicate recruitment of brown and brook trout in upper Lee Vining Creek. The horizontal spatial extent of reduced dissolved oxygen in Saddlebag and Tioga lakes is not known, but the profiles collected and bathymetric data available indicate a substantial area of the reservoirs are likely not available as habitat in late summer/early fall. Additionally, the occurrence of anoxia and hypoxia in the reservoir hypolimnia during summer/fall after prolonged stratification suggests that this occurs under ice during winter as well. Unlike in summer/fall, the warmest reservoir water during winter is at the bottom of the reservoir which is also the likely preferred habitat for charr and where reduced oxygen limits available habitat8. 8 Blanchfield, P.J., Tate, L.S., Plumb, J.M., Acolas, M.L. and Beaty, K.G., 2009. Seasonal habitat selection by lake trout (Salvelinus namaycush) in a small Canadian shield lake: constraints imposed by winter conditions. Aquatic ecology, 43, pp.777-787.	See response to comment 54 for additional details on Project operations and DO. DO levels in reservoirs during winter and spring are limited due to inaccessibility. Water levels are drawn down in Tioga and Saddlebag Lakes for reservoirs to be able to capture water during spring melt, in accordance with the LADWP Sales Agreement. The potential reservoir stratification because of ice is a naturally occurring process and not a result of Project Operations. Fish condition for most fish in Saddlebag Lake were good, suggesting that water quality conditions in the epilimnion during summer/fall and in the water column in the winter are sufficient to support beneficial users. FLA Section 6.4.2.3 was updated to include additional analysis on project operations impact to DO (i.e., reservoir water level operations and water releases).
53	SWRCB	**Exhibit E** State Water Board staff have included the June 2024 comments discussing the 2022-2023 survey findings here for clarity: Dissolved Oxygen (DO): DO concentrations collected near the bottom of Saddlebag and Tioga lakes reached a minimum of 3.4 milligrams per liter (mg/L) and 0 mg/L in 2023, respectively. Dissolved oxygen was similarly low in summer 2022, indicating an ongoing condition which was not eliminated in a wet water year. The Lahontan Basin Plan objective for DO states: "The dissolved oxygen concentration, as percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum DO concentration be less than 80 percent saturation." The Basin Plan further states for waters with beneficial uses of COLD with SPWN (such as Lee Vining Creek), the following additional criteria are applicable: (1) a 7 Day Mean concentration of 9.5 mg/L, and (2) a 1 Day Minimum of 8.0 mg/L. While low DO in Project reservoirs is likely related to decomposition in the hypolimnion and sediments, the extent to which Project operations promote or create these conditions at Tioga and Saddlebag lakes should be analyzed; particularly, maintaining Project reservoirs at maximum depth throughout the summer stratification period.	Project operations have a less-than-significant effect on DO concentrations. Seasonal stratification and patterns of low or hypoxic conditions in bottom waters are naturally occurring and almost universally observed in temperate lakes throughout the world (Horne and Goldman 1994; Wetzel 2001), with occurrences of near saturating oxygen conditions throughout the water column found in relatively few oligotrophic lakes (e.g., Lake Tahoe, Courtright Lake). Because the mixed depth of the reservoir is controlled by basin morphometry and valley position effects upon wind fetch that pre-date and are unrelated to Project operations, operating water levels are expected to have little influence upon the development of seasonal hypoxia below the thermocline. Hypsographic curves of both Saddlebag and Tioga lakes indicate that stratification likely occurred naturally prior to dam construction; however, Saddlebag and Tioga lakes water levels are managed differently, which may have a minor influence on stratification patterns. Saddlebag Lake water levels decrease naturally throughout the summer and fall, which may result in more mixing and reduced stratification. Tioga Lake is maintained at a higher water surface elevation to comply with USFS 4(e) conditions and may reduce mixing and increased stratification. Water quality profiles collected from both Tioga and Saddlebag lakes in 2022 and 2023 indicate DO concentrations in the epilimnion, and metalimnion are consistently above 80% saturation and provide adequate DO to support aquatic beneficial uses. Furthermore, water released from Tioga and Saddlebag reservoirs is generally from the epilimnion where DO concentrations are near saturation and results in no DO issues observed downstream. The moderate water temperatures and available DO

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		In addition, the Project does not appear to have a moderate level of algal productivity as implied in the response provided in WQ-1 to the State Water Board's 2023 comment letter. Water quality data collected in 2022 and 2023 as part of WQ-1 demonstrate that Project reservoirs are likely ultra-oligotrophic, as indicated by total phosphorus concentrations which were below the minimum detection limit at all sampling events. The extent to which Project operations impact DO concentrations is still unclear and needs to be analyzed further.	in the metalimnion and epilimnion meet Basin Plan objectives and provide adequate refuge for fish during periods of low oxygen in the hypolimnion. Fish collected in these reservoirs are generally in good condition, indicating that there is sufficient DO in the reservoir to support the fish population, and toxins (i.e., un-ionized ammonia) are not present. FLA Section 6.4.2.3 was updated to include additional analysis on Project operations impact to DO (i.e., reservoir water level operations and water releases). Finally, further analysis attempting to achieve complete clarity about DO concentrations is not warranted, as there is sufficient evidence to document that Project operations are not causing a significant adverse effect.
54	SWRCB	**Exhibit E** pH: Saddlebag and Tioga lakes had minimum summer 2023 pH values of 5.5 and 5.1, respectively. pH in the hypolimnia of both Saddlebag and Tioga lakes was similarly low in summer 2022, indicating an ongoing condition which did not respond strongly to water year type. The Lahontan Basin Plan pH objective states that: "In fresh waters with designated beneficial uses of COLD9 or WARM10, changes in normal ambient pH levels shall not exceed 0.5 pH units." Low pH is likely related to decomposition, but as with DO, the extent of which Project operations impact pH should continue to be analyzed. State Water Board staff would still like to discuss the potential of protection, mitigation, and enhancement (PM&E) measures to address the low pH values. 9 Cold Freshwater Habitat is defined as beneficial uses of waters that support cold water ecosystems, including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates. 10 Warm Freshwater Habitat is defined as beneficial uses of water that support warm water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	Observations of pH outside of the ranges identified in the Basin Plan water quality objectives are due to several natural processes unrelated to Project operations. Because the geology of the surrounding watershed is granitic with low buffering capacity, small changes in dissolved CO2 (resulting from algal photosynthesis during daylight hours and from dark respiration of algae and bacteria at night) can result in variable pH potentially exceeding water quality objectives. For example, the higher pH concentrations in summer are consistent with higher levels of primary productivity during the longer daylight hours. Similarly low pH values are frequently observed in other high elevation watersheds (e.g., Upper American River) (Devine Tarbell & Associates, Inc., 2005). Salmonids are most sensitive to low pH during early life stages and reproduction; negative effects on salmonid reproduction generally occur at pH values below 5.5 (Weiner et al. 1986). Established Brook and Brown Trout populations in Project waters reproduce in stream channels, far from the influence of low pH levels found in the hypolimnion of Saddlebag and Tioga lakes during summer stratification. Hypsographic curves of both Saddlebag and Tioga lakes indicate that stratification likely occurred naturally prior to dam construction. SCE does not discharge nutrients or other substances that directly or indirectly alter pH, water released from reservoirs is generally from the epilimnion with higher pH levels, and the variations in pH are naturally occurring. Therefore, SCE does not propose any PME measure to address pH in Project waters since there is no nexus to Project operations and no significant effect on aquatic resources.
55	SWRCB	**Exhibit E** Bacterial: Fecal coliform bacteria data collected in 2023 were within the Basin Plan objectives, however, data collected in 2022 ranged from 49 to 540 most probable number per 100 milliliters (MPN/100 mL) on a single sampling date. The Lahontan Basin Plan objective for fecal coliform states that "The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 mL, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100mL." Although sampling from 2022 may have been an isolated incident, it is important to understand: (1) under what conditions caused the exceedance; and (2) how frequently exceedances occur. The results from the studies were inconclusive in determining why the exceedances occurred. State Water Board staff believe further discussions are appropriate to determine PM&E measures to address the high fecal coliform values in Project waters.	See response to comment 4 for possible sources of fecal coliform. The recreation facilities (i.e., campgrounds) are not affiliated with the Project, and Project operations do not directly discharge effluent; therefore, SCE does not propose any PME measures related to fecal coliform because there is no nexus to the Project.
56	SWRCB	**Exhibit E** Turbidity: Turbidity sampling data collected within Lee Vining Creek Downstream of Poole Powerhouse (Site LVC-DSPP1) from May through July 2023 ranged from 0 to 50 Nephelometric Turbidity Unit (NTU). Data collected in Lee Vining Creek near Lower Lee Vining Campground (Site LVC-DSPP2) from May through July 2023 ranged from 0 to 150 NTU. The Lahontan Basin Plan objective for turbidity states "Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent." From June through August of 2022, turbidity data shows that hydro-resource optimization events caused distinct, significant increases in turbidity. Relative to periods of stable low turbidity during minimum flows, clearly defined hydro-resource	See response to comment 22.

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		optimization events in summer 2022 caused turbidity to increase roughly 100% and 133%, 0.2 mile and 4.3 miles downstream of Poole Powerhouse, respectively. While equipment malfunctions and fouling can possibly skew data, there is still a concern for the correlation between peak flow rates and increased turbidity. Ongoing discussions between SCE and State Water Board staff should continue moving forward to determine appropriate PM&Es to address the spikes in turbidity and ensure the Project meets the Lahontan Basin Plan's water quality objectives.	
57	SWRCB	**Exhibit E** Section 6.5.2.1 Effects of Project Operations on Quantity and Quality of Aquatic Habitat for Fish Populations within Project-Affected Streams: In its 2024 comment letter, State Water Board staff requested additional information in the DLA regarding Project impacts on sediment supply, accumulation, and mobilization; particularly of gravels relevant to fish spawning habitat with additional elaboration on the results from the Aquatic Habitat Sediment (AQ-3) study. The DLA states "Overall, the results of the AQ-3 study suggest current Project operations have little effect on spawning habitat and reproductive success in Project reservoirs due to the abundance of suitable spawning gravel throughout Project-affected stream reaches." Yet the average quality score of 1.8 for gravel below Poole Powerhouse is much lower than the upstream reaches which received scores of 2.5 between the confluence of Slate Creek and Ellery Lake and 3.1 between Tioga Dam and the confluence of Lee Vining Creek. No explanation is given as to why the quality of sediment decreases downstream of Poole Powerhouse.	See response to comment 58.
58	SWRCB	**Exhibit E** Figure 6.5-21 Spawning Gravel Volume by Quality in Project-Affected Stream Reaches of the Lee Vining Creek Hydroelectric Project, 2023 further demonstrates that no "excellent"-scored spawning gravels were observed in Lee Vining Creek downstream of Poole Powerhouse. State Water Board staff request that the FLA include an explanation as to why SCE's operation of the Project has no impact on sediment transport; particularly suitable gravels for fish spawning downstream of Poole Powerhouse given the difference in gravel quality scores.	Limited mobilization of sediment (i.e., no net aggradation or incision of the channel) can and does occur in lower Lee Vining Creek from multiple sources, including natural peak flows, warm winter storms, and hydropeaking. Several variables can result in variation in spawning gravel quality in a watershed, including channel morphology, water depth, gravel shape (e.g., size, shape, angularity), embeddedness, and sediment sources. For example, a large scree deposit is downstream of Rhinedollar and immediately upstream of Poole Powerhouse, which provides a steady supply of angular sediment into lower Lee Vining Creek that likely impacts spawning gravel scores. Hydropeaking may mobilize smaller sized sediment, including spawning gravels; however, results of Study AQ-6 indicate that mobilization of smaller sediments (e.g., 12 mm D_{50}) in lower Lee Vining Creek may be selective and may not occur even under peak magnitude (e.g., 470 cfs) flow events. Selective mobility of smaller sediments is a common phenomenon in rivers and has been documented in lower Lee Vining Creek. Further, young-of-year and up to age 4+ brown trout were observed at the AQ-2 site in the reach below Poole, where hydropeaking occurs. These data indicate successful and regular spawning occurs based on the presence of multiple age classes. Therefore, there is no evidence to suggest that hydropeaking alone or in combination with other natural or management mechanisms is significantly affecting fish spawning success in lower Lee Vining Creek.
59	SWRCB	**Exhibit E** Section 6.5.2.1. Effects of Project Operations on Quantity and Quality of Aquatic Habitat for Fish Populations within Project-Affected Reaches provides a brief analysis of the potential for stranding after hydropeaking events. The analysis and its conclusions assume that: a) hydropeaking in spring (February through May) typically varies flows in Lee Vining Creek from 10 to 70 cfs, and b) fish population data collected at site LLVC-F1 is representative of fish throughout the entirety of lower Lee Vining Creek between Poole Powerhouse and the LADWP diversion. Flows through Poole Powerhouse have typically exceeded 70 cfs in spring since SCE began hydropeaking in 2015; daily averages exceed 100 cfs in April or May in 2016, 2017, 2020, and 2021. Sub-daily data in Figure 5.2-1 in AQ- 5 indicates that flows likely exceed 100 cfs earlier each year than daily averages capture. Modeled water depth should have assessed stage change including flows up to 100 cfs. The section concludes that, in part, because fish population results in AQ- 2 indicate a typical age-class distribution at site LLVC-F1, hydropeaking does not appear to have significant adverse impacts on young-of-year fish in spring. Fish population site LLVC-F1 is nearest to Lower Lee Vining Campground in DLA Table 6.5-15, where the maximum increase in stage between 10 and 70 cfs (0.7 feet) is nearly half that of the most upstream	Project-related flows that enter lower Lee Vining Creek in the spring comprise uncontrolled spill over Rhinedollar Dam, releases through the penstock, and/or minimum flow releases through a release valve at Ellery Lake (Exhibit B). The maximum capacity of flow through the Poole Powerhouse conveyance system is 110 cfs (Exhibit A). When flows in lower Lee Vining Creek exceed 110 cfs, it is due to flow input other than those used for Hydro-resource Optimization. The average magnitude of Hydro-resource Optimization events in the spring is approximately 65 cfs (see Table 6.4-3). Table 6.5-15 has been expanded to include stage changes up to 110 cfs, the maximum capacity of the Poole Powerhouse conveyance system. The relationship between water depth and flow is highly variable throughout lower Lee Vining Creek due to the complexity of channel morphology present such that water depth and flow varies both within a river cross-section and among them. While change in maximum water depth is higher for the most upstream sites relative to the most downstream site, a comparison of the average change in water depth across sites shows that the change in water depth across a range of flows differs between the most upstream and downstream site by only 0.1 feet. SCE agrees with the commenter that the linear extent of potential hydropeaking effects would be expected to decrease further downstream of the

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		site (1.2 feet; Big Bend Campground). AQ-2 Table 4.2-1 Fish Population Estimated Abundance, Density, and Biomass at All Fish Study Sites Sampled in September 2022 demonstrates that there is substantial variability in fish population metrics among sites in upper Lee Vining Creek, presumably responding to multiple variables. It should be expected that fish populations surveyed several river miles downstream of Poole Powerhouse, where peaking flows are attenuated, would exhibit a weaker response to those fluctuations than a population sampled near the powerhouse. The section also states that "no stranding has ever been documented", but neglects to note that it has never been systematically surveyed. State Water Board staff request that SCE include in the FLA an expanded analysis of potential fish stranding, as well as analyses of the other potential impacts of hydropeaking on downstream aquatic resources.	powerhouse and that results of Study AQ-2 support this hypothesis. Further, SCE agrees with the commenter that variability in fish population metrics likely occurs throughout Lee Vining Creek in response to varying habitat conditions and fish behavior. As described in Section 6.5.2.1 of the FLA, several empirical data sources (e.g., physical stream and habitat, biological, and hydraulic) were considered in the evaluation of stranding potential, in addition to anecdotal observations made during hydropeaking events while conducting a suite of studies over two years. Please also see responses to comments 25 and 27.
60	SWRCB	**Exhibit E** Section 6.5.2.2 Effects of Project Operations on Populations of Invasive Aquatic Algae in Project-Affected Stream Reaches: The section in part states "SCE would continue to operate and maintain the Project in accordance with the terms and conditions of the existing license. Because existing information indicates Project operations do not appear to be contributing to or increasing potential for invasive aquatic plants or Didymo in Project-affected streams…" Although Didymosphenia geminata (Didymo) was not observed during Project-related studies, Lee Vining Creek historically has had Didymo present in the system as noted in the DLA. Didymo is notoriously difficult to eradicate once it is established in a system. The available data indicate that Project operations are likely related to the development of nuisance growth of Didymo in Project reaches11. The FLA should include a measure which provides for intermittent monitoring of Didymo in upper Lee Vining Creek to determine the frequency and spatial extent of Didymo outbreaks and their relationship to Project operations. 11 Rost, A.L. and Fritsen, C.H., 2014. Influence of a tributary stream on benthic communities in a Didymosphenia geminata impacted stream in the Sierra Nevada, USA. Diatom Research, 29(3), pp.249-257.	See response to comment 20.
61	SWRCB	**Exhibit E** Section 6.9.2.3 Effects of Dispersed-Use Recreational Activities on Yosemite Toad and Habitat: The section states "Based on the analysis discussed above, the results of the TERR studies, and because the Proposed Action does not include changes to O&M activities, no adverse effects have been identified for Proposed Action." The Yosemite Toad (Anaxyrus canorus) Technical Report provided as part of the Terrestrial Wildlife (TERR-2) Technical report states "DNA samples collected in 2023 at the two sites within the study are scheduled to be processed and compared against a hybrid genetic panel currently being developed by the El Dorado National Forest. Because the sample and processing analysis are in progress, no results are yet available." If the populations of toad located in Upper Lee Vining Creek and adjacent to Tioga Lake are determined to be Anaxyrus boreas, the FLA should include discussion regarding the extent to which Project operations (i.e., flows within Lee Vining Creek and Tioga Lake levels) support habitat for these populations. Additional data collection may be required to understand whether Yosemite toad populations in these two areas are stable, or how they may respond to Project operations under various water year types. Additionally, State Water Board staff are yet to receive the laboratory results for the eDNA sampling of the Yosemite toads found in 2023. It is premature to say the Project has no adverse effects on Yosemite toads until the data is available.	No eDNA samples were taken during these studies. SCE is still waiting for the DNA samples to be analyzed. Based on the three years of studies, more than enough data have been obtained to determine Project effects on the Yosemite toad populations in the Project Area. Please see SCE response to USFS comment 9.
62	SWRCB	**Appendix E.1; Resource Management Plan** Table 3.2-1 and Section 3.2-1 indicates that sediment management at "intake areas" is proposed "as needed" as a Project maintenance activity, which is similar to language addressed in Comment 12. It is not clear how or where SCE is specifically proposing to remove sediment from Project facilities. State Water Board staff request SCE clarify the location of sediment removal activities in the FLA.	Sediment removal has not historically been necessary at the Lee Vining Project. As Table 2.2-1 indicates, if sediment removal was to be necessary at dam intake areas or diversion structures, it would be on an "as needed" basis and would be conducted with hand shovels.

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63	SWRCB	**Appendix E.1; Erosion Control Plan** Appendix D Plan for Control of Erosion, Stream Sedimentation, Soil Mass Movement, and Dust states that the Lahontan Regional Water Quality Control Board will be consulted, when appropriate, for use of erosion control and soil stabilization measures. This should be updated to include consultation with the State Water Board in a future license, as the State Water Board is the water quality certification authority for the Project.	An updated Erosion Control Plan has been included with Appendix E.1 (Volume II of the FLA). SWRCB has been added as a party for consultation throughout the Plan.
64	SWRCB	**Technical Reports** As stated in Section 1, SCE's Final Technical Reports, provided to State Water Board staff in April 2024, documenting results from Project studies in 2022 and 2023 were incomplete. State Water Board staff have yet to receive the eDNA results for the Yosemite Toad (Anaxyrus canorus) as described in TERR-2. Additionally, State Water Board staff have yet to receive the Visitor Intercept Survey described in the Recreational User Assessment Report (REC-1). The results from these studies are critical in helping State Water Board staff determine Project-related effects and appropriate PM&E's moving forward.	No eDNA samples were taken during these studies, and SCE is still waiting for the Yosemite toad DNA samples to be analyzed. The Draft REC-1 report was distributed to stakeholders on January 20, 2025, and has been filed with the FLA.
65	MLC	**General Comment** 3. Better transparency in public data sharing and coordination in SCE operations is needed to support downstream management and restoration efforts. In a comment submitted on 6/11/24 (Draft License Application Volume III, Table 1-1, Comment 29), MLC raised the following concern: SCE should publicly share real-time data for reservoir storage and flows, including the hourly and telemetry requirements found here (https://www.waterboards.ca.gov/waterrights/water_issues/programs/diversion_use/water_measurement.html#who-needs-to). Reporting these data to SWRCB appears to be required by state law, and these data are also essential for LADWP reporting and operations downstream. SCE's FERC license should have provisions that do not conflict with SWRCB requirements and where possible facilitate LADWP compliance with its water rights licenses. The California Department of Water Resources is seeking to add daily storage information from this project to the California Data Exchange Center, and as with other projects, can add a time lag that has addressed any market manipulation concerns at other projects. This is important for runoff tracking, downstream LADWP operations, restoration, and monitoring license requirements, as well as public recreation. SCE's response to this comment was "SCE is in compliance with SB88 water rights reporting requirements. This information can be found on the referenced Website in your comment." We were unable to identify the exception on the Website to which SCE is referring. SCE should be more specific about what it is required to report. Based on the size of the diversion, it appears SCE is subject to the telemetry requirements found at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/measurement_regulation/telemetry_requirements.html. Regardless of whether SCE is subject to SB88, due to the high level of public interest in this Project, FERC should require SCE to publicly share real-time, daily, or weekly data on reservoir storage and flows or provide documentation explaining why it cannot. SCE's reservoir storage data is essential for calculating unimpaired runoff, ensuring accurate runoff forecasts, and managing downstream operations at Los Angeles Department of Water & Power (LADWP) facilities. Both MLC and LADWP rely on timely SCE reservoir storage data to anticipate flow fluctuations at the LADWP diversion dam, including the timing and magnitude of peak flows. Additional data on flow, snowpack, and meteorology are also critical for operations and forecasting, while reservoir stage and streamflow data are of significant interest to the public due to the area's recreational and research values. Prior to the year 2000, SCE shared operations, flow, and storage data more openly with MLC and LADWP, including preliminary daily data and future reservoir storage and release projections. Providing timely notifications of sudden flow changes would improve downstream management and compliance with regulatory requirements. Since deregulation in 2000, the only publicly accessible SCE data from the Lee Vining Project are posted on the following two websites:	SCE will work with relicensing participants to develop a proposed license measure to provide daily reservoir storage and streamflow information (data) from the Project. The data will be provided via the internet and may be posted directly from SCE or through a third party. Please see response to comment 16.

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		1. California Data Exchange Center (CDEC): snow surveys, weather stations, and end-of-month Saddlebag Lake Reservoir level 2. United States Geological Survey (USGS): daily reservoir storage and flows posted approximately six months after the end of the water year (e.g. 2024 water year data is posted by April 2025). Public interest considerations in favor of timely data sharing and notifications of sudden flow changes and planned operations to interested parties include: 1. The California Department of Water Resources is seeking to add daily storage information from this project to the California Data Exchange Center. With other projects it has added a time lag when necessary to address concerns that the data might be used for market manipulation. 2. In order to calculate unimpaired flows (for use in forecasting and comparing observed to forecasted runoff), SCE's reservoir storage data is necessary. Currently, SCE's data aren't available until they are posted on the USGS Website about six months after the end of the water year. This delay reduces the effectiveness of water management and requires guesswork and estimation. Over the past twenty years MLC has estimated SCE storage based on in-person visits to reservoirs, satellite and aerial photos, and the use of past years with similar hydrology. This additional effort would be unnecessary if SCE shared data in real-time. 3. LADWP's water rights licenses require it to coordinate with SCE, and coordination and communication allow better management of LADWP's system and the streamflows it releases; better management would likely benefit the ecosystem in the restoration reaches of Lee Vining Creek from the LADWP diversion downstream to Mono Lake. For example, the operation of the Lee Vining Creek diversion dam (diversions, releases, and peak flow and sediment bypass) is more efficient when LADWP can anticipate upstream operations. LADWP installed a Langemann gate in 2005, allowing LADWP to mitigate many of the biggest problems caused by upstream flow fluctuations. However, communication with LADWP about expected flow changes is still helpful in the operation of that facility. 4. Certain years have large error in LADWP's runoff forecast. Sharing of SCE's data in real-time could ground truth and improve runoff forecasts. Improved forecasting would help avoid problems such as the extremely low Grant Lake Reservoir levels (relevant because Lee Vining Creek diversions enter this reservoir) that resulted from an over-forecast in 2008. A 2013 settlement agreement between LADWP, CDFW, Cal Trout, and MLC requires monthly reporting of unimpaired flows by LADWP in order to compare observed to forecasted runoff and to identify errors in forecasting as quickly as possible, so that water management changes can be made. 5. In years when Aerial Snow Observatory data are available, pairing that data with unimpaired flow is necessary to generate a runoff efficiency curve for that year. Delays in the release of SCE storage data hamper efforts to use the best available snowmelt monitoring and forecasting techniques. 6. Public safety and recreation considerations would be better informed by anticipated reservoir levels, when dams are expected to spill, or when sudden flow fluctuations are expected. Expected operations as well as real-time data would allow recreationists to better plan their activities (e.g. fishing, boating, hiking, camping). MLC operates an Information Center in Lee Vining that is also the Lee Vining Chamber of Commerce, providing visitor information to thousands of recreationists each year. MLC also has a newsletter and a blog that disseminates information about the conditions in the area. Timely data from the Project would allow MLC to better serve the public. 7. MLC conducts monitoring in Lee Vining Creek and coordinates with other researchers who would also benefit from the sharing of SCE's real-time information. For example, in May 2018, researchers studying the April 5–7, 2018 rain event that produced "spectacular hydrological and geomorphic impacts" (Sue Burak, May 29, 2018 personal communication) were looking for observations of debris flows and flooding in order to quantify how anomalous the event was. They tried to access USGS discharge data for Lee Vining Creek below Rhinedollar Dam, but learned that current discharge data were not available until the following year. We recommend that as a PME measure, SCE share the following provisional data: 1. On a real-time website: Planned and actual daily reservoir storage and flows. Example from SCE's Big Creek Project: https://www2.kisters.net/scepublic/.	

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		2. With agencies and stakeholders: monthly data sheets containing daily reservoir storage and flows as was routinely shared upon request during the decade when the Project was last relicensed. 3. Annually in April: Forecasted runoff and planned operations and anticipated monthly storages for the year. 4. With LADWP: notifications of changes to planned operations and sudden flow changes. This PME measure would protect the public interest in timely access to the best available information on hydrology and Project operations for recreationists and researchers. Especially when paired with the same PME on Rush Creek, it would improve management of Rush and Lee Vining creeks downstream of the LADWP diversion, Grant Lake Reservoir, and Mono Lake by facilitating informed decision making and flow tracking.	
66	MLC	**Exhibit E** 4. Better oversight of vegetation management is needed to mitigate impacts to riparian vegetation The Botanical Technical Study, on page 6-150 of Volume I of the DLA, notes that despite California Department of Fish & Wildlife, US Forest Service, and SWRCB consultations, Population 2 of Black Cottonwood (Populus trichocarpa) was unintentionally removed during large scale vegetation removal in fall 2022. We commented on this on 6/11/24 (Draft License Application Volume III, Table 1-1, Comment 34) and SCE's response was "All tree removal conducted in the vicinity of Poole Powerhouse was done in consultation with CDFW and USFS as part of the Wildfire Mitigation Plan." We are concerned that despite this consultation, 8 healthy cottonwood saplings were "unintentionally" cut down (despite being more than 200 feet away from the nearest structure). The lack of care in this clearing indicates there may be a need for additional license conditions that protect important riparian species. We also recommend mitigation for the loss of these black cottonwoods in the form of tree planting and an explicit review of the CDFW/USFS consultation and contractor procedures to understand what went wrong and how this can be avoided in the future. In addition, there is a population of Rocky Mountain Maple (Acer glabrum) (one of only two such populations in the Mono Basin) on the hillside above the Poole Powerplant, and this population should also be protected from fuel reduction efforts taken to reduce risks to project facilities (i.e. powerhouse and power lines).	As stated in the DLA, the vegetation clearing at Poole Powerhouse was conducted in consultation with USFS and CDFW. The work was completed as part of SCE's commitment to wildfire safety and preparation. Rocky mountain maple and black cottonwood are not federally or State-listed as Rare, Threatened, or Endangered species; they are not considered "special-status" by CDFW, they do not have a designated California Rare Plant Rank; and they are not considered a Species of Concern by the Inyo National Forest. SCE will continue to work with the agencies on best management practices where appropriate.
67	MLC	**Technical Reports - General Comment** The DLA insufficiently describes hydro-resource optimization and associated environmental downstream impacts. Table 1-1. Consultation Summary—Response to Comments on Draft Technical Reports summarizes comments provided to SCE on the Draft Technical Reports. The following resource reports received comments pertaining to SCE's hydro-resource optimization operations, known in the scientific community as hydropeaking: WQ-1 Water Quality, AQ-2 Stream Fish, AQ-3 Habitat Mapping, AQ-5 Operations Model, AQ-6 Channel Morphology, TERR-1 Botanical, and TERR-2 Wildlife. While MLC is appreciative of SCE's continued engagement on the concerns raised by stakeholders pertaining to hydropeaking, the DLA fails to analyze key aspects of SCE's hydro-resource optimization events. In so doing, the DLA fails to adequately analyze the incremental and cumulative impacts of hydropeaking in Lee Vining Creek. The following discussions seek to highlight specific ways in which the resource reports in the DLA fail to adequately address stakeholder concerns demonstrated by MLC comments submitted on the Draft Technical Reports and SCE's response to those comments. The following discussions also outline opportunities for SCE to ameliorate these concerns in the FLA.	Potential impacts of Project operations, including hydropeaking, are analyzed in Exhibit E of the FLA. While SCE agrees the peer-reviewed studies conducted in different river systems with different operation constraints documented adverse effects of hydropeaking, SCE notes that many of the studies referenced by the commenter illuminate mixed effects of hydropeaking on downstream aquatic ecosystems. SCE believes that the studies conducted to date as part of this relicensing provide sufficient information to determine whether Project operations have a significant, ongoing adverse effect on aquatic resources.
68	MLC	**Technical Report: Stream and Reservoir Water Quality (WQ-1)** In comments submitted on 6/11/24 pertaining to the WQ-1 Draft Technical Report, California State Water Resources Control Board (SWRCB) noted that "from June through August of 2022, turbidity data shows that hydro-resource optimization events caused distinct, significant increases in turbidity" and that there is a "concern for the correlation between peak flow rates and increased turbidity." SCE's response noted the comment, stated that PME discussions are ongoing, and that "no adverse effects on species have been observed." SCE also	Please see responses to comments 22, 51, and 56. SCE conducted turbidity monitoring in lower Lee Vining Creek and in several unimpaired tributaries in the Lee Vining Creek watershed. Results of these monitoring efforts are available in Volume III of the FLA. Turbidity was measured using Nephelometric Turbidity Unit (NTU) because the Water Quality Control Plan for the Lahontan Region sets forth regulations as measured by NTU, and the stated objective of the study was to assess the Project's consistency with those objectives. Measuring turbidity

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		raised uncertainty about distinguishing Nephelometric Turbidity Unit (NTU) increases associated with hydro-resource optimization events and increases "independent of Hydro-resource Optimization" (Draft License Application Volume III, Table 1-1, Comment 82). This exchange raises questions and demonstrates the need for SCE to clarify the following: i. Relationship between hydropeaking and turbidity a. What is the specific relationship between hydropeaking events and observed turbidity increases? b. How significant are the increases in turbidity during hydropeaking events compared to other flows/operational configurations? c. How is hydropeaking affecting turbidity levels across seasons or water year types? To address the uncertainty raised by the WQ-1 Final Technical Report, the FLA should address each of the concerns described above in its Environmental Analysis. Further, SCE should include PME measures and operational changes (e.g., reducing hydropeaking frequency, adjusting seasonal timing of hydropeaking events, and/or reducing hydropeaking magnitudes) necessary to mitigate turbidity increases and/or mitigate ecological impacts during ecologically critical periods. If, however, SCE cannot adequately address the relationship between turbidity and hydro-resource optimization, SCE should undertake a hydropeaking-specific study, with the goal of addressing the questions above. MLC is concerned that the uncertainty pertaining to the causal relationship between hydropeaking and water quality borne from the WQ-1 Final Technical Report is significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.	using NTUs, which measure light refraction, does not necessarily correlate with increased suspended sediment loads (Bash et al. 2001). SCE acknowledges that turbidity as measured by NTUs may increase with hydropeaking and that there appears to be a wide range of variability in turbidity conditions (FLA Section 6.4.2.3). However, good fish nutritional state and other indicators of a healthy aquatic community were observed from Study AQ-2, indicating that the ecological community in lower Lee Vining Creek is accustomed to a wide range of turbidities. Therefore, it is reasonable to conclude that turbidity is having a less-than-significant adverse effect on water quality for aquatic beneficial uses. Finally, limited "uncertainty pertaining to the causal relationship between hydropeaking and water quality" is not sufficient to merit additional study because it is clear that any adverse effects on aquatic resources are already less than significant. In response to commenter questions: a. Hydropeaking events in lower Lee Vining Creek correlated with turbidity increases of up to ~20 NTU, as seen in August and September of 2022 at Site LVC-DSPP2 (Appendix D of the Water Quality Technical Report), although during many other periods of the study these peaks associated with hydropeaking were approximately 2–5 NTU. From July through October of 2022, hydropeaking events did not generally correlate with increases in turbidity at Site LVC-DSPP1, and a number of time frames were identified where hydropeaking appears to actually decrease turbidity in lower Lee Vining Creek. Turbidity peaks of a similar or greater magnitude than those seen in correlation with hydropeaking were also seen in these months during time frames that do not correlate with hydropeaking releases, indicating that natural processes are generating similar or greater temporary turbidity peaks to what is seen during hydropeaking. Hydropeaking may increase the frequency of temporary turbidity increases, but the magnitude of these peaks does not appear to increase. b. Lower Lee Vining Creek has a high natural variation in turbidity, as is common in streams fed by glacial meltwater (Lloyd et al. 1987). For instance, during peak snowmelt run-off conditions in the summer of 2023, turbidity was elevated to 20-100 NTU at both monitoring locations in lower Lee Vining Creek for weeks at a time (Appendix D of the Water Quality Technical Report). Turbidity peaks up to ~100 NTU at site LVC-DSPP1 and up to ~200 NTU at LVC-DSPP2 were observed during this time. Hydropeaking was generally not occurring during this time. Since the largest turbidity increases associated with hydropeaking appear to be ~20 NTU, well within the range of natural turbidity variation, it is expected that this should have less than a significant effect on aquatic resources in lower Lee Vining Creek. c. Hydropeaking did not occur until later in the summer in 2023 due to high run-off conditions, making it difficult to assess the effects of hydropeaking during a wet year. However, it can be assumed that lower flow conditions during dry years may exacerbate any turbidity increases related to hydropeaking releases when compared to wet years. Data obtained in 2022 are therefore sufficient to characterize the effects of hydropeaking on aquatic resources in lower Lee Vining Creek, as late-summer Hydro-resource Optimization during a dry year provides a worst-case scenario in which flows are naturally low. Since the largest turbidity increases observed with hydropeaking during the late summer of 2022 were only ~20 NTU, a level where very little effect upon aquatic resources is expected, it can be assumed that during wet years these effects would be even smaller.
69	MLC	**Technical Report: Stream and Reservoir Water Quality (WQ-1)** ii. Ecological impacts of turbidity increases a. What studies or monitoring data support SCE's claim that no adverse effects on species have been observed due to increased turbidity? b. How are species of benthic macroinvertebrates (BMI) (specifically mayflies, caddisflies, and stoneflies) and each species of observed fish (specifically brown trout, rainbow trout, and brook trout) affected by short-term turbidity spikes?	SCE studies of fish populations, spawning gravel quality, and habitat conditions all support the conclusion that the level of turbidity increase reasonably attributed to the Project does not cause significant adverse effects on aquatic resources. The WQ-1 study was not designed to directly study the impacts of turbidity increases on benthic macroinvertebrates. BMI are used as an aquatic habitat quality indicator due to their sensitivity to environmental conditions. The BMI community is the primary food source for fish in Project waters, and fish conditions in Lee Vining Creek are good, indicating that BMI communities are healthy and able to support a healthy nutritional state in the fish population.

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		c. How do repeated hydropeaking events and associated turbidity increases cumulatively affect aquatic habitats and species over time? The literature suggests winnowing of fine sediments would be occurring due to this operation (see later comments regarding AQ-3 Final Technical Report).	Please also see responses to comments 22, 51, and 56.
70	MLC	**Technical Report: Stream and Reservoir Water Quality (WQ-1)** iii. Attribution of turbidity sources a. How were NTU increases attributed to hydropeaking versus other causes? b. What data gaps or methodological challenges contribute to the uncertainty in distinguishing turbidity increases caused by hydropeaking from those due to other factors? c. Are there opportunities to refine the analysis or modeling to address these uncertainties?	Increased streamflows in Lee Vining Creek, absent any hydropeaking activity, were used to determine if increased turbidity was attributed to hydropeaking or other causes. Sensor fouling contributed to the methodological challenges and uncertainty of turbidity increases because the sensors were not equipped with a wiper to clear turbidity. Although there were equipment malfunctions, turbidity data indicate that the increases in turbidity during hydropeaking were within background levels observed in Lee Vining Creek and stream reaches upstream of the Project. Sufficient information was collected to determine that ongoing operation of the Project is not causing significant adverse effects on aquatic resources relating to turbidity changes.
71	MLC	**Technical Report: Stream and Reservoir Water Quality (WQ-1)** iv. Mitigation and operational adjustments a. What potential PME measures are under discussion to address turbidity spikes resulting from hydropeaking events? b. Are there operational modifications (e.g., reducing hydropeaking frequency, adjusting seasonal timing of hydropeaking events, and/or reducing hydropeaking magnitudes) that could mitigate turbidity increases and/or mitigate ecological impacts during ecologically critical periods?	Please see responses to comments 22, 51, and 56. No significant adverse effects have been observed or are inferred from the studies conducted to date, so no PME measures or future studies related to hydropeaking are being proposed.
72	MLC	**Technical Report: Stream and Reservoir Water Quality (WQ-1)** v. Monitoring and future studies a. Could more detailed monitoring of turbidity during hydropeaking events be conducted to reduce uncertainty and clarify impacts? b. Would continuous monitoring or targeted studies during hydropeaking and during high turbidity periods help differentiate sources and better understand ecological effects?	See response to comments 68 through 71.
73	MLC	**Technical Report- Stream and Reservoir Water Quality (WQ-1)** vi. Historical and regulatory context a. How do observed hydropeaking events in the WQ-1 Final Technical Report compare to observed hydropeaking events over the last 10 years and potential future hydropeaking events (e.g., hydropeaking frequency, seasonal timing, and magnitude)? b. How will SWRCB's concerns about turbidity and peak flows be addressed in the licensing process?	Section 6.4.1.3 includes analysis on observed Hydro-resource Optimization events, including the duration, magnitude, and frequency by season between 2015–2023. Operation of the Project is expected to continue in the future in a manner similar to that of the past 10 years. Please see responses to comments 22, 51, and 56.
74	MLC	**Technical Report - Stream Fish Populations (AQ-2)** In comments submitted on 6/11/24 pertaining to the AQ-2 Draft Technical Report, MLC noted that "Kennedy et al. 2016 documents how hydropeaking can prevent viable populations of many aquatic insects from inhabiting rivers. Hydropeaking can eliminate some groups of aquatic insects, such as mayflies, caddisflies, and stoneflies. (…) The authors found that rivers with greater variation in the volumes of discharged water were also home to fewer types of aquatic invertebrates. (…) Reducing hydropeaking during crucial egg-laying periods for aquatic insects could benefit river communities. There does not appear to be a study report addressing these concerns." SCE's response did not address these concerns, emphasizing instead that "results of [AQ-2] study indicate that the fish populations within Project-affected stream reaches are self-sustaining and in good condition. Condition factors reflect a healthy nutritional state of fish, related to size and growth based on habitat conditions, including water temperature, water quality, flow, and food resources. Additionally, self-sustaining fish populations composed of predominantly insectivorous species (i.e., trout) indicate BMIs in Project-affected reaches are sufficiently abundant to support fish condition." (Draft License Application Volume III, Table 1-1, Comment 1).	SCE agrees with the commenter that fish populations in lower Lee Vining Creek are self-sustaining and exhibit good fish condition, which are indicators that Project operations are not having a significant, adverse, ongoing effect on lower Lee Vining Creek fish populations. Because reasonably available historical fish population information does not exist for lower Lee Vining Creek, a comparison could not be made to pre-hydropeaking population metrics. However, a comparison of fish condition values in lower Lee Vining Creek, where hydropeaking occurs, to fish condition values in upper Lee Vining Creek, where hydropeaking does not occur, demonstrates that hydropeaking has a less-than-significant effect on the fish population in lower Lee Vining Creek. Further, condition values for brown trout and rainbow trout in lower Lee Vining Creek were consistently within the range of values reported in western Sierra Nevada streams (0.8 to 2.0 with a mean condition factor generally 1.2 or below [Beak 1991; EA 1987; Ebasco Environmental 1993; Wilcox 1994; Hanson Environmental 2005]) and with Bishop Creek, a nearby creek where no hydropeaking occurs (Bishop Creek Hydroelectric Project-FERC Project No. 1394).

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		While SCE may have produced a study that demonstrates that fish populations in the project-affected area are self-sustaining and in good condition, this does not ameliorate the concern, based on the literature, that SCE's hydro-resource optimizations are having a significant negative impact on BMIs and fish populations. The body of scientific literature on hydropeaking impacts suggests that SCE's hydro-resource optimizations are likely having a negative impact on fish populations. A systematic review of the impacts of hydropeaking incorporating 155 relevant studies determined that "within the studies relating fish and hydropeaking, articles focusing on habitat almost unanimously agree on its degradation (16 studies out of 20). Literature also agrees on the overall negative effect of hydropeaking on fish density (13 studies out of 14), stranding (10 studies), survival (8 studies out of 11), diversity (3 studies out of 4) and spawning (4 studies). On the other hand, the impact of hydropeaking on fish length, growth, and dietary activities is more debated, as the ratio between studies claiming a negative or positive/null effect is more balanced." (Bipa et al., 2024, page 11) MLC is concerned that SCE is attempting to use current fish population data produced by the AQ-2 Final Technical Report as justification for ignoring how hydro-resource optimization activities have had a likely negative impact on fish populations over the last decade. Since significant hydropeaking did not occur in Lee Vining Creek until 2015, fish population condition and project impacts should be analyzed based on pre-hydropeaking conditions. Because SCE has not analyzed or ruled out the likely negative impacts of hydro-resource optimization on fish populations in the project-affected area, several key questions remain unanswered: i. Impacts of hydropeaking on aquatic ecosystems a. How has hydropeaking affected the diversity, abundance, and life cycles of aquatic insects and fish populations in project-affected reaches? b. Are there data or studies assessing the specific impacts of hydropeaking on aquatic insects and fish populations before and after the implementation of more intensive hydro-resource optimization activities (2010–2014 and 2015–2023 when activities increased)? c. How does the presence of self-sustaining fish populations definitively indicate that hydropeaking is not negatively affecting fish or their food supply in terms of both abundance and diversity? MLC believes that the concerns raised from the AQ-2 Final Technical Report are significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.	The commenter's "concern, based on the literature" is not based on the available data from Lee Vining Creek, nor does the "body of scientific literature on hydropeaking" consider background conditions in Lee Vining Creek or the specific operation of the Project. The best available site-specific information on Lee Vining Creek water quality and biological resources suggests the existing trout species (both introduced and planted species) are not experiencing a significant, adverse, ongoing effect due to Project operations. Finally, regarding the effect of hydropeaking on BMIs, the Kennedy et al. (2016) paper articulates that the sensitivity of different invertebrate life stages to hydropeaking is dictated by the unique life history strategy employed by the species. BMI taxonomic and life history diversity present in the stream reach should buffer against a ubiquitous effect of Project operations on BMI communities. Because the BMI community is the primary food source for fish in Project waters and fish conditions in Lee Vining Creek are good, it is reasonable to conclude that BMI communities in this reach are healthy and able to support the fish population.
75	MLC	**Technical Report - Stream Fish Populations (AQ-2)** ii. Seasonal and temporal considerations a. Are there data or studies assessing the impacts of the seasonal timing, frequency, and magnitude of hydropeaking events on aquatic insects and fish populations? b. Since hydropeaking activities greatly increased in 2015 under the current license, is there a need to analyze potential impacts to fish populations under O&M configurations with additional increases in hydropeaking activities?	See responses to comments 74 and 79.
76	MLC	**Technical Report - Stream Fish Populations (AQ-2)** iii. Cumulative and long-term effects a. Could reductions in aquatic insect diversity and abundance due to hydropeaking result in cumulative effects on trout health, such as reduced growth rates, reproductive success, or resilience to environmental stressors? b. How do repeated hydropeaking events over time cumulatively affect aquatic insects, fish populations, and overall ecosystem health?	See response to comment 74.

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77	MLC	**Technical Report - Stream Fish Populations (AQ-2)** iv. Mitigation and operational modifications a. What operational modifications (e.g., reducing hydropeaking intensity, frequency, or adjusting seasonal or daily timing) could mitigate harm to aquatic insects, fish populations, and their food supply? b. Could functional flow regimes, including reduced hydropeaking variability, improve conditions for aquatic insects, trout populations, and overall ecosystem health? c. What PME measures could be implemented to address potential harm caused by hydropeaking (e.g. avoid hydropeaking during fish spawning seasons)?	See response to comment 71.
78	MLC	**Technical Report - Stream Fish Populations (AQ-2)** v. Monitoring and adaptive management a. Could more detailed and ongoing monitoring of aquatic insects and fish populations during hydropeaking events be conducted to reduce uncertainty and improve understanding of impacts? b. Can adaptive management be incorporated into the license to allow for operational adjustments based on potential future observed ecological impacts?	See response to comment 71.
79	MLC	**Technical Report - Aquatic Habitat Mapping and Sediment Characterization (AQ-3)** In comments submitted on 6/11/24 pertaining to the AQ-3 Draft Technical Report, MLC raised concern that "the aquatic habitat mapping study (AQ-3) does not focus on relevant metrics, such as fish habitat at different flow rates, and the effects on fish of rapidly varying those flow rates during sensitive seasons." SCE's response correctly identified that the "DLA includes an evaluation of habitat as a function of streamflow (Appendix E.3, provided in Volume II of this DLA)", but neither this response nor Appendix E.3 address the specific concern of varying flow rates during sensitive seasons as expressly stated (Draft License Application Volume III, Table 1-1, Comment 4). For example, Figure 1-4 in Appendix E.3 demonstrates that there is a very sharp response in percentage of weighted usable area (WUA) for spawning brown trout between minimum flows and 80 cubic feet per second (cfs) in Lee Vining Creek between Poole Powerhouse and the Los Angeles Department of Water and Power (LADWP) Diversion Dam. Rapidly varying flow rates produced from hydro-resource optimization would therefore produce rapidly varying usable area for spawning brown trout. In essence, hydro-resource optimization events likely produce a functionally reduced usable area for spawning brown trout during biologically sensitive time periods, which is inadequately addressed by the current WUA vs. Discharge charts. Additionally, the AQ-3 Final Technical Report identifies that "Spawning gravel in lower Lee Vining Creek decreased in abundance from upstream to downstream, but the quality was lower in the upstream section of the reach (Figure 4.2-4). Gravel deposits in lower Lee Vining Creek were primarily semiactive. In Glacier Creek, large, deep deposits of excellent and good quality spawning gravel were evenly distributed and mostly active throughout the reach (Figure 4.2-5). Spawning gravel particle size distribution and individual patch size are included in Appendix D." (Draft License Application Volume III, AQ-3 Final Technical Report, Page 14). These observations are not adequately discussed or interpreted and should address whether spawning gravel abundance or quality could limit fish populations.	Study AQ-3 was designed to characterize habitat and spawning gravel distribution throughout the Project Area. An evaluation of habitat as a function of streamflow is available in Appendix E.3 (included in Volume II of the FLA). Habitat availability fluctuates as a function of streamflow, as shown in Appendix E.3. The commenter implies that spawning habitat for brown trout varies sharply, with decreases between 80 and 27 cfs; however, the habitat flow relationship depicted in Figure 1-4 of Appendix E.3 actually shows a bell-shaped relationship, with peak (100%) WUA occurring at ~ 40 cfs and about 60% of WUA occurring at 27 cfs (MIFs during fall) and 80 cfs. These data suggest that Project operations generally provide more than 60% of maximum spawning habitat as a function of streamflow. This, in combination with the abundance of suitable spawning gravel available in lower Lee Vining Creek and the fact that successful and regular recruitment occurs in the fish population, indicates that instream flow releases are having a less-than-significant adverse effect on fish populations in lower Lee Vining Creek. FLA Section 6.5.1.4 describes the variability in spawning gravel quantity and quality throughout the Project Area. A multitude of variables can result in variation in spawning gravel quality in a watershed, including channel morphology, water depth, gravel shape (e.g., size, shape, angularity), embeddedness, and sediment sources. For example, a large scree deposit is located below Rhinedollar Dam and immediately upstream of Poole Powerhouse and provides a steady supply of angular sediment into lower Lee Vining Creek that likely impacts spawning gravel scores. Simply because spawning gravel is fair to good in lower Lee Vining Creek does not in and of itself indicate a significant, ongoing, adverse effect of Project operations on fish spawning. Brown trout recruitment in lower Lee Vining Creek observed during Study AQ-2 was similar to those observed in Lee Vining Creek upstream of Glacier Creek (Figure 6.5-14 in the FLA). These data demonstrate the brown trout population within lower Lee Vining Creek is self-sustaining and the habitat provides suitable conditions for all life stages of trout. Furthermore, abundance and biomass estimates of brown trout in lower Lee Vining Creek are within the range of values reported for the watershed (Table 6.5-4 in the FLA) and are similar to those reported in Bishop Creek, a similar sized Eastern Sierra Stream where no hydropeaking occurs (Bishop Creek Hydroelectric Project- FERC Project No. 1394). Because brown trout abundance in lower Lee Vining Creek is similar to abundances observed in upper Lee Vining Creek and well within the range of values reported for sites in Bishop Creek, it does not appear to be a significant adverse effect to the brown trout population as a result of Project operations.

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80	MLC	**Technical Report - Aquatic Habitat Mapping and Sediment Characterization (AQ-3)** Furthermore, the findings in the AQ-3 Final Technical Report regarding the spatial distribution and quality of spawning gravel in Lee Vining Creek raise questions about sediment dynamics that warrant further exploration, particularly considering hydropeaking's influence. Bipa et al. (2024) identifies several ways in which hydropeaking influences sediment transport in ways that should be addressed in the AQ-3 Final Technical Report and Environmental Analysis section of the FLA: In the case of particles entrainment under frequent hydropeaking, López et al. (2020) provided circumstantial evidence that the hydropower station's peak discharge primarily impacted the adjacent downstream river section, causing the entrainment of fine to medium-sized gravels. The movement of finer sediment fractions from the riverbed termed as partial transport, involving selective transportation downstream of the hydropower plant. This process gradually shifted sand and smaller gravel to more distant points downstream. The effects of hydropeaks on river-bed particle mobility was also observed by Vericat et al. (2020). (…) Hydropeaking induces frequent and selective bed movement, depleting fine sediment patches on the riverbed and causing the gradual loss of intermediate fractions, including medium-sized gravel. While the substantial structural components like boulders within the channel remain stationary, sand and finer gravel in bed patches are consistently washed away, and intermediate to larger gravel fractions eroded from inner spaces. Bucek et al. (2021) also stated that hydropeaking had negligible effect on the bedload transport in the studied cross section, located 23.42 km downstream from power plant. On the other hand, López et al. (2023) stated that the peak discharge from the hydropower plant mainly affected the most distant downstream portion, situated at approximately 17 km downstream. There, finer fractions of the riverbed were entrained, including coarse gravels. Hydropeaking induced size-based selective partial transport downstream, shifting sand and small gravel, enhancing armor on the riverbed, and decreasing fine sediment presence. (Bipa et al., 2024, page 10). The observed decrease in gravel abundance downstream and the lower quality of upstream gravel deposits are consistent with documented patterns of sediment entrainment and selective transport under hydropeaking conditions, as highlighted by studies such as López et al. (2020) and Vericat et al. (2020) stated above. These studies describe hydropeaking-induced mobility of fine to medium-sized gravel leading to downstream sediment depletion and altered particle size distributions. However, the AQ-3 report does not provide sufficient interpretation of how these patterns relate to hydropeaking or how they interact with the findings from the AQ-6 Channel Morphology Final Technical Report. A more integrated analysis is needed to clarify how hydropeaking influences sediment characterization, functional fish habitat availability, and the broader geomorphic processes shaping Lee Vining Creek. SCE should address comments to focus and guide further discussion and efforts pertaining to fish habitat concerns borne from hydro-resource optimization. Additional efforts are needed to adequately understand results from the AQ-3 Final Technical Report as they relate to other resource reports, specifically the AQ-6 Channel Morphology Final Technical Report and perhaps the AQ-5 Operations Model Final Technical Report. The questions raised from the AQ-3 Final Technical Report are significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.	See response to comment 79. Hydropeaking may mobilize smaller-sized sediments, including spawning gravels within lower Lee Vining Creek. However, results of Study AQ-6 indicate that selective transport of coarse sediment greater than 2 millimeters occurs throughout the study area such that even the historically large spring snowmelt runoff season in 2023 with a peak flow of 581 cfs did not always move the coarse fraction (Volume III, AQ-6 Technical Report, Section 4). Tracer recovery was conducted over multiple days in September 2023 when total flow in lower Lee Vining Creek ranged from approximately 60 cfs up to 160 cfs. During this time, surveyors did not identify any measurable disturbance or entrainment of tracer particles down to 16 mm.
81	MLC	**Technical Report - Operations Model (AQ-5)** The AQ-5 Operations Model Final Technical Report provides an important framework for understanding the operational patterns of the Project, including the significant escalation in hydropeaking activity since 2015. However, the report fails to adequately address how hydropeaking will be managed under the new license or to assess its long-term ecological consequences. This omission is alarming given the substantial increases in both the magnitude and frequency of hydropeaking events in recent years and the well-documented impacts of hydropeaking on downstream fish populations and habitat quality in scientific literature. The AQ-5 Final Technical Report highlights a dramatic increase in hydropeaking activity after 2015, with significant growth in the frequency, duration, and magnitude of events across all seasons. This operational shift raises serious concerns about the long-term sustainability of the affected downstream ecosystem, particularly given that these practices and their environmental impacts were not thoroughly analyzed during the previous licensing process. The AQ-5 Final Technical Report underscores the need for greater clarity on future operational	SCE intends to operate the Project in a manner similar to the way it is currently being operated, with the addition of the flow enhancements below Saddlebag and Tioga lakes (PME-1, *Water Management*) along with other PME measures described in the FLA. The studies conducted for the relicensing do not indicate a significant impact to resources in the Project Area, including resources in lower Lee Vining Creek. SCE is not proposing thresholds to hydropeaking outside of the operational limitations in the FERC license, nor is SCE proposing a hydropeaking-specific study.

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		practices, leaving critical questions unanswered about how hydro-resource optimization events might evolve under a new license if not explicitly addressed and regulated. Specifically, SCE should define clear thresholds for hydro-resource optimization under the current license that will not be exceeded under the new license. These thresholds should include specific limits on hydropeaking frequency (e.g., the number of hydropeaking events per month), magnitude (e.g., maximum flow change allowable in a hydropeaking event), and seasonal timing (e.g., whether or not SCE will attempt to avoid hydropeaking during critical periods such as fish spawning or sediment transport seasons). Hydropeaking has well-documented effects on river ecosystems, including altered flow regimes, increased sediment mobility, and habitat degradation. At the 5/24/21 Aquatic Resources Technical Working Group Meeting, SCE outlined a plan to analyze hydropeaking with "slight expansions of existing studies and integrating those studies into a framework for looking at [the] relationship between flows and resources." The AQ-5 Final Technical Report acknowledges that the HEC-RAS intraday model was developed to capture the effects of hydropeaking events but does not extend this analysis to evaluate how these effects interact with ecological resources downstream of the Poole Powerhouse. For example, the report's hydraulic modeling focuses on physical parameters such as water surface elevation, depth, and velocity but does not link these findings to biological outcomes such as impacts on spawning habitat, benthic macroinvertebrates, or fish populations. This gap is especially concerning given the documented shifts in sediment distribution downstream, where semi-active gravel deposits and reduced spawning habitat quality have already been observed. The lack of a hydropeaking-specific study undermines the utility of the AQ-5 Operations Model as a tool for guiding adaptive management. While the model provides a useful baseline for understanding operational patterns, the AQ-5 Final Technical Report does not discuss alternative scenarios that could mitigate ecological impacts caused by hydropeaking. For example, the report does not evaluate how hydro-resource optimization events could be modified in terms of flow magnitudes, seasonal timing, or event frequency to improve sediment retention, maintain habitat during ecologically significant periods, or reduce the risk of fish stranding. Without this analysis, stakeholders are left without a clear understanding of how hydropeaking could be optimized to balance energy generation with ecological resource health. MLC provided a Lee Vining Relicensing Study Request on Hydropower Peaking Operations, as documented in SCE's Preliminary Application Document (Volume II, P170-176 out of 502 in PDF), which was not incorporated into the DLA. Given the substantial operational changes documented in the AQ-5 Final Technical Report under the current license, it is crucial for SCE to conduct a hydropeaking-specific study as part of the relicensing process. This study should examine the ecological effects of hydropeaking on sediment transport, habitat quality, and aquatic species health while exploring management strategies to minimize these impacts. Addressing these concerns in the FLA will not only help meet FERC's requirements for evaluating project impacts but also facilitate compliance with the National Environmental Policy Act (NEPA). Providing this information upfront will streamline the NEPA process, ensuring FERC has the necessary data to finalize its environmental review and develop effective mitigation measures that protect downstream ecosystems.	
82	MLC	**Technical Report - Lower Lee Vining Creek Morphology (AQ-6)** The AQ-6 Final Technical Report provides a valuable assessment of channel morphology and sediment dynamics in lower Lee Vining Creek. However, it fails to adequately address stakeholder concerns regarding the specific influence of hydropeaking on channel morphology, fluvial processes, and coarse sediment transport rates. Given the documented increase in hydropeaking activity during the current license term, this omission represents a critical gap in understanding how project operations may continue to alter geomorphic and ecological processes under the new license. While the AQ-6 Final Technical Report characterizes sediment transport dynamics at three sites and provides valuable data on substrate compositions and bed mobility, it does not explicitly evaluate how rapid flow fluctuations from hydropeaking events influence these data. For instance, tracer rock data presented in the report show evidence of particle mobility at Sites LLV-G1, LLV-G2, and LLV-G3 following the seasonal peak flow. However, the analysis does not differentiate between mobility caused by normal operations and mobility caused by hydro-resource optimization events. This distinction is critical because hydropeaking creates artificial,	The primary goal of the AQ-6 study was to provide baseline data sufficient to inform development of potential PMEs for inclusion in the license application, if warranted. Study AQ-6 included an analysis of bed mobility for coarse sediments (greater than 2 mm) over a broad range of flow conditions that occur under Project operations within lower Lee Vining Creek, including Hydro-resource Optimization events. See response to comment 81. SCE disagrees that the limited description of armored fluvial gravel patches and the presence of semi-active gravel deposits described in AQ-3 necessarily raises significant questions about the cumulative impacts of hydropeaking events on habitat quality, sediment availability, and channel stability. River sediment textures, degree of armoring, and activity level vary spatially and temporally over a broad spectrum of scales in river systems. AQ-6 results demonstrate the abundance and diversity of spatially complex range of sediment textures and activity levels (Figures 4.1-1, 4.2-1, 4.3-1, Tables 4.1-1, 4.2-1, 4.3-1; Volume III) with no apparent trend; sediment texture heterogeneity and activity level were variable throughout lower Lee Vining Creek. Based on the results of relicensing studies, there appear to be no

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		frequent, and short-duration pulses that can disrupt sediment deposition and transport patterns in ways that less-variable operations do not. Additionally, the report does not adequately connect sediment transport findings to broader fluvial processes and channel morphology. For example, the presence of semi-active gravel deposits identified in the AQ-3 Final Technical Report and armored gravel deposits identified in the AQ-6 Final Technical report raise questions about the cumulative impacts of repeated hydropeaking events on habitat quality, sediment availability, and channel stability. Peer-reviewed studies have documented hydropeaking's capacity to selectively mobilize fine to medium-sized gravels while leaving larger particles in place, leading to sediment depletion downstream and reduced habitat value (see MLC comments under AQ-3 Final Technical Report). Despite these established patterns, the AQ-6 Final Technical report does not investigate whether similar processes are occurring in lower Lee Vining Creek. Moreover, the report does not incorporate an analysis of how hydropeaking might exacerbate or mitigate sediment transport rates during critical ecological periods, such as spawning seasons. Stakeholders have emphasized the importance of understanding these seasonal dynamics, as hydropeaking's impacts on sediment movement could affect turbidity and the availability and quality of spawning gravel. Finally, while the AQ-6 study acknowledges the need to evaluate geomorphic changes downstream of Poole Powerhouse, it stops short of recommending operational modifications to reduce adverse effects. Without such recommendations or additional modeling of alternative operational scenarios, the report does not fully inform on how the Project could balance energy generation with ecological resource health. In light of these deficiencies, the Final AQ-6 Report does not adequately address the relationship between hydropeaking and channel morphology. A hydropeaking-specific analysis is needed to fill these gaps. This analysis should: 1. Quantify the effects of hydropeaking on sediment mobility and deposition patterns, distinguishing these from less-variable operations that characterized the Project prior to 2015 when the current license was issued. 2. Examine how hydropeaking impacts habitat quality and sediment availability during critical ecological periods, particularly for aquatic species dependent on stable substrate conditions. 3. Evaluate the cumulative impacts of repeated hydropeaking events on channel morphology and fluvial processes over time. 4. Explore alternative operational scenarios that mitigate hydropeaking's adverse effects while maintaining project objectives. SCE should address comments to focus and guide further discussion and efforts pertaining to fish habitat concerns borne from hydro-resource optimization. Additional efforts are needed to adequately understand results from the AQ-6 Final Technical Report as they relate to other resource reports. The questions raised here from the AQ-6 Final Technical Report are significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.	significant adverse effects or potential impacts to habitat quality, sediment availability, and channel stability relating to Project Operations.
83	MLC	**General Comment** The substantive comments above should inform and guide the relicensing process for the Project, specifically the importance of addressing the cumulative ecological and hydrological impacts of hydropeaking operations. Across multiple technical reports, including those on water quality, fish populations, habitat conditions, sediment transport, and channel morphology, MLC has identified critical gaps in analysis and has concerns about the Project's environmental impacts. These concerns indicate the need for a dedicated hydropeaking-specific study to evaluate the cumulative and long-term effects of hydro-resource optimization on downstream ecosystems. MLC urges SCE to address these gaps comprehensively in the FLA, addressing the concerns and questions raised in this comment letter. Critically, SCE should clearly define thresholds for hydro-resource optimization under the current license that will not be exceeded under the new license. With a clear proposal of hydro-resource optimization events, the FLA should also include a hydropeaking-specific study that examines the relationships between flow variability, sediment dynamics, aquatic species health, and habitat quality, as outlined in our comments above. This study should include robust analyses of pre- and post-hydropeaking conditions,	Please see response to comment 68 for additional information on hydropeaking. SCE believes that data collected during relicensing studies are sufficient to characterize the effects of hydropeaking on the ecological community in Lee Vining Canyon. SCE intends to implement PME-1, *Water Management*, which describes MIF enhancements below Saddlebag and Tioga Lakes.

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		identify potential mitigation strategies, and ensure alignment with the requirements of the Federal Power Act, which mandates consideration of environmental, recreational, and economic impacts, including those downstream of the Project. This effort should also support a more streamlined NEPA process for FERC. Lastly, given the dynamic and evolving nature of hydropeaking impacts, the FLA should establish a framework for ongoing monitoring of hydropeaking effects. This monitoring would provide the necessary data to adaptively manage operations, refine mitigation measures, and ensure sustained ecological health over the life of the license.	
84	MLC	**General Comment** SCE should continue to explore operational adjustments to enhance peak flows and support Lee Vining Creek restoration goals. Historically, the Lee Vining Hydropower Project has been operated to store water in three reservoirs during the spring snowmelt runoff. This operation impairs the peak flows, reducing the energy and stage needed for the maintenance of the alluvial reaches of the creek. In recent meetings, SCE has proposed changes that would reduce the impairment of the snowmelt peak flow by slowing down the filling of reservoirs on the dates of the highest springtime peak flows to achieve desired peak flow recurrence intervals. MLC supports SCE making operational changes to the Project where feasible to facilitate an increase in the frequency of annual snowmelt peak flow magnitudes above 250 cfs as outlined in the 2010 Synthesis Report Figure 4-6 and Table 4-2, to facilitate the maintenance of the stream ecosystem upstream and downstream of the diversion dam. [See Figure 1.] Figure 1: The 2010 Synthesis Report identified desired peak flow recurrence intervals. The difference between the dark blue line and the brown line in Fig 4-6 is entirely due to SCE's operations, and modification of SCE's operations (i.e. storing less runoff during the peak flow) is required to raise the brown line to the dashed red line. SEF stands for Stream Ecosystem Flow, and the intake is at the LADWP diversion for the Lee Vining Conduit (LVC). In order to maximize geomorphic benefits of peak flows downstream, no LADWP diversions are permitted when flows at the gauge above the LVC (LADWP gauge 5008) exceed 250 cfs. This removes any effect of LADWP's operations on peak flow magnitudes in excess of 250 cfs, with the remaining impairment wholly due to SCE's operations. Therefore, in order to benefit as much of the creek as possible all the way to Mono Lake, any augmented releases from Tioga and/or Saddlebag reservoirs should be timed for when flows exceed approximately 250 cfs at the gauge above the LVC. Slightly modifying SCE operations to increase peak flow magnitude in years when Tioga Lake Reservoir will fill would not impact hydro generation and could have minimal impacts on generation in other years, with no impacts in dry years. Higher peak flow releases from Saddlebag Lake Reservoir also would benefit the long reach of stream below Saddlebag Dam and further improve conditions downstream. For example, the AQ4 study conducted in 2023 suggests that the distribution and presence of Didymo is reduced during wet water year types, which is consistent with the findings of many studies that show more natural flows limit all types of invasive species in rivers. Prolonged low flow conditions due to SCE's Project operations mimic drier water year types, and higher peak flows below Saddlebag Lake Reservoir could limit the spread of this invasive diatom. We recommend that SCE manage flows below its reservoirs to mimic the natural snowmelt peak flow as far as feasible and monitor for Didymo in non-wet years to see if the flow improvement has a limiting effect on this invasive species. Downstream of the LADWP diversion dam, the SWRCB's goal is to maintain "functional and self-sustaining stream systems with healthy riparian ecosystem components" and "trout in good condition" (McBain & Trush, Inc., 2010). Lee Vining Creek above the LADWP diversion and below SCE's FERC project area should be managed in a consistent manner in order to comply with California Fish & Game Code Section 5937 and keep fish in good condition. This reach can also benefit from the studies that already have been conducted downstream. The nexus between the Lee Vining Hydropower Project and the maintenance of the stream ecosystem is articulated in the 2010 Synthesis Report (p73):	Please see response to comment 68 for additional information on hydropeaking. SCE believes that data collected during relicensing studies are sufficient to characterize the effects of hydropeaking on the ecological community in Lee Vining Canyon. SCE intends to implement PME-1, *Water Management*, which describes MIF enhancements below Saddlebag and Tioga Lakes.

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		Premise No.2. Annual snowmelt and baseflow hydrograph components for Lee Vining Creek above Intake (5008) are moderately regulated by SCE. Annual snowmelt flood peak magnitude and duration in the SCE annual hydrographs have been diminished compared to unregulated annual snowmelt peaks; fall and winter baseflows in the SCE annual hydrographs are elevated compared to unimpaired baseflows (Figure 4-1). Premise No.3. Some portions of the SCE regulated hydrographs can mimic unimpaired streamflows. SCE annual hydrographs selectively preserve the magnitude, duration, frequency, timing, and/or rate of a few unregulated annual hydrograph components. Most notably, the fast and slow snowmelt recession limbs in the SCE annual hydrographs are extremely similar to the fast and slow unregulated snowmelt recession limbs (Figure 4-1). Also, the timing of snowmelt peaks does not appear significantly altered by SCE operations. Premise No.3 identifies portions of the SCE hydrograph that should not be impaired by changes to SCE operations. This means the intact hydrograph components mentioned in Premise No.3—the timing of the snowmelt peak, and the recession limb of the hydrograph—should be preserved. The pre-2010 (period analyzed by the Synthesis Report) management of the daily reservoir storage change between the time of the peak flow and the end of August should be preserved as much as possible. In addition, SCE should maintain the seasonal unimpaired hydrograph pattern as much as possible. 2019 is an example of a year when the April–August flow from Saddlebag was low, and much higher after August. This pattern, evident in many wet years due to temporary variances from FERC requirements, is the inverse of the natural flow pattern and should be avoided. For extremely wet years like 2017 and 2023, instead of the release of a high August flow, that high flow could be added to the snowmelt peak to increase the magnitude and extend the duration earlier in the summer when higher flows would be more beneficial to the stream ecosystem. Additional considerations include ramping rates and seasonal baseflows. These are important components that should be evaluated and added to the license conditions.	

Basin Plan = Water Quality Control Plan for the Lahontan Region; BMI = benthic macroinvertebrate; CDFW = California Department of Fish and Wildlife; cfs = cubic feet per second; D_{50} = Particle Size Distribution D50; DLA = Draft License Application; DO = dissolved oxygen; FERC = Federal Energy Regulatory Commission; FLA = Final License Application; LADWP = Los Angeles Department of Water and Power; LRWQCB = Lahontan Region Water Quality Control Board; MIF = minimum instream flow; MLC = Mono Lake Committee; MPN/100mL = most probable number per 100 milliliters; NDVI = Normalized Difference Vegetation Index; NTU = nephelometric turbidity unit; O&M = operation and maintenance; PME = protection, mitigation, and enhancement; SB = Senate Bill; SCE = Southern California Edison; SEF = Stream Ecosystem Flow; SWRCB = California State Water Resources Control Board; USFS = U.S. Forest Service; USGS = U.S. Geological Survey

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TABLE 2. RESPONSE TO COMMENTS ON TECHNICAL REPORTS

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Table 2. Response to Comments on Technical Reports

Comment Number	Entity / Date	Resource Report	Comment	SCE Response
1	MLC 6/11/24	AQ-2 Stream Fish	Kennedy et al. 2016 documents how hydropeaking can prevent viable populations of many aquatic insects from inhabiting rivers. Hydropeaking can eliminate some groups of aquatic insects, such as mayflies, caddisflies, and stoneflies. In contrast, the few insects that lay eggs in open water, such as blackflies (*Simulium arcticum*), are mostly unaffected by hydropeaking. However, the results also suggest that hydropeaking practices could be modified to help alleviate some of these negative impacts. The authors found that rivers with greater variation in the volumes of discharged water were also home to fewer types of aquatic invertebrates. However, their model does indicate that a diverse assemblage of aquatic insects can still exist in a managed river, as long as the size of the artificial tides created by hydropeaking is not too large. Invertebrates play a crucial role in providing food for fish. In order to avoid negative impacts on stream invertebrates, the goal should be to create a flow regime that mimics the characteristics of the natural hydrograph. Reducing hydropeaking during crucial egg-laying periods for aquatic insects could benefit river communities. There does not appear to be a study report addressing these concerns.	*The goal of the AQ-2 Study is to characterize fish populations and distribution within Project-affected stream reaches and was developed in consultation with Stakeholders over several TWG Meetings. Results of this study indicate that the fish populations within Project-affected stream reaches are self-sustaining and in good condition. Condition factors reflect a healthy nutritional state of fish, related to size and growth based on habitat conditions, including water temperature, water quality, flow, and food resources. Additionally, self-sustaining fish populations composed of predominantly insectivorous species (i.e., trout) indicate BMIs in Project-affected reaches are sufficiently abundant to support fish condition.*
2	MLC 6/11/24	AQ-3 Habitat Mapping	The November-March SEF below the Lee Vining Diversion Dam is a constant flow rate (beginning in October in most years) and is designed to provide suitable holding habitat and to prevent “undesirable operational fluctuations caused by SCE’s upstream hydropower operations.” (McBain & Trush et al., 2010, page 42). The AQ-5 Operations Modeling Study found fluctuations in velocity of up to 3 feet per second (fps; going from less than 2 fps to nearly 5 fps in Figure 5.5-5), and stage fluctuations of nearly 1.5 feet (Figure 5.5-4). Scruton et al. 2005 found “In winter, fish remained relatively sedentary in comparison with the	*Results of the AQ-2 Study indicate that the fish populations in lower Lee Vining Creek are self-sustaining and in good condition. Age-class distribution in this reach is similar to that which was observed in upper Lee Vining Creek and suggests that (1) regular and successful spawning and recruitment occurs annually and (2) trout survive multiple years. Condition factors reflect a healthy nutritional state of fish, indicating habitat conditions, including water temperature, water quality, flow, and food resources are sufficient to promote fish health.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
			summer foraging period, and this behavior may increase the likelihood for dewatering, stranding, and freezing. A secondary concern with hydropeaking regimes is the energetic cost to fish of moving to find suitable habitats, and during summer this cost could affect stored energy reserves, which could, in turn, affect overwinter survival."	*Therefore, hydropeaking during winter months does not appear to adversely affect the trout population or nutritional state of fish in lower Lee Vining Creek. Furthermore, the AQ-3 Study indicates there is abundant refugia habitat within Lee Vining Creek downstream of Poole Powerhouse in the form of large woody debris and cobble/boulder cover.*
3	MLC 6/11/24	AQ-3 Habitat Mapping	Seasonal implementation of hydropeaking raises other concerns. "Rapidly varying flows soon after emergence can either strand or flush newly emerged fry because they are relatively poor swimmers and have difficulty maintaining positions along the channel margins." (Shepard et al. 2009)	*Results of the AQ-2 Study show a typical age-class distribution with evidence of regular and successful recruitment of naturally reproducing brown and brook trout in lower Lee Vining Creek. Rainbow trout in this reach are sterile. Further, lower Lee Vining Creek is generally characterized by a confined channel where stranding has low potential to occur. Hydro-resource optimization does not appear to adversely affect emergent young of year in lower Lee Vining Creek during spring months.*
4	MLC 6/11/24	AQ-3 Habitat Mapping	Unfortunately, the aquatic habitat mapping study (AQ-3) does not focus on relevant metrics, such as fish habitat at different flow rates, and the effects on fish of rapidly varying those flow rates during sensitive seasons.	*The goal of the AQ-3 Study was to characterize habitat and spawning gravel distribution throughout the Project Area and was developed in consultation with Stakeholders over several TWG Meetings. The DLA includes an evaluation of habitat as a function of streamflow (Appendix E.3, provided in Volume II of the DLA and this FLA).*
5	SWRCB 6/11/24	AQ-4 Aquatic Invasive Plants	Surveys conducted along Project reaches in 2023 found no evidence of *Didymosphenia geminata* (Didymo). During the May 14, 2024 meeting, stakeholders stressed Didymo was present along certain parts of the Project reaches in 2022. Didymo may have been scoured and washed further downstream due to elevated flow rates through the reach. Didymo is historically documented in Lee Vining Creek. Once Didymo enters a system, it is almost impossible to eradicate. SCE should consider posting signs to inform visitors of its presence and remind recreationalists to check	*Didymo is an invasive diatom generally spread to waterbodies via recreationists; there is no nexus to Project O&M. Therefore, SCE does not propose any PME measures. SCE acknowledges that Didymo may occur in Project waters during some water years; the AQ-4 Study conducted in 2023 suggests that the distribution and presence of Didymo is reduced during wet water year types.*

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			and clean their equipment to prevent the Didymo from spreading. The National Park Service provides guidelines to reduce the impact of Didymo. Link below: Invasive Species: Didymo or "Rock Snot" - Yosemite National Park (U.S. National Park Service) (nps.gov)	
6	MLC 6/11/24	AQ-4 Aquatic Invasive Plants	No didymo was detected in any creeks last year despite its previous detection. Its detection wouldn't be expected in an extreme-wet year like 2023, and SCE should conduct the survey again this year and in the next dry year.	*See response to Comment #5 above, no additional monitoring is necessary.*
7	SWRCB 6/11/24	AQ-5 Operations Model	The intraday flow timeseries data presented in Figure 5.2-1 and used throughout Section 5.0 Intraday and Hydraulic Model Description should be provided to stakeholders for use and analysis.	*This model was distributed to CDFW on June 20, 2024, and MLC on July 5, 2024.*
8	SWRCB 6/11/24	AQ-5 Operations Model	Please clarify whether any hydro-resource optimization events occurred in 2023. Information and timing of events specific to 2023 is relevant to interpreting turbidity results presented in WQ-1 Stream and Reservoir Water Quality.	*Hydro-resource optimization did occur in 2023, though it was late in the year due to late-season snow melt.*
9	SWRCB 6/11/24	AQ-5 Operations Model	Section 5.3 Model Calibration states that "...the model identified 931 hydro-resource optimization events, 82 of which directly corresponded with a generation peak event." To better understand the model output, please explain whether the additional 18% of events detected by the model are false positives and thus a potential overestimation of hydro-resource optimization events, or whether the additional detected events may have been caused by triggers other than price peaking, as suggested by Figure 5.3-3. If 18% of events not associated with generation do represent an overestimation, it would be informative to specify whether there is a seasonal or annual trend in those events.	*The 82% correspondence statistic is based on the number of peak flow timesteps that fall specifically within the window of price events. As noted, price peaking is not the only determining factor in flow peaking by SCE operations, as flow and generation may peak in response to grid and load concerns, which likely accounts for the 18% of events identified.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
10	SWRCB 6/11/24	AQ-5 Operations Model	In Section 5.5.2 Hydraulic Model Sample Results, it does not appear that the March hydro-resource optimization events selected for analysis are representative of the range of flows that often occur during the events. Hydro-resource optimization events in summer 2022 frequently reached flows of 100 to 110 cubic feet per second (cfs) and maintained that maximum flow for several hours. The March events selected for hydraulic analysis reach a very brief peak of 81 cfs, but are primarily stable at 58 cfs. The water depth and flow velocity modeling must be conducted at 100 to 110 cfs to accurately represent potential changes downstream.	*Comment noted. The event chosen is representative of the frequency and approximate magnitude of the Hydro-resource Optimization events during a typical water year where the events were prevalent. SCE will model the additional flow and provide an update in the FLA.*
11	SWRCB 6/11/24	AQ-5 Operations Model	The downstream-most cross section used for water depth and velocity analysis is located only 0.75 mile downstream of Poole Powerhouse, but the reach of Lee Vining Creek impacted by hydro-resource optimization extends an additional roughly 4.5 miles and passes multiple designated campgrounds. To understand the attenuation and timing of hydro-resource optimization events as flow moves downstream through the reach impacted by rapid flow fluctuations, the hydraulic modeling should be extended to the cross sections collected for sites LLV-G2 and LLV-G3 as specified in AQ-6 Lower Lee Vining Creek Channel Morphology.	*The Hydro-resource Optimization events do have effects to velocity and depth downstream of Big Bend Campground; however, as Big Bend Campground is the farthest upstream recreational site on lower Lee Vining Creek, SCE believes that the effects at this location will be the most significant. Flows will attenuate downstream of the campground, reducing the sharp changes in velocity and depth. Additionally, adding two cross sections from the AQ-6 Study is not useful as the hydraulic model requires greater detail in between cross sections than the additional two cross sections will provide.*
12	SWRCB 6/11/24	AQ-5 Operations Model	As currently presented in figures 5.5-4 and 5.5-5, during hydro-resource optimization events maximum water depth and velocity increased by an approximate peak of 1.5 feet and 2.5 feet per second, respectively. At maximum event flows of 110 cfs, depth and velocity are expected to increase even more drastically. These changes occur very rapidly and often take place in the late afternoon or early evening, and as such **may present a safety concern to recreationists downstream**, particularly near high-use recreation zones such as campgrounds.	*Comment noted. Safety is one of SCE's top priorities; SCE is not aware of any safety incidents since the implementation of Hydro-resource Optimization in 2015. SCE will include a wading-suitability analysis with the FLA.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
13	MLC 6/11/24	AQ-5 Operations Model	We have not yet fully reviewed the operations model, and we look forward to participating in the 6/27/24 meeting focused on this model. Upon review of the study report, we have the following initial comments: • Figure 5.2-1 appears to be missing data for October 2017-March 2018. • Figure 5.5-3 has a y-axis that spans 100 feet, making it difficult to see the stage fluctuations. It should be split into 3 or 4 figures with a y-axis range of 5-10 feet.	*Comment noted, new figures have been created in the report.*
14	MLC 6/11/24	AQ-5 Operations Model	At the 5/24/21 Aquatic Resources Technical Working Group Meeting, Southern California Edison (SCE) outlined a plan to analyze hydropeaking with “slight expansions of existing studies and integrating those studies into a framework for looking at [the] relationship between flows and resources.” We have not yet seen that integrated framework, and making piecemeal comments on each study is of limited value. Here we present our comments in an integrated manner.	*Comment noted. The HEC-RAS model included in the AQ-5 Final Technical Report is the framework SCE was describing.*
15	MLC 6/11/24	AQ-5 Operations Model	Extreme fluctuations in flow since 2015 (Operations Modeling Study Table 5.4-3 shows a big increase in frequency since 2015 and Table 5.4-2 shows a big increase in magnitude) caused by SCE’s hydropower operations make it challenging to measure and implement minimum Stream Ecosystem Flows (SEFs) at the Lee Vining Creek Diversion Dam. Most of the time, the Los Angeles Department of Water & Power’s (LADWP) hourly operations dampen the flow changes and protect downstream ecological values compared to SCE’s hydropeaking patterns. LADWP is operating as best it can to divert flows in excess of the minimum SEFs, while doing everything it reasonably can to ensure the minimum flows are maintained below the diversion dam. However, there are certain configurations that LADWP employs under specific conditions that unintentionally transfer rapid flow	*Comment noted.* *SCE has open communication with LADWP and confers with LADWP when requested regarding their project operations. Further, there is no Project nexus between SCE operations and LADWP’s ability to meet SWRCB license commitments downstream of the Project (to which SCE is not a party). To comply with these license commitments, LADWP files an annual Operations Plan with the SWRCB describing proposed water management.*

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			changes to the bottomlands of either Lee Vining or Rush Creek.	
16	MLC 6/11/24	AQ-5 Operations Model	Hydropeaking fluctuations and impacts cannot be consistently dampened at the Lee Vining Diversion Dam. For example, on 9/18/23, the flow at the Diversion Dam went from 45 cubic feet per second (cfs) to 120 cfs in 2 hours. Because diversions were shut off due to a nearly-full Grant Lake Reservoir, the impact of that flow change passed all the way down Lee Vining Creek to Mono Lake. Flow changes of this magnitude are not permitted under LADWP's water rights license requirements, which are designed to maintain healthy stream ecosystem function. When diversion operations are able to protect lower Lee Vining Creek from hydropeaking fluctuations, the fluctuations are usually absorbed by Grant Lake Reservoir. However, if the reservoir is spilling or if the Five Siphons Bypass is being used to release water to Rush Creek, those fluctuations are transferred to Rush Creek. For example, during the month of July 2022, hydropeaking operations were observed in LADWP's 15-minute flow data in the Lee Vining Conduit (Figure 1), which is the conduit that diverts water from Lee Vining Creek to Grant Lake Reservoir. If the Lee Vining Conduit were not taking water at this time, rapid and large flow changes would have been impacting the creek downstream of the Lee Vining Diversion Dam. However, at this time, LADWP was delivering all Lee Vining Conduit flows directly to Rush Creek via the Five Siphon Bypass. During July 2022, SCE's operations, uncoordinated with LADWP's, produced unstudied yet potentially harmful flow variations in Rush Creek, another creek that is state-mandated for restoration. [See Figure 1. in comment letter] Figure 1 – 15-minute flow data for the Lee Vining Conduit, collected and shared by LADWP, during a period when this flow was augmenting Rush Creek. These fluctuations of up to 40 cfs in a few hours added to Rush Creek flow of 70 cfs	*Comment noted. See response to Comment #15.*

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			on July 1 that slowly ramped down to 31 cfs on July 31. LADWP's water rights license specifies a maximum daily ramping rate of 10% for Rush Creek (this would be a limit of 7 cfs early in the month and 3 cfs at the end of the month) or 10 cfs, with a target ramping rate of 6% early in the month and 3% late in the month. For reference, LADWP's maximum permitted daily ramping rate is 20% on Lee Vining Creek—had this flow stayed in Lee Vining Creek, it would have augmented an average July flow of 31 cfs below the diversion dam, resulting in sub-daily fluctuations over 100% at times. No matter which creek the diversion dam directed this flow to, it would have exceeded these maximum ramping rates in LADWP's amended water rights licenses based on studies and recommendations found in the 2010 Synthesis Report.	
17	MLC 6/11/24	AQ-5 Operations Model	The studies conducted downstream of the Lee Vining Diversion Dam are summarized in the 2010 Synthesis Report (McBain & Trush, Inc. and Ross Taylor and Associates, 2010), and were used to inform the conditions on diversion dam operation in the Amended Licenses. SCE and the Federal Energy Regulatory Commission (FERC) can use these important studies and requirements to inform license conditions that ensure the creek is protected from SCE's operations and encourage consistent management throughout the entire length of the stream based on the best science.	*Comment noted.*
18	MLC 6/11/24	AQ-5 Operations Model	Impacts from hydropeaking span multiple study areas. Geomorphology, riparian, macroinvertebrate, recreation, and fish impacts should all be looked at in an integrated way.	*Comment noted.*
19	MLC 6/11/24	AQ-5 Operations Model	**Recreation and public safety concerns** of hydropeaking should be addressed.	*Comment noted.*

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20	MLC 4/27/24	AQ-6 Channel Morphology	Figure 3.2-1 shows a period of time in March when Total SCE was much higher than LADWP. Please explain how this is possible, and if one of the traces is likely erroneous, which one and why?	*SCE believes there is an error in the LADWP hydrology dataset because SCE data shows increasing water surface elevations at Ellery Lake and spill conditions over Rhinedollar Dam. A note has been added to the figure caveating the LADWP data.*
21	MLC 4/27/24	AQ-6 Channel Morphology	Table 3.3-1 refers to SCE and USGS gauges. These gauges should be shown on the map, and the footnote should note what flow path is being measured by each gauge. If one of the gauges matches "Total SCE" in Figure 3.2-1, that should be noted.	*Figure 2.1-1,* Channel Morphology Study Sites*, has been revised to include USGS/SCE stream gages.*
22	MLC 4/27/24	AQ-6 Channel Morphology	The peak discharge of 470 cfs noted on page 11 is higher than the peak shown for "Total SCE" in Figure 3.2-1.	*Figure 3.2-1,* Daily Mean Discharge in Lower Lee Vining Creek During Tracer Rock Deployment and Recovery*, shows daily mean discharge which averages all instantaneous streamflow values over a daily timestep. The 470 cfs is the peak instantaneous discharge value. The AQ-6 Final Technical Report has been updated.*
23	MLC 4/27/24	AQ-6 Channel Morphology	I recommend separate analysis of the cross section data focused on stages that occur during typical hydropeaking resource optimization operations. These frequent repeated fluctuations in a similar stage range could be impacting the morphology, benthic macroinvertebrate community, and vegetation community in these ranges.	*The goal of the AQ-6 Study was to describe general channel conditions in lower Lee Vining Creek and was not designed to evaluate effects of Hydro-resource Optimization on morphology, benthic macroinvertebrate community, or vegetation communities. Trout spawning and recruitment occurs regularly in all Project-affected stream reaches and all trout populations in the Project Area have a healthy nutritional state, suggesting the BMI community in lower Lee Vining Creek is sufficient to support trout growth and reproduction. See response to Comment #3. NDVI analysis conducted as part of the TERR-2 Study shows no effects to riparian communities resulting from Hydro-resource Optimization. See response to Comment #33.*

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24	MLC 6/11/24	AQ-6 Channel Morphology	Recreationists have observed log jams forming in Lee Vining Creek due to hydropeaking. This should be investigated. Stage change behind these jams and other obstructions could be significantly higher than where geomorphology was studied, resulting in greater impacts than modeled.	*Comment noted. Large woody material is frequent through lower Lee Vining Creek as described in the Technical Report for the AQ-3 Study. Log jams are a natural occurrence in wooded streams and SCE has seen no evidence linking log jam formation to hydropeaking.*
25	MLC 6/11/24	AQ-6 Channel Morphology	Freeze-thaw events, a natural way stage fluctuates in winter, should be compared to hydropeaking stage changes in order to assess how the frequency and magnitude of stage changes exceeds the natural occurrence.	*The goal of the AQ-6 Study was to describe general channel conditions in lower Lee Vining Creek, a comparison of natural stage fluctuations to Hydro-resource Optimization is beyond the scope of this study.*
26	MLC 6/11/24	AQ-6 Channel Morphology	The study did not detect geomorphic change from the less than 2-foot (Operations Model Study Figure 5.5-5) stage change from hydropeaking operations. We recommend separate analysis of the cross-section data focused on stages that occur during typical hydropeaking resource optimization operations and the particle sizes most susceptible to mobilization. These frequent repeated fluctuations in a similar stage range could be impacting the morphology, benthic macroinvertebrate community, vegetation community, and fish population in these ranges.	*See response to Comment #23.*
27	SWRCB 6/11/24	AQ-6 Channel Morphology / AQ-3 Habitat Mapping	In AQ-6, Section 3.2.4 Bed Mobility and Sediment Transport states that “Peak discharge for the 2023 water year was calculated by combining flows measured at United States Geological Survey (USGS) Gage #10287770 (SCE gage 353) and USGS Gage #10287762 (SCE gage 363). **However, as indicated in AQ-5 Operations Modeling Study, there is a significant unregulated inflow into Lee Vining Creek downstream of Ellery Lake.** Particularly in wet years, the Warren Fork and other ungauged tributaries provide substantial flow in lower Lee Vining Creek. **It is likely that the peak discharge used in the HEC-RAS model significantly underestimates 2023 peak flow**. Figure 3.2-1 may also reflect this discrepancy,	*Critical D_{50} calculations have been computed for the 581 cfs peak instantaneous discharge measured at the LADWP above diversion site and included in the AQ-6 Final Technical Report. Peak discharge used in the HEC-RAS model is based on available data. Modeled peak flow from unregulated Warren Fork is described on page 5 of the AQ-5 Final Technical Report.*

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			as the peak flow at the LADWP gage is roughly 100 cfs greater than that labeled “Total SCE”. This may also be reflected in figures 4.1-4, 4.2-4, and 4.3-4, which all indicate that sediment larger than the predicted critical D_{50} was mobilized. To better interpret the results of AQ-6, it would be helpful to (1) provide discussion or estimated quantification of the underestimation of peak flow, or (2) work with the model developed for AQ-5 to incorporate a modeled peak flow from the unregulated tributaries downstream of Ellery Lake.	
28	SWRCB 6/11/24	AQ-6 Channel Morphology / AQ-3 Habitat Mapping	Given that bed particle size distribution field measurements were conducted in a dry year (2022), the subsequent wet year (2023) results from tracer rocks and modeling indicate that many smaller sediments measured in 2022 may have been mobilized during 2023 peak flows. Notably, AQ-3 Table 4.2-1 indicates that spawning gravels in lower Lee Vining Creek downstream of Poole Powerhouse were of lower quality, and less abundant than in Glacier Creek below Tioga Dam and upper Lee Vining Creek downstream of Slate Creek. Lower Lee Vining Creek also had no spawning gravel with an “excellent” quality score, although “excellent” was the most common score in upstream reaches where gravels were present. **Discussion of Project impacts on sediment supply, accumulation, and mobilization, particularly of gravels relevant to fish spawning habitat** elaborating on the results of AQ-3, should be included in the Draft License Application.	*Comment noted. Additional context regarding sediment supply and mobilization has been included in the DLA.*
29	MLC 6/11/24	General Comment	SCE should publicly share real-time data for reservoir storage and flows, including the hourly and telemetry requirements found here (https://www.waterboards.ca.gov/waterrights/water_issues/programs/diversion_use/water_measurement.html#who-needs-to). Reporting these data to SWRCB appears to be required by state law, and these data are also essential for	*SCE is in compliance with SB88 water rights reporting requirements. This information can be found on the referenced website in your comment.*

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			LADWP reporting and operations downstream. SCE's FERC license should have provisions that do not conflict with SWRCB requirements and where possible facilitate LADWP compliance with its water rights licenses. The California Department of Water Resources is seeking to add daily storage information from this project to the California Data Exchange Center, and as with other projects, can add a time lag that has addressed any market manipulation concerns at other projects. This is important for runoff tracking, downstream LADWP operations, restoration, and monitoring license requirements, as well as public recreation.	
30	MLC 6/11/24	General Comment	SCE should share runoff forecast and planned monthly operations in April, as well as any updates or changes to those planned operations during the runoff year. This is important for downstream LADWP operations, restoration, and monitoring, as well as public recreation.	*Comment noted. SCE has open communication with LADWP and confers with LADWP when requested.*
31	MLC 6/11/24	General Comment	SCE should coordinate operations with LADWP when requested. Downstream concerns are relevant where SCE's operations impact SWRCB water rights license requirements, which includes state-mandated restoration of Lee Vining Creek. There are times when a lack of coordination impairs the Lee Vining Creek restoration effort.	*See response to Comment #30.*
32	MLC 6/11/24	General Comment	Peak flow increases have been identified as important for Lee Vining Creek restoration, and we submitted a study plan request that was denied by SCE. In the absence of a new study, information is still available from the studies from downstream of the Diversion Dam, including the 2010 Synthesis Report, which included this recommendation. SCE operations should be modified where feasible to facilitate an increase in the frequency of peak flow magnitudes as outlined in the Synthesis Report and facilitate the restoration and maintenance of the stream	*SCE previously did not adopt this study as there is no Project nexus between SCE operations and the settlement Parties' ability to meet settlement agreement commitments downstream of the Project (to which SCE is not a party). As committed to, the Relicensing Team did develop an Operations Model with Project hydrology for Stakeholder review. Moreover, the type of operation proposed in this comment would need to be reconciled with USFS 4(e) conditions for reservoir levels and operations,*

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			ecosystem downstream of the diversion dam. Slightly modifying operations to increase peak flow magnitude when Tioga Lake Reservoir will fill would not impact hydro generation in many years and could have minimal impacts on generation in many more years. For example, this chart shows how adding 40 cfs from Tioga Lake to the peak flow could achieve the 2010 Synthesis Report goals for peak flow magnitude in many years. Figure 2 – A 2010 Mono Lake Committee analysis showed that adding 40 cfs from Tioga Lake Reservoir during the peak flow would result in exceeding Synthesis Report minimum goals for peak flow magnitude (when the black line exceeds the red line; in cfs at the diversion dam on the y-axis) in 20 out of 28 years, with improved performance toward the goal in the other years. The operations model (described in AQ-5) should be used to determine the feasibility and trade-offs of this operation.	*which are currently maintained to meet recreational goals.*
33	MLC 6/11/24	TERR-1 Botanical	Unfortunately, SCE chose not to extend the botanical study downstream to the Lee Vining Diversion Dam, with the exception of the Normalized Difference Vegetation Index (NDVI)--a study not conducted in the hydropeaking tidal zone and not likely to detect impacts from this type of operation. Frequent stage fluctuations in a narrow range of streambank would be expected to impact vegetation establishment and growth in that band, especially when seeds are deposited. During post-snowmelt peak seed dispersal, a steady drawdown would be a less impactful mode of operation. Understanding whether this is a problem would be helpful in determining if license conditions are needed to modify the seasonality, timing, and extent of the stage fluctuations.	*The Botanical Resources Study Area was determined based on Project O&M locations within the FERC Project Boundary. The exception was the NDVI study that included one location below Poole Powerhouse. The site was located along Lee Vining Creek below Aspen Campground. The NDVI study compared sites under Project influence, such as the site below Aspen Campground, and sites not under Project influence. The results of the comparisons did not demonstrate any changes in the relative greenness of sites under Project influence and sites not under Project influence, including the site below Aspen Campground.*
34	MLC 6/11/24	TERR-1 Botanical	Botanical Technical Study comments: It is concerning that despite California Department of Fish & Wildlife, US Forest Service, and California State Water Resources Control Board (SWRCB) consultations, Population 2 of Black	*All tree removal conducted in the vicinity of Poole Powerhouse was done in consultation with CDFW and USFS as part of the Wildfire Mitigation Plan.*

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			Cottonwoods was unintentionally removed during large scale vegetation removal in fall 2022. The purpose was for wildfire risk reduction, however 8 healthy cottonwood saplings more than 200 feet away from the nearest structure would not appear to be a high wildfire risk, and the lack of care in this clearing indicates there may be a need for additional license conditions that protect important riparian species.	
35	CDFW 5/28/24	TERR-2 Wildlife	Before the dam was implemented, in a drought year would the ponds always go dry?	*We have no evidence of the site conditions prior to dam installation and for the purposes of this relicensing, the current existing Project is considered the baseline condition.*
36	CDFW 5/28/24	TERR-2 Wildlife	Were there previously nesting sites in the area?	*There have not been any confirmed nesting records of willow flycatchers (*Empidonax traillii*) upstream on Lee Vining Creek above Highway 395 or within the FERC Project Boundary. There are three records for willow flycatcher observations along Lee Vining Creek south of Poole Powerhouse, but no confirmed nesting. Surveys performed for the relicensing determined the presence of potentially suitable habitat for nesting willow flycatchers between Poole Powerhouse and the LADWP diversion.*
37	CDFW 5/28/24	TERR-2 Wildlife	Has the dam caused consistent increased flows in any areas? In years of excess snowmelt, is it possible the dam restricts natural water diversion, increasing flows, and reducing suitable habitat for flycatchers?	*The current existing Project is the baseline condition that is evaluated during relicensing. The Project has been in place for over 100 years and is an existing feature, any analysis to look at pre-Project conditions is outside the scope of this relicensing. The only willow flycatcher (*Empidonax traillii*) habitat is below Poole Powerhouse outside of the FERC Project Boundary.*
38	CDFW 5/28/24	TERR-2 Wildlife	Is 3 cameras sufficient?	*Yes, given the cameras were to provide some additional data but were not an essential part of the*

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				study. Because of the open nature of the Project Area, no clear terrestrial wildlife corridors are present and, subsequently, additional cameras are not expected to have significantly increased the diversity of wildlife species documented. Further, it is difficult to find areas to place cameras away from public view, but still within the study area.
39	CDFW 5/28/24	TERR-2 Wildlife	Relevance of predatory animals not noted. 1 DNA sample sent, but are there any other plans to consider their impact as keystone species? Is there absence or presence insignificant?	*SCE is aware of the important role of predators in the ecosystem; however, a discussion of their role in the Lee Vining ecosystem is beyond the scope of the wildlife study and not necessary to inform the relicensing process. The DNA sample sent into CDFW was submitted because of the recent documented occurrence of wolverine in the area (Mammoth).*
40	CDFW 5/28/24	TERR-2 Wildlife	Are any other dense foliage (suitable nesting sites) areas impacted by project?	*As discussed in response to Comment #35, there is no data on Lee Vining Creek prior to the installation of the Project. The results of the long-term riparian monitoring study have demonstrated that the Project has not had an effect on riparian resources. The NDVI study performed for this relicensing supports the conclusion that the Project has not had an effect on riparian health.*
41	CDFW 5/28/24	TERR-2 Wildlife	Has reduced and/or modified flow had an impact on the willow populations? Are there any areas of the site that either promote overly dense willow habitat or lack of sufficient willows completely?	*See response to Comment #40 regarding Project relationship to riparian habitat.*
42	CDFW 5/28/24	TERR-2 Wildlife	What role do bighorn sheep play in the project area ecosystem? Positive, negative? Are there any water sources in the area known to have more sheep than the others?	*The Project Area is located between two area bighorn sheep (*Ovis canadensis nelsoni sierrae*) herds. Based on GIS data available from CDFW's website, this area can be used by either herd but does not seem to be part of either herd's primary territory. The role of bighorn sheep in the*

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				surrounding ecosystem is beyond the scope of the wildlife study for this relicensing. In general, bighorn sheep have a positive effect on the ecosystem. For example, their grazing helps prevent the dominance of some plant species over others, which helps to maintain an open and diverse floristic environment. Bighorn sheep are an important prey source for mountain lion and they provide soil nutrients through their feces.
43	CDFW 5/28/24	TERR-2 Wildlife	Have trail cameras been used? Have toga lake inlets been added?	*Using trail cameras to track toads was not deemed a reliable method due to the amount of area that needs to be visually covered and the trigger sensitivity needed to reliably capture toads. However, acoustic recorders were deployed to document toad breeding calls. The acoustic recording was determined to have a wider detection range and higher success rate compared to the cameras. The inlets to Tioga Lake that contained potentially suitable toad breeding habitat were included in the field surveys.*
44	CDFW 5/28/24	TERR-2 Wildlife	Could surveying these 12 ponds create helpful comparable data between YOTO populations within and outside of the project area? As YOTO females go to higher elevations after breeding, maybe those ponds could be a good indicator of fitness levels in the project area population.	*The area surrounding the Lee Vining Yosemite Toad Study Area, is outside the FERC Project Boundary and therefore not included in the scope of this study. The Tioga Pass Pond area has been well surveyed for Yosemite toad (*Anaxyrus canorus*) in the past by many researchers and has been well reported on in the literature. Additional surveys would not increase our knowledge of the toads in the area or add to our analysis for the purposes of relicensing. We are aware of the ability of Yosemite toad to move long distances. Given the toad's ability to move up to 2,250 feet and maybe more, the Tioga ponds are within the dispersal distance of the Tioga Lake inlet.*

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45	CDFW 5/28/24	TERR-2 Wildlife	Should stocking data and disease trend data be correlated with YOTO survival to identify more clear understanding?	*The relationship between stocking and disease transmission from trout to Yosemite toad (*Anaxyrus canorus*) has not been established and is beyond the scope of the studies needed for relicensing. Stocking policies are established by CDFW.*
46	CDFW 5/28/24	TERR-2 Wildlife	Upland suitable habitat and nesting areas should be monitored.	*Field surveys for Yosemite toad (*Anaxyrus canorus*) are continuing in 2024 with one of the goals to characterize the surrounding upland habitat. Preliminary results have determined that substantial upland habitat is present through the areas adjacent to the FERC Project Boundary and no barriers are present (or proposed) between the observed breeding areas and upland habitat. Regardless, the upland habitat is outside the FERC Project Boundary and is well outside the influence of SCE's operations and maintenance. SCE believes that since the toads have persisted and are in areas not subject to SCE O&M, monitoring these populations is not currently necessary.*
47	CDFW 5/28/24	TERR-2 Wildlife	Please add which Critical Habitat Unit this project is located in. There is specific language in the Critical Habitat rule which talks about the physical and biological features within each Unit where special management considerations may be required. See page 59082 in the Federal Register Notice for Yosemite toad Critical Habitat. Critical habitat is determinable...not sure if this is enough info.	*Text describing Critical Habitat Unit 5 (Yosemite Toad Critical Habitat) has been incorporated into the Yosemite Toad Report (appendix to the TERR-2 Final Technical Report).*
48	CDFW 5/28/24	TERR-2 Wildlife	How is the ecological impact of the dam affected by heavy or low snow years?	*Yosemite toad (*Anaxyrus canorus*) breeding locations observed during these studies were observed to be hydrologically influenced by adjacent snowpacks and not by Project operations, including levels of Project-stored water or released flows. The upstream and downstream water levels within the Project system are regulated. The water*

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				level in Saddlebag Lake is drawn down to the minimum each fall to allow it to receive snowmelt the following spring. There are minimum instream flows that must be maintained. Please see Section 3.3, Project Operations*, in Exhibit E of the DLA. Under the current license, minimum flow requirements are based on the water year type and water inflow into each reservoir. Additionally, as noted in Comment #35, we have no evidence of the site conditions prior to dam installation and for the purposes of this relicensing, the current existing Project is considered the baseline condition.*
49	CDFW 5/28/24	TERR-2 Wildlife	Are enough cameras in appropriate locations?	*See response to Comment #43 regarding use of cameras for Yosemite toad (*Anaxyrus canorus*) and Comment #38 regarding use of cameras for general terrestrial wildlife.*
50	CDFW 5/28/24	TERR-2 Wildlife	Could the dams impact on the water cycle and local biodiversity have an impact on YOTO outside of 200 ft buffer zone?	*See response to Comment #48 regarding water cycle affects.*
51	CDFW 5/28/24	TERR-2 Wildlife	Is there a pattern year for YOTO breeding?	*Yosemite toad (*Anaxyrus canorus*) begin breeding when sufficient amounts of water have pooled in breeding locations from snow melt. Yosemite toad tadpoles can metamorphize within weeks after hatching (early summer months); however, tadpoles were also observed in water trapped beneath ice during field studies into the late fall months.*
52	CDFW 5/28/24	TERR-2 Wildlife	What is the plan to increase YOTO #s after a 50% decline?	*SCE is not making plans to "increase YOTO numbers" and is not responsible for developing a recovery plan. While many factors contribute to declining toad populations, the studies performed indicate that neither SCE's facilities nor their operations are factors in Yosemite toad (*Anaxyrus canorus*) population decline.*

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53	CDFW 5/28/24	TERR-2 Wildlife	Does project impact any YOTO prey species?	*The Project has been running for over 100 years and the ecologies surrounding the Project have equilibrated to the regime. Although the prey base for Yosemite toad (*Anaxyrus canorus*) was not studied, the fact that they have persisted alongside the Project is evidence that a sufficient prey base is present to support the population.*
54	CDFW 5/28/24	TERR-2 Wildlife	Should surveillance be increased around snowmelt?	*Yosemite toad (*Anaxyrus canorus*) studies began at the onset of snow melt, and we have collected sufficient data to analyze the relationship between Project facilities and operations and the YOTO populations. Continued surveillance is not necessary to inform the relicensing or new license conditions.*
55	CDFW 5/28/24	TERR-2 Wildlife	Should correlation between YOTO survival and chytrid fungus, roads, and grazing proximity be more closely monitored to determine the most serious threat?	*These items have been addressed extensively in the literature. No evidence of Chytrid in the Yosemite toad (*Anaxyrus canorus*) populations studied for this relicensing was observed during the study effort.*
56	CDFW 5/28/24	TERR-2 Wildlife	When does the distance between disconnected YOTO patches become too far for reliable migration?	*The relationship between disconnected populations of "YOTO patches" is beyond the scope of the studies performed for the relicensing.*
57	CDFW 5/28/24	TERR-2 Wildlife	Instead of focusing on the breeding habitat, where their presence is short and identification difficult, maybe upland suitable habitat should be prioritized to provide more data.	*See response to Comment #46 regarding relevance of studies for suitable upland habitat.*
58	CDFW 5/28/24	TERR-2 Wildlife	Seems unlikely there are no consistent patterns in differences between occupied and unoccupied areas.	*Our observations concerning unoccupied habitat are not inconsistent with the literature for Yosemite toad (*Anaxyrus canorus*). In the Yosemite Toad Study Area, there are large areas of potentially suitable habitat that is currently unoccupied. These toads tend to be strongly philopatric. But that does not mean that this species could not occupy any of*

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				those potentially suitable areas in the future. In general, for any species, 100% of suitable habitat is never occupied.
59	CDFW 5/28/24	TERR-2 Wildlife	Should relationship and interaction levels between YOTO and tree frog be more closely monitored?	*Tree frogs and Yosemite toad (*Anaxyrus canorus*) co-occur throughout the Sierra Nevada. There is no nexus between intra-species interactions and the Project that warrants monitoring.*
60	CDFW 5/28/24	TERR-2 Wildlife	Overarching concerns: Lack of data from 2022-2023 field seasons may require another season of research before agreement is extended Many suitable habitat areas are devoid of YOTO, especially compared to previously, are the dams a contributing factor? Upland areas should be studied to compare YOTO populations to the project area. How is YOTO impacted by stocking and disease rates? Would improved water diversion tactics during a year of excess snowmelt provide YOTO with more suitable shallow water habitat? Is the lack of willow catcher nesting sites related to the dam? Should indicator species be surveyed more consistently? Lack of historical data provided as well, at least in terms of clearly understanding whether the project is impacting species sustainability.	*An additional field season (2024) is currently in progress. See responses to Comments #52, #53, and #54 regarding contribution of Project to Yosemite toad (*Anaxyrus canorus*) population numbers. See response to Comment #46 regarding upland habitat. See response to Comment #45 regarding fish stocking and disease rates. See response to Comments #35 and #48 regarding the lack of hydrologic connection to breeding habitat. See response to Comments #36 and 37 regarding Project relationship to willow flycatcher (*Empidonax traillii*) habitat. The Project facilities and operations have been in place for over 100 years and are considered existing conditions. The persistence of special-status wildlife or other indicator species on-site and in the vicinity is evidence the Project is not negatively affecting these populations.*
61	USFWS 5/17/24	TERR-2 Wildlife	What about a description of lakeshore habitat from all 3 reservoirs within the project area.	*A description has been added to the Technical Report.*
62	USFWS 5/17/24	TERR-2 Wildlife	Which reservoir are you referring to here?	*Saddlebag Lake. This has been clarified in the Technical Report.*
63	USFWS 5/17/24	TERR-2 Wildlife	Please add which Critical Habitat Unit this project is located in (Tuolumne Meadows/Cathedral). There is specific language in the Critical Habitat rule which talks about the physical and biological features within each Unit	*Additional critical habitat text has been added to the Technical Report.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
			where special management considerations may be required. See page 59082 in the Federal Register Notice for Yosemite toad Critical Habitat.	
64	USFWS 5/17/24	TERR-2 Wildlife	Ensure this PCE is addressed in your BA given the nature of the project.	*Comment noted.*
65	USFWS 5/17/24	TERR-2 Wildlife	Additional citation: Dodge, C.M., C. Brown, A.J. Lind, R.A. Knapp, L.R. Wilkinson, and V.T. Vredenburg. 2024. Historical and contemporary impacts of an invasive fungal pathogen on the Yosemite toad. Biological Conservation 291:110504.	*This reference has been added to the list of citations in the Technical Report.*
66	USFWS 5/17/24	TERR-2 Wildlife	The average is 68", in 2023 the snow depth was 64.5" yet it was 211% of average. Please explain.	*The typo was corrected in the Technical Report. The percentages remain correct but the previous measurement values erroneously listed snow water equivalent rather than snow depth.*
67	USFWS 5/17/24	TERR-2 Wildlife	To aid in identifying which areas are being described in the text, consider using the reference numbers (1-50) shown in Figures A-4 through A-5 to better help the reader. For example you could reference Northern Saddlebag Lake, Figure 4-1, pool numbers 1-9	*The Technical Report has been updated to reflect these edits.*
68	USFWS 5/17/24	TERR-2 Wildlife	Add the pool numbers to aid the reader.	*The Technical Report has been updated to reflect these edits.*
69	USFWS 5/17/24	TERR-2 Wildlife	Were these two ponds filled with water in 2023? Reference Figure in Appendix A.	*Yes, and no potential evidence of toad breeding was observed.*
70	USFWS 5/17/24	TERR-2 Wildlife	Did CDFW write a report? If they did, consider adding as an appendix.	*We are not aware of a report prepared by CDFW for their surveys in 2022.*
71	USFWS 5/17/24	TERR-2 Wildlife	To aid in identifying which areas are being described in the text, consider using the reference numbers (1-50) shown in Figures A-4 through A-5 to better help the reader. For	*The report has been updated to reflect these edits.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
			example you could reference Upper Lee Vining Creek, acoustic recorder locations as Figure 4-2, pool number 16	
72	USFWS 5/17/24	TERR-2 Wildlife	Consider adding a Figure which depicts the critical habitat polygon compared to the action area.	*A figure has been added to the report.*
73	USFWS 5/17/24	TERR-2 Wildlife	At the technical team meeting in Lee Vining it was conveyed that this breeding area is not within the FERC boundary yet this Figure clearly shows the boundary bisecting the breeding habitat. Please explain the discrepancy.	*As part of relicensing, SCE is updating the FERC Project Boundary. As a result, old figures incorrectly depict the Project Boundary. Updated figures are included in the DLA and finalized for the FLA. The FERC Project Boundary around the majority of Tioga Lake ends at the established water line (associated with static topography of the Tioga Dam crest). The occupied breeding habitat observed does not extend past that water line. The boundary line in this figure will remain for consistency with other study Technical Reports and a footnote has been added to the exhibit clarifying this discrepancy.*
74	USFS 6/10/24	TERR-2 Wildlife	It would be good to see these on a map: "The closest recorded willow flycatcher nest site (not identified to subspecies) is approximately 4 miles south of the Project in the Pumice Valley of the Mono Basin region (McCreedy, 2007; CDFW, 2022). Observations of willow flycatcher (not identified to subspecies) occur along Lee Vining Creek in the Willow Flycatcher Study Area, but there are no records of nesting (CDFW, 2022; eBird, 2022)."	*The location has been added to the Wildlife Technical Report.*
75	SWRCB 6/11/24	TERR-2 Wildlife	Yosemite toads (Anaxyrus canorus) are currently listed as threatened under the federal Endangered Species Act and designated as a Species of Special Concern by the California Department of Fish and Wildlife. Visual encounter and acoustic recording survey methods only encountered confirmed Yosemite toads in the South of Saddlebag Lake survey area. The study states Yosemite toads are known to interbreed with the Western toad	*SCE disagrees that DNA is vital in helping determine if Project operations affect critical habitat for the Yosemite toad (*Anaxyrus canorus*). Further, while the DNA sampling will help determine if hybridization has occurred in the breeding habitat adjacent to the FERC Project Boundary by Saddlebag Lake and upper Lee Vining Creek, the*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
			(Anaxyrus boreas) with the closest known location being approximately 4.7 miles north of Saddlebag Lake. DNA samples collected in 2023 are currently being processed and compared against a hybrid genetic panel developed by the El Dorado National Forest and are not yet ready for review. **The results of the DNA sampling conducted in 2023 are vital in helping determine if Project operations affect critical habitat for the Yosemite toad**. DNA sampling will also determine the frequency of interbreeding between the Yosemite and Western toads. State Water Board staff look forward to seeing the DNA sampling results to better understand potential Project effects. If the populations of toad located in Upper Lee Vining Creek and adjacent to Tioga Lake are determined to be Anaxyrus boreas, the draft license application should include discussion regarding the extent to which Project operations (i.e., flows within Lee Vining Creek and Tioga Lake levels) support habitat for these populations. **Additional data collection may be required to understand whether Yosemite toad populations in these two areas are stable, or how they may respond to Project operations under various water year types.**	*DNA results will not be available in time to inform the DLA.*
76	USFS 6/12/24	TERR-2 Wildlife	The assumptions about egg masses not belonging to Yosemite toads if those observations weren't tied to positive auditory observations. I think we would assume the opposite, just because the acoustic monitors didn't capture a call doesn't mean those egg masses aren't Yosemite toads. My guess is the USFWS would want us to approach it this way.	*Because of the potential for interbreeding, we have kept these identifications to the genus level at this time in lieu of actual direct observations for the metamorphs and adults or genetic data.*
77	MLC 6/11/24	TERR-2 Wildlife	Local residents have observed American Dippers (Cinclus mexicanus) losing nests as a result of hydropeaking events. Seasonal timing and magnitude of hydropeaking during nesting season has the potential to continue to impact American Dippers.	*Comment is noted, but anecdotal information such as this is not a reliable dataset. Furthermore, the section of Lee Vining Creek below Poole Powerhouse is outside the FERC Project Boundary and was only included for willow flycatcher habitat*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
				assessment, not part of the surveys for general wildlife in the TERR-2 Study.
78	SWRCB 6/11/24	WQ-1 Water Quality	Saddlebag and Tioga lakes had minimum summer 2023 pH values of 5.5 and 5.1, respectively. pH in the hypolimnia of both Saddlebag and Tioga lakes was similarly low in summer 2022, indicating an ongoing condition which did not respond strongly to water year type. The Water Quality Control Plan for the Lahontan Region (Basin Plan) pH objective states that: "In fresh waters with designated beneficial uses of COLD[2] or WARM[3], changes in normal ambient pH levels shall not exceed 0.5 pH units." Lee Vining Creek upstream of the Los Angeles Department of Water and Power (LADWP) diversion includes COLD as a beneficial use. **Future discussions will help determine how protection, mitigation, and enhancement (PM&E) measures could be applied, to address low pH values.** Dissolved oxygen concentrations collected near the bottom of Saddlebag and Tioga lakes reached a minimum of 3.4 milligrams per liter (mg/L) and 0 mg/L in 2023, respectively. Dissolved oxygen was similarly low in summer 2022, indicating an ongoing condition which was not eliminated in a wet water year. [2] Cold Freshwater Habitat is defined as beneficial uses of waters that support cold water ecosystems, including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates. [3] Warm Freshwater Habitat is defined as beneficial uses of water that support warm water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.	*Observations of pH outside of the ranges identified in the Basin Plan water quality objectives are due to several natural processes unrelated to Project operations. Because the geology of the surrounding watershed is granitic with low buffering capacity, small changes in dissolved CO_2 (resulting from algal photosynthesis during daylight hours and from dark respiration of algae and bacteria at night) can result in variable pH potentially exceeding water quality objectives. For example, the higher pH concentrations in summer are consistent with higher levels of primary productivity during the longer daylight hours. SCE does not directly discharge nutrients or other substances that directly or indirectly alter pH, and the variations in pH are naturally occurring; therefore, SCE does not propose any PME measure to address pH in Project waters.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
79	SWRCB 6/11/24	WQ-1 Water Quality	The Basin Plan objective for dissolved oxygen states: "The dissolved oxygen concentration, as percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum dissolved oxygen concentration be less than 80 percent saturation." The Basin Plan further states for waters with beneficial uses of COLD with SPWN[4] (such as Lee Vining Creek), the following additional criteria are applicable: (1) a 7 Day Mean concentration of 9.5 mg/L, and (2) a 1 Day Minimum of 8.0 mg/L. **While low dissolved oxygen in Project reservoirs is likely related to decomposition in the hypolimnion and sediments, the extent to which Project operations promote or create these conditions at Tioga and Saddlebag lakes should be analyzed; particularly, maintaining Project reservoirs at maximum depth throughout the summer stratification period.** [4] Spawning, Reproduction, and Development is defined as beneficial uses of water that support high quality aquatic habitat necessary for reproduction and early development of fish and wildlife.	*Seasonal stratification and patterns of low or hypoxic conditions in bottom waters are naturally occurring and almost universally observed in temperate lakes throughout the world (Horne and Goldman, 1994; Wetzel, 2001), with occurrences of near saturating oxygen conditions throughout the water column found in relatively few oligotrophic lakes (e.g., Lake Tahoe, Courtright Lake). Although seasonal hypoxia is commonly attributed to aerobic decomposition of watershed- and algae-derived sources of natural organic matter at depth, the Project does not discharge nutrients or organic materials that could directly or indirectly influence dissolved oxygen levels. Because the mixed depth of the reservoir is controlled by basin morphometry and valley position effects upon wind fetch pre-dating and unrelated to Project operations, operating water levels are expected to have little influence upon the development of seasonal hypoxia below the thermocline. Furthermore, water quality profiles collected from both Tioga and Saddlebag Lakes in 2022 and 2023 indicate DO concentrations in the epilimnion and metalimnion are consistently above 80% saturation and provide adequate DO to support aquatic beneficial uses. The moderate water temperatures and available DO in the metalimnion and epilimnion meet Basin Plan objectives and provide adequate refuge for fish during periods of low oxygen in the hypolimnion; therefore, SCE does not propose any PME measures to address DO in Project waters.*
80	SWRCB 6/11/24	WQ-1 Water Quality	In addition, the Project does not appear to have a moderate level of algal productivity as implied in the response provided in WQ-1 to the State Water Board's 2023 comment letter. Water quality data collected in 2022 and 2023 as part of WQ-1 demonstrate that Project	*As discussed in the previous comments, the causal mechanisms for low pH in Project reservoirs are naturally occurring and the Project does not directly discharge substances that would alter pH into*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
			reservoirs are likely ultra-oligotrophic, as indicated by total phosphorus concentrations which were below the minimum detection limit at all sampling events. As discussed below in this comment letter, mercury concentrations in fish in both Saddlebag and Tioga lakes are a concern, and understanding how Project operations may promote anoxia in reservoir sediments is critical to determining Project effects on beneficial uses. **Low pH is also likely related to decomposition, but as with dissolved oxygen, the extent to which Project operations impact pH should be analyzed.**	*Project reservoirs. SCE does not propose any PME measure to address pH in Project waters.*
81	SWRCB 6/11/24	WQ-1 Water Quality	Fecal coliform bacteria data collected in 2023 were within the Basin Plan objectives, however, data collected in 2022 ranged from 49 to 540 most probable number per 100 milliliters (MPN/100 mL) on a single sampling date. The Basin Plan objective for fecal coliform states that "The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 mL, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100mL." Although sampling from 2022 may have been an isolated incident, it is important to understand: (1) under what conditions caused the exceedance; and (2) how frequently exceedances occur. State Water Board staff look forward to continued discussion with SCE regarding the fecal bacteria data collected to determine appropriate PM&E measures associated with the Project moving forward.	*Fecal coliform collected during 1 of 11 sampling dates during 2022 and 2023 indicates that high fecal coliform counts are infrequent and short in duration. High bacteria results after Labor Day weekend in 2022 suggest that recreation at USFS campgrounds could be contributing coliform bacteria into Tioga, Saddlebag, and Ellery Lakes during peak recreation usage (e.g., summer holidays). The recreation facilities (i.e., campgrounds) are not affiliated with the Project and Project operations do not directly discharge effluent; therefore, SCE does not propose any PME measures related to fecal coliform.* *The LRWQCB adopted the statewide amendment on June 28, 2023, which modified the Basin Plan water quality objectives for the REC-1 Study to use an E. coli pathogen indicator. E. coli data were collected during six sampling events surrounding the 2023 Labor Day weekend (8/24–9/26) and were less than laboratory PQLs (<1.8 MPN/100mL). Based on current E. coli results, no exceedances of the bacteria numerical objectives were observed in Project reservoirs and the Project has no effect on*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
				bacteria; therefore, SCE does not propose any PME measures related to E. coli.
82	SWRCB 6/11/24	WQ-1 Water Quality	Turbidity sampling data collected within Lee Vining Creek Downstream of Poole Powerhouse (Site LVC-DSPP1) from May through July 2023 ranged from 0 to 50 Nephelometric Turbidity Unit (NTU). Data collected in Lee Vining Creek near Lower Lee Vining Campground (Site LVC-DSPP2) from May through July 2023 ranged from 0 to 150 NTU. The Basin Plan objective for turbidity states "Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent." From June through August of 2022, turbidity data shows that hydro-resource optimization events caused distinct, significant increases in turbidity. Relative to periods of stable low turbidity during minimum flows, clearly defined hydro-resource optimization events in summer 2022 caused turbidity to increase roughly 100% and 133%, 0.2 mile and 4.3 miles downstream of Poole Powerhouse, respectively. While equipment malfunctions and fouling can possibly skew data, there is still a concern for the correlation between peak flow rates and increased turbidity. State Water Board staff look forward to continued discussion with SCE to determine appropriate PM&E measures and prevent future exceedances.	*Comment noted. PME discussions surrounding flows and operations are ongoing with Stakeholders. No adverse effects to species have been observed. Similar to experiences on Bishop Creek, one challenge is defining or clarifying the baseline conditions in the Basin Plan. The 2023 season showed a significant increase in NTUs (independent of Hydro-resource Optimization) during fall runoff.*
83	SWRCB 6/11/24	WQ-1 Water Quality	Mercury in fish tissue sampling data shows the mean total Mercury for fish in Saddlebag Lake and Tioga Lake is 0.121 and 0.056 micrograms per gram wet weight (µg/g ww), respectively. These data are within the USEPA 304(a) recommended criterion standards for concentrations of methylmercury in fish tissue of 0.2 mg/kg[5]. However, on May 2, 2017, the State Water Board adopted Resolution 2017-0027, which approved "Final Part 2 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California - Tribal and Subsistence	*Comment noted. A comparison to Basin Plan objectives is included in the DLA and FLA. The proposed revisions to the Basin Plan have not been finalized as of January 2025, so no additional discussion is included in the FLA.*

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Comment Number	Entity / Date	Resource Report	Comment	SCE Response
			Fishing Beneficial Uses and Mercury Provisions." Resolution 2017-0027 established new beneficial use definitions for tribal beneficial uses: Tribal Tradition and Culture (CUL), Tribal Subsistence Fishing (T-SUB), and Subsistence Fishing (SUB). Five new Mercury water quality objectives were established in the resolution for tribal beneficial uses. The Lahontan Regional Water Resources Control Board is proposing to amend the Water Quality Control Plan for the Lahontan Region (Basin Plan) to designate Tribal Beneficial Uses to waterbodies in the Mono Basin, including Tioga and Saddlebag lakes. If the Basin Plan is amended, Saddlebag and Tioga lake mercury concentrations might exceed tribal beneficial use objectives. [5] 1 mg/kg = 1 µg/g	

Basin Plan = Water Quality Control Plan for the Lahontan Region; BMI = benthic macroinvertebrate; CDFW = California Department of Fish and Wildlife; cfs = cubic feet per second; D_{50} = Particle Size Distribution D50; DLA = Draft License Application; DO = dissolved oxygen; FERC = Federal Energy Regulatory Commission; FLA = Final License Application; GIS = geographic information system; LADWP = Los Angeles Department of Water and Power; LRWQCB = Lahontan Region Water Quality Control Board; MLC = Mono Lake Committee; MPN/100mL = most probable number per 100 milliliters; NDVI = Normalized Difference Vegetation Index; NTU = nephelometric turbidity unit; O&M = operation and maintenance; PME = protection, mitigation, and enhancement; PQL = practical quantification limit; SB = Senate Bill; SCE = Southern California Edison; SEF = Stream Ecosystem Flow; SWRCB = California State Water Resources Control Board; TWG = Technical Working Group; USFS = U.S. Forest Service; USGS = U.S. Geological Survey; YOTO = Yosemite toad

REFERENCES

Horne, A.J., and C.R. Goldman. 1994. Limnology. Second edition. USA: McGraw-Hill, Inc.

Wetzel, R.G. 2001. *Limnology Lake and Reservoir Ecosystems*. San Diego: Academic Press.

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COMMENT LETTERS ON THE DRAFT LICENSE APPLICATION

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Draft License Application Comments

Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
E-01	5/6/2024	Cultural and Tribal TWG	Notice of draft cultural section of DLA to Indian Tribes for review	Email
E-02	11/20/2024	CDFW	CDFW DLA Comment Letter	Letter
E-03.1	11/21/2024	USFS	USFS Cover Letter to DLA Comments (see Attachment 1, Item E-3.2)	Letter
E-03.2	11/21/2024	USFS	USFS Comments on DLA	Letter
E-04	11/22/2024	CA State Water Board	CA State Water Board DLA Comment Letter	Letter
E-05	11/25/2024	Mono Lake Committee	Mono Lake Committee comments on DLA	Email (w/ Letter Attached)
E-06.1	12/17/2024	USFS	Discussion re USFS comments on DLA, Forestwide Invasive Plants Treatment Project	Email
E-06.2	1/13/2025	USFS	Discussion re USFS comments on DLA, Forestwide Invasive Plants Treatment Project	Email

CA = California; DLA = Draft License Application; CDFW = California Department of Fish and Wildlife; TWG = Technical Working Group; USFS = U.S. Forest Service

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Item E-01_SCE notice of draft cultural section of DLA to Indian Tribes for review

From:	Audry Williams
To:	culture@bridgeportindiancolony.com; events@mammothmuseum.org; clerkrecorder@mono.ca.gov; rainbowpackers@aol.com; adam.barnett@usda.gov; Jacqueline.beidl@usda.gov; ashley.blythehaverstock@usda.gov; adam.cohen@waterboards.ca.gov; lori.gillem@LADWP.com; stephanie.heller@usda.gov; sheila.irons@usda.gov; beth.lawson@wildlife.ca.gov; tristan.leong@usda.gov; bryan.muro@waterboards.ca.gov; Wilfred.Nabahe@usda.gov; courtney.rowe@usda.gov; monique.sanchez@usda.gov; nathan.sill@usda.gov; kspears@mono.ca.ogv; curator@monobasinhistory.org; jennifer.watts@waterboards.ca.gov; lundylakeresort@gmail.com; ssmiwuknation@gmail.com; claymiwumati@gmail.com; secretary@southernsierramiwuknation.org; ndondero21@gmail.com; director@southernsierramiwuknation.org; Vicechair@southernsierramiwuknation.org; mariposamiwuk@sti.net; preservation@southernsierramiwuknation.org; numugrace@gmail.com; cheyenne.stone@bigpinepaiute.org; d.gutierrez@bigpinepaiute.org; s.manning@bigpinepaiute.org; meryl.picard@bishoppaiute.org; darren.delgado@bishoppaiute.org; kutzanuumu@yahoo.com; chair@bridgeportindiancolony.com; admin@bridgeportindiancolony.com; culture@bridgeportindiancolony.com; carl@fortindependence.com; falconkeeper22@gmail.com; chair@lppsr.org; patsiata@yahoo.com; char54lange@gmail.com; jsheltraw@monolaketribe.us; dtonenna@gmail.com; Rwgoode911@hotmail.com; fbeihn@nfr-nsn.gov; cmcdonald@northforkrancheria-nsn.gov; efink@nfr-nsn.gov; bhale@northforkrancheria-nsn.gov; one_mug@yahoo.com; administrator@timbisha.com; environmental@timbisha.com; THPO@timbisha.com; andrea@mewuk.com; jon@mewuk.com; rfuller@mewuk.com; s.saulque@bentontribe.org; omccloud@wrpt.org; rmcminn@wrpt.org; Lscott@wrpt.org; lucy_basket4@yahoo.com; nayanake@comcast.net; nativearchdoc@yahoo.com; serrell.smokey@washoetribe.us; THPO@WashoeTribe.us
Cc:	Matthew Woodhall; Shannon Luoma; Finlay Anderson; Carissa Shoemaker; Audry Williams; Julie Granbery
Subject:	Lee Vining Project - availability of Cultural Resources Report, as required by CUL 1 - Cultural Resources TSR
Date:	Monday, May 6, 2024 9:43:36 AM
Attachments:	image002.png P-1388 Cultural Resources TSR Non-Confidential_20240506.pdf

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Dear Lee Vining Project Cultural Technical Working Group (TWG) Team,

Attached for your reference is the non-confidential version of the Cultural Resources Report for the Lee Vining Creek Project. This report summarizes the results of the FERC-approved *CUL-1 Cultural Resources* Technical Study Plan for FERC Project No. 1388, which included one study element covering the archaeology and built-environment resources (SCE, 2022). The discussion here is intended to provide a basis for evaluating the potential issues summarized in the Confidential Technical Study Reports (Pickrell et al., 2024; Waldroop, 2024)., which will be filed as Confidential and Privileged as a supplement to the Draft License Application (**CUI//CEII/PRIV**); Please provide any comments to audry.williams@sce.com by July 1, 2024.

Best regards,

Audry Williams
Senior Advisor, Archaeology Program
Operational Excellence
T. 626-302-5104 | M. 310-617-2636
2244 Walnut Grove Ave., Rosemead, CA 91770

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Boulevard, Suite C-220
Ontario, CA 91764
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

November 20, 2024

Debbie-Anne A. Reese, Acting Secretary
Federal Energy Regulatory Commission
Division of Hydropower Licensing
888 First Street NE
Washington, DC 20426

Subject: Comments from the California Department of Fish and Wildlife on Southern California Edison's Draft License Application for the Relicensing of the Lee Vining Hydroelectric Project, FERC Project No. 1388

Dear Ms. Reese,

The California Department of Fish and Wildlife (CDFW) has received and reviewed the Draft License Application (DLA), filed by Southern California Edison (SCE) for the relicensing of the Lee Vining Hydroelectric Project (Project, FERC No. 1388). The DLA was filed by SCE with the Federal Energy Regulatory Commission (FERC) on August 27, 2024. Pursuant to 18 CFR §5.16(e), CDFW is providing comments and recommendations on the DLA below.

AUTHORITIES

CDFW is the relevant State fish and wildlife agency for resource consultation pursuant to the Federal Power Act Section 10(j) (16 U.S.C. section 803 (j)). The fish and wildlife resources of the State of California are held in trust for the people of the State by and through CDFW (Fish & G. Code § 711.7). CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species (Fish & G. Code § 1802). Information generated through the appropriate studies will be utilized by CDFW in the development of recommendations.

The mission of CDFW is to manage California's diverse fish, wildlife, and plant resources, and the habitats on which they depend, for their ecological values and for their use and enjoyment by the public. It is the goal of CDFW to preserve, protect, and as needed, to restore habitat necessary to support native fish, wildlife, and plant species within the FERC-designated boundaries of the Project, as well as the areas adjacent to the Project in which resources are affected by ongoing Project operations, maintenance, and recreational activities.

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COMMENTS ON DRAFT LICENSE APPLICATION (DLA)

General Statement

CDFW's comments provided in this letter mainly consider studies that were complete and had final technical study reports (TSRs) issued and filed with the DLA. CDFW has not completed a full review of some studies which were not complete or with TSRs that were not finalized at the time of the DLA filing. CDFW's DLA comments also reflect and respond to some discussions with SCE and other Relicensing Participants during meetings or email exchanges with respect to the ongoing protection, mitigation, and enhancement measures (PM&E measures) discussions for some resources. CDFW will provide additional comments on any outstanding studies and accompanying project impact analyses when these TSRs are finalized, and the impacts are analyzed under the Final License Application (FLA) and these documents are filed with FERC.

Specifically, CDFW does not provide comments in this letter on the following study as this study was either not complete or the technical memorandums had not been finalized when Licensees filed the DLA with FERC:

- Recreation Use Assessment (REC-1)

The FERC Project Relicensing Participants (SCE, CDFW and other Technical Working Group Members, henceforth abbreviated as RP) have been meeting for several months to determine if there are areas where collaborative agreement can be reached on protection, mitigation, and enhancement measures that would be included in the new FERC license. CDFW plans to continue to work with the Licensee and other RPs to determine where protection, mitigation, and enhancement measures can be agreed upon before the filing of the FLA.

DLA Volume I: Initial Statement

Information Required Pursuant to 18 CFR §4.51 (a)(1)

Pursuant to 16 U.S.C. § 808(e) any license issued by FERC shall be for a term of no less than 30 years and no more than 50 years from the date the license is issued. CDFW's understanding is that FERC generally issues new licenses for more than 30 years if significant changes in Project operations, new construction, and/or other large capital expenditures are proposed. The information provided by SCE thus far to RP's and FERC, including the Pre-Application Document (PAD) and DLA, does not indicate that any major operational changes, new construction, or expenditures are proposed by Licensees for the Project at this time. Thus, CDFW recommends FERC issue the shorter 30-year license term to Licensees for the Project.

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Information Required Pursuant to 18 CFR §4.51 (a)(5)(i)

CDFW recommends the addition of applicable Game Code (FGC) section to this part of the DLA. CDFW recommends the addition of:

FGC §5937 which states the following: "Sufficient Water for Fish Existing Below Dams – The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam. During the minimum flow of water in any river or stream, permission may be granted by the department to the owner of any dam to allow sufficient water to pass through a culvert, waste gate, or over a or around the dam to keep in good condition any fish that may be planted or exist below the dam, when, in the judgment of the department, it is impracticable or determinant to the owner to pass the water though the fishway."

DLA Volume I Exhibit E: Section 3.1.7

Comment: There are seven gages recording streamflow and reservoir stage for Project Operations, including four in stream gages, and three reservoir gages. The DLA states that the United States Geological Survey (USGS) reviews and publishes these records to satisfy the existing FERC license requirements but the frequency at which the data is available is not discussed. As of November 18, 2024, the last update USGS made to these gages was on September 30th, 2023, over a year ago. These gages are required by the 4(e) Conditions 4-6 set by the United States Forest Service (USFS) in the previous license to ensure that streamflow and reservoir level requirements are in compliance. The substantial delay in publicly available data hinders any stakeholders from reviewing compliance with these conditions or providing a timely identification and resolution to any issues. CDFW recommends that SCE work with USGS and the California Department of Water Resources to add daily storage and streamflow information from this project to the California Data Exchange Center and the USGS National Water Information System (NWIS). If there is a concern regarding market manipulation, a time lag from a day to a week could be added to address this issue. This is important for runoff tracking, downstream Los Angeles Department of Water and Power (LADWP) operations, restoration, and monitoring license requirements, as well as public recreation.

DLA Volume II Appendix E.1: Protection, Mitigation, and Enhancement Measures

Comment: Section 1.0 *Environmental Measures and Plans* states that the measures described in this document are proposed as a result of consultation with stakeholders and agencies. The RPs have been having ongoing discussions related to the Project PM&E Measures with SCE but the PM&E measures included in the DLA are carried

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over from the previous license and do not include the recommendations made from stakeholders or commitments made by SCE during the ongoing discussions.

Comment: CDFW appreciates the ongoing discussions and SCE's consideration of the concerns raised during the ongoing PM&E meetings. Specifically, CDFW supports modifying PME-1 Minimum Instream Flow Requirements and PME-2 Reservoir Level Requirements for Recreation to allow for a more natural hydrograph with higher spring flows and filling the reservoirs more slowly, while maintaining dam safety. CDFW is also supportive of the continued effort to use the Operations Model to develop realistic minimum instream flows that do not require frequent variance requests.

CDFW also appreciates the ongoing discussions and SCE's consideration of changing the structure of PME-3, Fish Stocking in Ellery Lake, to a set weight/number of fish that SCE is responsible to stock annually, with the location and timing of stocking determined through annual consultation with CDFW.

Comment: Project operations have the potential to affect populations of invasive aquatic algae in Project-affected stream reaches. Didymo (*Didymosphenia geminata)*, an invasive algal species, was historically observed in Project-affected stream reaches (Rost and Fritsen, 2014). The Aquatic Invasive Plants (AQ-4) Study did not observe didymo in any Project-affected stream reaches during 2023, but this was due to an extremely high water year. Given previous observations of didymo in the Project affected reaches, SCE should assume presence. Stakeholders and agencies have expressed concerns during PM&E discussions regarding the spread of didymo and CDFW requests that SCE address this issue in the FLA by drafting a comprehensive aquatic invasive management and monitoring plan, as discussed during the third PM&E Meeting on August 1, 2024.

DLA Volume I Exhibit E: Environmental Report

Impacts on water quality from Hydro-resource Optimization

Comment: Section 6.4.2.3 evaluates the Project's consistency with current resource management objectives set in the Forest Plan and Basin Plan. The DLA evaluates the effects of Hydro-resource Optimization by assessing turbidity data collected as part of the WQ-1 Water Quality TSR, concluding "The observed increases in turbidity did not exceed natural levels and were well below the range of natural variability observed during the 2022 to 2023 monitoring period." In Volume III of the DLA, the final AQ-1 Water Quality TSR acknowledges that turbidity increases were observed coincident with Hydro-resource Optimization and figure 4.3-2 is a graph of data collected between July 17th and 20th, 2022 showing how turbidity increases from a baseline of 0.5 to 4 NTUs at the monitoring site LVC-DSPP2 near the Lee Vining Campground. Appendix D of WQ-1 Hydro-resource Optimization Event Turbidity Data contains the full record of turbidity

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data related to Hydro-resource Optimization events. From June through December of 2022, turbidity data shows distinct significant increases in turbidity coincident with Hydro-resource Optimization events, with turbidity values frequently reaching 20 NTU above stable turbidity values of around 1 NTU.

The Basin Plan objective for turbidity states “Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent” (LRWQCB, 2019). The conclusion made in Section 6.4.3 that “The observed increases in turbidity [related to Hydro-resource Optimization events] did not exceed natural levels and were well below the range of natural variability observed during the 2022 to 2023 monitoring period” should be reassessed and the FLA should disclose the potential adverse effects Hydro-resource Optimization events can have on water quality and aquatic ecosystems as well as address these impacts by developing a PM&E measure to limit the impacts of Hydro-resource Optimization.

Impacts on Stream Fish Populations from Hydro-resource Optimization

Table 6.5-1 Life History Timing of Fish Species Likely to Occur in the Study Area

Comment: The fry/young of the year (YOY) periods displayed in Table 6.5-1 are incorrect. The DLA contradicts this table stating in section 6.5.2.1 that, “reductions in streamflows, like those that occur during Hydro-resource Optimization at Poole Powerhouse, have the potential to strand emergent life stages of naturally reproduced brown and brook trout in lower Lee Vining Creek during spring months (February through May) when their swimming abilities are most limited.” The fry/YOY period should start sometime in December and run through March or April, depending on the species. CDFW requests that the information in this table be reviewed and corrected, as appropriate.

Section 6.5.2.1 Effects of Project Operations on Quantity and Quality of Aquatic Habitat for Fish Populations within Project-Affected Stream Reaches

Comment: The stream reach potentially impacted by Hydro-resource Optimization is Lee Vining Creek between Poole Powerhouse and the pool upstream of the LADWP Diversion Dam (LLVC-F1). The Stream Fish Populations TSR (AQ-2) surveyed this reach in 2022. Fish Captured in this reach included brown trout (*salmo trutta)*, brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and cutbow (*Oncorhynchus clarkii* × *mykiss*). Brown trout were the most abundant and ranged from YOY to the 4+ age class, brook trout ranged from YOY to the 3+ age class, and the two rainbow trout and one cutbow were within 4+ and 5+ age classes based on scale analysis.

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Brown trout and brook trout spawn in the fall and winter, most commonly in November and December (Moyle, 2002). Spawning sites are selected by the female, and site selection occurs once water temperatures drop to 6 to 10°C. Eggs are fertilized and buried in redds and incubate through the winter months (Moyle, 2002). Natural streamflows are low and steady during winter months and disturbance and destruction of the redds can occur is the sediment in the channel becomes mobilized.

As part of the relicensing process, SCE conducted the Lower Lee Vining Creek Channel Morphology TSR (AQ-6) to assess how Project operations have the potential to affect fluvial processes and channel morphology in lower Lee Vining Creek. This study area included Lee Vining Creek downstream of Rhinedollar Dam to the LADWP diversion. This reach is composed of predominately plane bed and pool-riffle morphology with large wood throughout that influence channel morphology and sediment dynamics. Section 6.3.2.2 of the DLA states, “Results from the AQ-6 Study suggest that… the channel bed is relatively mobile, there is no evidence of systematic aggradation or incision, and the channels are not incised, providing connection with the floodplain during floods.”

As part of the relicensing process, SCE also conducted the Aquatic Habitat Mapping and Sediment Characterization TSR (AQ-3) to assess the quality and quantity of spawning gravel in the Project-affected reaches. Table 3.1-2 of the TSR in Volume III of the DLA defined spawning gravel for trout species to include a “sediment size composition between 0.2 and 3.9 inches located in an area with adequate water depth and velocity (i.e., greater than 9.4 inches and 15.7 to 35.8 inches per second, respectively) during flows with a recurrence interval of up to 1.5 years.” The TSR found that spawning gravel in lower Lee Vining Creek decreased in abundance from upstream to downstream, but the quality was lower in the upstream section of the reach, with Figure 4.2-4 classifying the quantity and quality of spawning gravel as “good” to “poor.” The TSR also states that “gravel deposits in lower Lee Vining Creek were primarily semiactive.”

Table 6.4-3 of Volume III of the DLA provides Hydro-resource Optimization event duration, magnitude, and frequency by season, from 2015 to 2023, with the highest frequency occurring during the winter. AQ-3 has demonstrated that the gravels within lower Lee Vining Creek are mobilized during Hydro-resource Optimization events and AQ-3 has also documented that there is suitable spawning gravels within the reach. This evidence suggests that there are potential impacts to spawning brook and brown trout redds from sediment mobilization and scouring of redds during Hydro-resource Optimization events in the winter months. CDFW disagrees with the conclusion in Section 6.5.2.3 that there are no adverse effects on fish and wildlife resources under the Proposed Action and requests that SCE address these impacts by developing a PM&E measure to limit the impacts of Hydro-resource Optimization.

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Comment: Potential impacts to fish populations from Hydro-resource Optimization events were discussed in section 6.5.2.1. of Volume III of the DLA. Part of the Lower Lee Vining Creek Channel Morphology TSR (AQ-6) assessed changes in stage to assess the potential for stranding fish due to rapid changes in flows. Rapid decreases in instream flows have the potential to strand fish and other aquatic life, leading to direct mortality or predation. Areas of a channel that are alternately wet and dry may create habitat that would not support the macroinvertebrate communities important as food for fish. Juvenile fish are especially vulnerable as they often prefer to reside in shallow waters along stream margins. The primary risks from changes in flows from Hydro-resource Optimization are disruption of breeding, scouring, and stranding. Stranding risk is highest when reductions in water surface elevations (stage) are rapid, shoreline slopes and stream gradient are shallow, and topographic depressions create isolated pools and substrate is heavily structured (e.g., cobble and boulder dominated substrate with larger interstitial space). Substrate composition is most structured and poses the greatest stranding risk in the upper section of the reach near Big Bend Campground where gravel, cobble, and boulder substrates dominate, compared to downstream where smaller substrates of sand and gravel are more common.

CDFW disagrees with the conclusions made from the results of AQ-6 in Section 6.5.2 *Potential Adverse Effect and Issues* and believes that these results indicate that Hydro-resource Optimization has the potential to strand fish and other aquatic life. SCE includes in the DLA that “no stranding has ever been documented by SCE or by any of the agencies or other stakeholders in reference material compiled in the pre-application document.” Hydropeaking normally occurs in the evening hours and into the night and thus it would be very unlikely and difficult to document stranding occurring. This statement is misleading and should not be used to justify that the Proposed Action has no adverse effects and CDFW requests that SCE address these impacts by developing a PM&E measure to limit the impacts of Hydro-resource Optimization.

Comment: As discussed during the ongoing PM&E meetings, CDFW would like the FLA to include a PM&E measure that addresses the impacts Hydro-resource Optimization has on the aquatic environment. A rate of 1 inch per hour is generally within the range of natural rates of stage reductions in unregulated rivers (Olson and Metzgar 1987), while Higgins and Bradford (1996) state that maximum recommended stage reduction levels of regulated rivers are typically 2.5–5 cm (1-2 inches) per hour. Recommendations described in Hunter (1992) also suggest reductions in river stage of 1-2 inches per hour are protective of fish populations.

The current license restricts hydropeaking from Poole Powerhouse only by providing high base flows in June and July of 89 cfs versus the required 27 cfs in all other months of the year. CDFW has an interest in understanding how reducing hydropeaking, or slower ramping rates would affect SCE’s power generation at this location. CDFW requests that the intraday Hydro-resource Optimization model SCE developed as part of

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the Operations Model TSR (AQ-5) should be used to understand implications for how much ramping rates would have to be adjusted to keep the stream reaches from experiencing less than two inches per hour of stage change. Alternatively, a higher baseflow could be provided during other months (consistent with a natural hydrograph) such that peaking would not cause such drastic stage changes in Lee Vining Creek. During the next PM&E discussions, CDFW would like to consider and understand the impacts of both slower ramping rates and higher minimum instream flows in this reach on SCE's operations through modeling scenarios. The results of these scenarios should be documented in the FLA.

Impacts on Reservoir Fish Populations from Ongoing Project Operations

DLA Volume I, 6.5.2.3. Effects of Project Operations on the Condition of Recreational Fisheries within Project Reservoirs

Comment: The Reservoir Fish Populations TSR (AQ-1) documented the current fish populations within the Project reservoirs. Sampling was conducted through the deployment of gill nets and boat electrofishing. Water quality conditions had little variation between Project reservoirs and were cool with high dissolved oxygen levels throughout the study area. For Ellery Lake the results indicate that it was a small sample size (n=33) and that YOY were present, but Figures 6.5-2 and 6.5-3 in AQ-1 only show three brook trout and no brown trout as YOY, indicating that there is not a strong self-sustaining population of brook or brown trout in Ellery Lake. For Tioga Lake no brown trout were caught, no YOY brook trout were caught, and it was also a small sample size (n=42). Saddlebag also did not have YOY brook trout and only YOY Lahontan redside. The data collected in AQ-1 Reservoir Fish Populations indicates that there are low numbers of brook trout and brown trout in Project Reservoirs, with low recruitment rates. Given that the water quality conditions do not pose a limiting factor of reservoir fish populations, these results indicate that there may a high recreational fishing pressure and that these lakes need to be managed as a put and take fishery. CDFW recommends incorporating these data into the Recreation Use Assessment (REC-1) study to assess if additional stocking efforts are needed and include these results in the FLA.

DLA Volume I, Section 6.6 Terrestrial Wildlife Resources

Comment: The General Wildlife Resources Survey TSR (TERR-2) documented Yosemite toad (*Anaxyrus canorus*) breeding along the southern boundary of Tioga Lake within and adjacent to the FERC Project Boundary. Section 6.6.2.2 *Effects of Dispersed-Use Recreational Activities on Terrestrial Wildlife Resources* acknowledges that "recreational activities that occur within their FERC boundary most commonly coincide with the edge of waterlines (i.e., along the shorelines of Tioga and Saddlebag Lakes). Trampling of small, slow-moving wildlife (such as Sierran tree frog juveniles)

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and associated habitat may occur as a result of these activities." CDFW requests that this statement be revised to include potential impacts to the mapped Yosemite toad breeding habitat along Tioga Lake and that SCE consult with the USFS, United States Fish and Wildlife Service (USFWS), and CDFW to minimize Project impacts to Yosemite toad.

DLA Volume II, Appendix A, Wildlife Resources Management Plan (PME-4)

Comment: CDFW supports SCE's plan to continue implementing an Avian Protection Plan (APP), to adhere to a Nesting Bird Management Guide, and to conduct pre-activity nesting bird and raptor surveys. Although CDFW has not reviewed the specifics of these plans, CDFW believes that any buffers for special-status birds should be determined through collaborative discussion between SCE, CDFW, USFS, and USFWS. The General Wildlife Resources Survey (TERR-2) documented bald eagle (*Haliaeetus leucocephalus),* golden eagle (*Aquila chrysaetos*), peregrine falcon (*falco peregrinus*), and olive-sided flycatcher (*Contopus cooperi*) within the Project area. Willow flycatcher (*Empidonax traillii*), although not observed during the survey, also has potential to occur within the Project area. CDFW considers special-status bird species to include species State listed as endangered, threatened, or candidates for these listings; Federally listed as endangered, threatened, or proposed for these listings; State fully protected species; State Species of Special Concern, watch list species; and Forest Service sensitive species.

DLA, Volume II, Appendix E.3: Habitat-Flow Analysis Comments

Comment: This report states that weighted usable area as a function of streamflow over time would be evaluated in this report. However, the resultant habitat time series plots show monthly values, and are presented separated out by water year type. This is an inappropriate way to present a habitat time series analysis as habitat bottlenecks throughout time may be obscured.

CDFW recommends the following changes should be made to this analysis for presentation in the FLA:

- This analysis should not be presented by stacking all wet/normal/dry years together in plots to look like they present time series information. Figures 1-5 in this report present habitat available over time in non-successive similar-grouped water year types. There is no need to split these charts out by water year type, as this obscures seasons in particular water years where habitat bottlenecks may be illustrated and addressed with license conditions.

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- Habitat time series should be presented using daily values, not monthly averages. Monthly averages obscure times when low flows would limit habitat available to fish species.
- Habitat time series analyses should not be presented for the reach between Lower Lee Vining Creek between Poole Powerhouse and the LAWDP Diversion Dam (Figures 1-14 through 1-16). This is a peaking reach, and unless intra-daily plots are prepared, presenting these plots based on average daily, or average monthly values severely obscures times when fish habitat is limited at low flows.

DLA Volume III Operations Model (AQ-5) Final Technical Report Comments:

Comment: Although an operations model has been calibrated to meet the stated study plan goal:

> *The intent of the operations model is to measure the ability of the Lee Vining system to meet flow targets that may be beneficial as determined by studies conducted in support of the licensing process.*

The operations model and Hydro-resource Optimization model still do not contain any way to output the results of various scenarios' impact on SCE's power generation, both peaking capability and annual generation. SCE staff and consultants stated in the October 22, 2024 meeting that they intend to continue to discuss alternate instream flow releases in the next few months, but it is unclear what metrics will be used determine impact to power generation in those scenarios based on the most-recently provided operations model version.

Additionally, in response to the State Water Resources Control Board's comments regarding the maximum peak modeled in the Hydro-resource Optimization model, SCE commented that additional flows will be modeled to capture more typical peaks that occur (up to 100 to 110 cfs).

This study and any analysis of measures based on results of this study should be considered incomplete until adequate peaking and power generation impacts are documented in the FLA. Table 2.8-2. (Study Implementation Status for the Project) in the DLA should also be updated to indicate that this study is incomplete until the information discussed above is complete.

DLA Volume I, Section 6.2.6 Scope of Cumulative Effects Analysis

Comment: This section does not provide any Cumulative Effects Analysis and states that, "Cumulative effects will be fully described in the FLA*,"* but Section 8.4. *Finding of No Significant Impact* states that "Continuing to operate and maintain the Project with

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the recommended environmental measures (including management and monitoring programs) included under the proposed Action would not be a major federal action significantly affecting the quality of the environment." This Finding of No Significant Impact should not be made without adequately disclosing and analyzing the cumulative effects of the Project.

CONCLUSION

CDFW appreciates the opportunity to comment on the DLA filed by SCE for the relicensing of the Lee Vining Hydroelectric Project. CDFW looks forward to further discussions with the Technical Working Group members.

If you have any questions pertaining to this letter, please contact Graham Meese, Senior Environmental Scientist, at (760) 996-7387 or Graham.Meese@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Alisa Ellsworth
84FBB8273E4C480...

Alisa Ellsworth,
Environmental Program Manager

ec: Southern California Edison

Wayne P. Allen, Principal Manager
Wayne.allen@sce.com

Matthew Woodhall, Project Lead
Matthew.woodhall@sce.com

California Department of Fish and Wildlife

Rose Banks, Acting Habitat Conservation Program Supervisor
Alisa.Ellsworth@wildlife.ca.gov

Graham Meese, Senior Environmental Scientist (Specialist)
Graham.Meese@wildlife.ca.gov

Beth Lawson, Senior Hydraulic Engineer
Beth.Lawson@wildlife.ca.gov

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United States Forest Service

Tristan Leong, Region 5 Hydroelectric Coordinator
Tristan.Leong@usda.gov

Sheila Irons, Inyo National Forest Special Uses Administrator
Sheila.Irons@usda.gov

California State Water Resources Control Board

Garrett Long, Water Resources Control Engineer
Garrett.Long@Waterboards.ca.gov

Adam Cohen, Senior Environmental Scientist (Specialist)
Adam.Cohen@Waterboards.ca.gov

Mono Lake Committee

Bartshe Miller, Policy Director
Bartshe@monolake.org

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United States Department of Agriculture | Forest Service | Pacific Southwest Region

Inyo National Forest
351 Pacu Lane, Suite 200
Bishop, CA 93514
(760) 873-2400 Voice
(760) 873-2538 Text (TDD)

File Code: 2770

Date: November 21, 2024

Ms. Debbie-Anne A. Reese
Acting Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Via Electronic Submittal

Subject: Lee Vining Hydroelectric Project, FERC No. 1388
Response to SCE's Draft License Application

Dear Secretary Reese:

This document is in response to Southern California Edison Company (SCE or Licensee) August 27, 2024, filing of the Lee Vining Hydroelectric (FERC #1388) "Draft Application for New License" (DLA). Specifically, this response provides comments on the [three volumes] that comprise the DLA including: [Cover Letter, Volume I Initial Statement and Exhibits A-H, Volume II Exhibit E appendices, and Volume III Final Technical Report and Completed Study Plans]. This response is filed by the Inyo National Forest to provide comments and concerns as they relate to resource protection of National Forest System lands and resources, as provided for in the Federal Power Act.

While our comments include concerns with missing components of approved study plans or request clarification of existing data, we do not request modification of existing studies or new studies at this time. Therefore, we do not address the FERC modified or new study criteria at 18 CFR §5.15 (f). Since all of the study information is not currently available, we maintain our ability to comment on completed study information as it becomes available. In that regard, we are aware that SCE intends to file some incomplete information with the Final License Application, when there will be another opportunity to comment. There may not be sufficient information for the Forest Service to make informed decisions until all studies are complete.

In some other proceedings, Forest Service study proposals, additional information requests or recommendations for clarification have been denied by a Licensee, with some denials upheld by FERC. When later decisions were needed for those resources where the Forest Service felt there was insufficient information, we relied on our best professional judgment. In some of those cases the Licensee stated that there was insufficient data for Forest Service decisions based on professional judgment. This circular disagreement has resulted in hearings, disputes and other untenable situations. We state for the record that if Forest Service-requested information or clarification is not provided by the Licensee and we later use professional judgment to interpret

the limited information, we do not believe the Licensee can use “lack of information” as a reasonable justification for disagreeing with Forest Service proposed mitigations.

The collaborative meetings, to discuss information released to date and begin development of mitigations for resources affected by Project operations, have been productive. We are optimistic that we will reach consensus decisions on this relicensing and look forward to continued discussions with the Licensee and other relicensing participants. We appreciate this opportunity to provide comments on the Licensee’s DLA.

If you have any questions, please contact Sheila Irons, Forest FERC Coordinator at Sheila.irons@usda.gov.

Sincerely,

Digitally signed by LESLEY YEN
Date: 2024.11.21 13:19:40 -08'00'

LESLEY YEN
Forest Supervisor

Enclosure

Attachment 1

Forest Service Comments on SCE's Draft License Application and Adequacy of Studies for

Lee Vining Hydroelectric Project No. 1388

The Forest Service (FS) provides the following comments regarding SCE's (Licensee's) August 27, 2024 Draft License Application (DLA). We would appreciate these comments being addressed in the Final License Application (FLA) or other response document, as appropriate. Since these comments do not request either new studies or modify existing studies, we do not address the 18 Code of Federal Regulations, Part 5, §5.15 (f), as it is inapplicable.

We note for the record that many reports are still in the process of being refined or completed and much of the measures proposed are generic plan proposals that have yet to be fully developed. While this response provides some indications where we may differ with the Licensee's interpretation or conclusions, on the whole we are in general agreement with SCE's approach and direction towards meeting various resource goals and interests as well as their openness to engage in collaborative dialogue towards resolution. Comments reference the corresponding text from the DLA for ease in cross-referencing.

Volume I

Exhibits A, B, C, D, E, F, G, H

Exhibit A Project Description

Project Roads

A-13:

The text states that, *Project operation and maintenance activities use existing gravel access roads at Saddlebag Dam (2.05 acres) and Tioga Dam (0.52 acres). These roads are included in the proposed FERC Project Boundary*. The Forest Service notes that Poole Powerhouse Road is not included in this description, though it serves as the only road access route to the Poole Powerhouse and was originally constructed to build and operate powerhouse. The FLA should reflect this use and need as a project road. The Forest Service supports the road's inclusion as part of the proposed FERC project boundary. Further the FLA should discuss how this road is maintained to ensure access to the facility. Lastly, this road can contribute sediment directly to Lee Vining Creek below Poole Powerhouse and measures to reduce this impact should be discussed.

Exhibit E Environmental Report

6.3.1.2 Soils

6-12:

The soils description in the first two paragraphs restate the same descriptions and can likely be condensed.

6.4.1.7 Bacteria

6-65:

Fecal coliform readings for 9/15/2022, ranging from 49-350 MPN/100 mL are significantly higher (by 1-2 orders of magnitude) than samples taken on days close to this event. We suggest that the FLA and or water quality study provide additional discussion or explanations for this higher detection event.

6.7.2.4 No Action Vegetation Community

6-152:

This section states that, *Under the No Action, SCE would continue to operate and maintain the Project in accordance with the terms and conditions of the existing FERC license. No effects on vegetation communities as a result of Project O&M have been identified relative to baseline conditions…The No Action is consistent with the USFS desired conditions described in Section 6.7.2.4, Consistency with Current Resource Management Objectives, relative to vegetation communities… Project operations would not affect vegetation communities within and surrounding the Project because routine operations and maintenance do not involve expanding maintenance sites into native habitats.*

The conclusion that continued or future operation of the Project would have no effect on vegetation communities and be consistent with vegetation management objectives is predicated upon various assumptions: 1) that vegetation communities will remain unchanged in the future, 2) management objectives will correspondingly not update or adapt to future needs or conditions, and 3) Project maintenance or operational effects cannot result in potential new effects to surrounding vegetation communities. While current surveys demonstrate that the vegetation communities surrounding the Project remain similar to those surveyed during the current license term, they do not acknowledge that these communities have and will continue to change in the future. Periodic monitoring and vegetation management to prevent invasive introduction or spread through O&M activities will be needed as part of a new license to ensure that vegetation management objectives are me.

6.9.1.2 Rare Threatened and Endangered Plant Species

6-176-177:

The DLA states that: [Whitebark Pine (Pinus albicaulis)] *Recovery is expected if land managers facilitate the increase in pest resistance; climate change resilience; the free flow of genetic material, and manage wildfire (Environment and Climate Change Canada, 2017; Keane et al., 2012).* The citations provided do not support the claim that recovery is expected if only these actions are followed, nor should they be represented as a recovery plan, rather the citations provide a framework for restoration actions that could

contribute to improving conditions for Whitebark Pine populations. The current approved conservation strategy for this species can be found at: https://www.fws.gov/sites/default/files/documents/California%20Whitebark%20Pine%20Conservation%20Strategy%20508.pdf and should be referenced in the FLA.

Figure 6.9-1:

This Figure appears to be missing occurrences of Whitebark Pine. Four instances (dots) are shown, though Table 6.9-1 has 14 populations listed, including in locations not shown on map. The FLA should reconcile the figure with the data it was drawn from.

6.9.1.3 Yosemite Toad

6-180:

In this section of the DLA, SCE describes the presence and proximity of Yosemite toads to the FERC project. It also references the TERR-2 Final Technical Report which includes Yosemite Toad surveys for this project. Unlike other sections of the DLA, this section does provide conclusions as to whether SCE believes the Project has any effects on Yosemite Toads. While Yosemite Toads were discovered in surveys and are presumed to be present within the FERC Project area in other areas, the TERR-2 surveys were insufficient to fully characterize baseline information or use patterns. Longer-term surveys will be necessary to confirm species presence, use, distribution, and any potential effects of Project operations.

6.9.2.1:

The text in this section incorrectly describes Whitebark Pine's conservation status, it is listed as an ESA Threatened species and not an Inyo National Forest SCC species.

6.9.2.1: Effects of Project Operations and Maintenance on Rare, Threatened or Endangered Plants:

This Section states that the Project and O&M, *have no adverse effects on the spatial distribution of existing whitebark pine present in the area surrounding the Project.* The status of the Whitebark Pine population surrounding the Project is not necessarily static. While both the 2022 and 2023 surveys found this species near the Project, future surveys may find changes in recruitment and population. Future project operations, including regular O&M and vegetation management could affect the distribution and health of Whitebark Pines near the Project. It should be noted that any future Project O&M including any vegetation actions will address Whitebark Pine conservation status and needs.

6.10.2 Potential Adverse Effects and Issues:

The DLA states that there are no Project effects to recreation. SCE reaches this conclusion based upon its determination that no recreation facilities are associated with the Project, and because SCE has not proposed any recreation related measures. The Forest notes that the existing license includes requirements to manage the lake levels to address recreation and visual needs and that SCE provides funding to stock fish at its

reservoirs for recreational enjoyment. Regarding the statement that no recreation facilities are associated with the Project, no official determination has been made regarding facility use and recreational needs for his project. The Inyo NF asserts that there is a clear nexus to several recreation facilities immediately adjacent to the Project boundary – including those that provide public facilities at the Project reservoirs. Furthermore, REC-1 has not been completed which will provide additional insight into the recreational use of the Project via the adjacent campgrounds, day use sites, and trails. Therefore, SCE cannot conclude that there are no potential recreation effects and issues associated with the Project and by extension there is no need for recreation PM&E measures.

6.12.1.3 Wild and Scenic Rivers and Scenic Highways and Byways

6-293:

This section reads, *As part of the wild and scenic rivers classification system, 4.13 miles of Lee Vining Creek are listed as scenic, with 1.63 listed as wild, and 8.98 as recreational (USFS, 2024). The 2019 Inyo National Forest LMP (USFS, 2019) also identified over 75 miles of river in the Mono Basin as eligible for inclusion in the National Wild and Scenic Rivers System, including all of Lee Vining Creek (Section 6.10, Recreation).* This section could be misinterpreted or misread to imply that Lee Vining Creek is a designated Wild and Scenic River; it is not. The INF LMP identifies the creek as an eligible WSR and lists the potential classification of creek segments as scenic, wild, and recreational. The FLA should clarify this distinction.

Volume II

Appendix E:

4.5.3.1. Invasive Plant Management

15: This section states that, *Herbicide usage (chemical control) is not permitted within the Inyo National Forest.* This statement is incorrect. Herbicide utilization for invasive plant management can be applied with INF approval under specific conditions, and consistent with the Forest-wide Invasive Plants Treatment Project EA (2019).

The listed BMPs in this section do not constitute sufficient management for invasive plant management control. The FLA should describe or propose that SCE will develop an invasive weed management plan that will include among other things, the BMPs listed in this section as well as other actions as discussed and approved by the INF to address the control and spread of potential invasive plant species arising from Project activities.

Item E-04 _CA State Water Board DLA Comment Letter

From:	Muro, Bryan@Waterboards
To:	wayne.allen@sce.com
Cc:	Matthew Woodhall; Martin Ostendorf; tristan.leong@usda.gov; Chad_Mellison@fws.gov; Lawson, Beth@Wildlife; Moyer, Patricia (Trisha)@Wildlife; Meese, Graham@Wildlife; Carissa Shoemaker; Shannon Luoma; Finlay Anderson
Subject:	State Water Board Staff"s Comments on the Lee Vining Hydroelectric Project"s Draft License Application (DLA)
Date:	Friday, November 22, 2024 3:12:20 PM
Attachments:	LeeVining_DLACommentLetter.pdf

Dear Mr. Allen,

On August 27, 2024, SCE filed the Draft License Application (DLA) with FERC for relicensing of the Lee Vining Hydroelectric Project. Please see attached for the State Water Board's staff comments.

Thank you,

Bryan Muro
Water Resources Control Engineer
Water Quality Certification Program
Division of Water Rights
State Water Resources Control Board
Phone: 916-327-8702
E-mail: Bryan.Muro@Waterboards.ca.gov

CALIFORNIA Water Boards

GAVIN NEWSOM
GOVERNOR

YANA GARCIA
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

November 22, 2024

Mr. Wayne Allen
Southern California Edison Company
1515 Walnut Grove Avenue
Rosemead, CA 91770
Sent via email: Wayne.Allen@sce.com

Ms. Debbie-Ann Reese, Secretary
Federal Energy Regulatory Commission
Via e-filing to FERC Project Docket

Lee Vining Hydroelectric Project
Federal Energy Regulatory Commission Project No. 1388
Mono County
Lee Vining Creek, Glacier Creek, Ellery Lake, Tioga Lake, and Saddlebag Lake

COMMENTS ON THE DRAFT LICENSE APPLICATION FOR THE LEE VINING HYDROELECTRIC PROJECT

Dear Mr. Wayne Allen and Secretary Reese:

Southern California Edison Company (SCE) owns and operates the Lee Vining Hydroelectric Project (Project), also referred to as Federal Energy Regulatory Commission (FERC) Project No. 1388. As part of Project relicensing, on August 27, 2024, SCE distributed a Draft License Application (DLA) to FERC and interested parties for a 90-day comment period.

State Water Resources Control Board (State Water Board) staff have reviewed the Project DLA and hereby submit the enclosed comments. The comments are provided in *Attachment A: State Water Resources Control Board Staff Comments on Draft License Application for the Lee Vining Hydroelectric Project.*

If you have questions regarding this letter, please contact Bryan Muro, Project Manager, by email at Bryan.Muro@waterboards.ca.gov or by phone call to: (916) 327-8702. Written correspondence should be directed to:

State Water Resources Control Board
Division of Water Rights
Water Quality Certification Program
Attn: Bryan Muro
P.O. Box 2000
Sacramento, CA 95812

Sincerely,

Bryan Muro
Project Manager
Water Quality Certification Program
Division of Water Rights

Attachment A: State Water Resources Control Board Staff Comments on Draft License Application for the Lee Vining Hydroelectric Project

ec: Matthew Woodhall
Southern California Edison Company
Matthew.woodhall@sce.com

Martin Ostendorf
Southern California Edison Company
Martin.Ostendorf@sce.com

Tristan Leong
United States Department of Agriculture
tristan.leong@usda.gov

Chad Mellison
United States Fish and Wildlife Service
Chad_Mellison@FWS.gov

Beth Lawson
California Department of Fish and Wildlife
Beth.Lawson@wildlife.ca.gov

Patricia Moyer
California Department of Fish and Wildlife
Patricia.Moyer@Wildlife.ca.gov

Graham Meese
California Department of Fish and Wildlife
Graham.Meese@Wildlife.ca.gov

Carissa Shoemaker
Kleinschmidt Group
Carissa.Shoemaker@KleinschmidtGroup.com

Shannon Luoma
Kleinschmidt Group
Shannon.Luoma@Kleinschmidtgroup.com

Finlay Anderson
Kleinschmidt Group
Finlay.Anderson@kleinschmidtgroup.com

ATTACHMENT A

STATE WATER BOARD STAFF COMMENTS ON THE DRAFT LICENSE APPLICATION FOR THE LEE VINING HYDROELECTRIC PROJECT

The following comments are provided by State Water Resources Control Board (State Water Board) staff on Southern California Edison Company's (SCE) Draft License Application (DLA) for relicensing of the Lee Vining Hydroelectric Project (Project) also referred to as Federal Energy Regulatory Commission (FERC) Project No. 1388.

Volume 1 – Exhibit A

1. The minimum flow requirements description states that flows are dependent on water year types, but does not state what stations or datasets are used to determine water year types. State Water Board staff request that SCE include which stations and precipitation datasets are used to calculate water year types in its Final License Application.

2. The current minimum instream flow description for Saddlebag Dam appears incomplete as it is missing language from the 1997 FERC license which states:

   "It shall be the objective of the Licensee to maintain the flow regimes established by one of the two methods described above. However, in no case shall the Licensee release a minimum, continuous flow of less than 60% of the flow regime to be established for any given month per either of the methods described above."

   Amended Article 405 also requires that between October 15 and April 1, SCE may not vary flow below Saddlebag Dam by more or less than 10 cfs from the average daily inflow calculated between October 1 and October 14. This incomplete listing occurs in other areas of the DLA (e.g., Exhibit E, Table 3.5-1). State Water Board staff request SCE include all flow provisions of its FERC license when discussing current flow regimes in its FLA.

3. *Tioga Dam and Auxiliary Dam* section states that only the top 5 feet of the dam is visible due to backfill; please clarify whether the backfill is intentional or due to sediment accumulation and whether the area being described is the impoundment or downstream side of the dam.

4. *Storage Capacity of Reservoirs* section states that Saddlebag and Tioga Lakes are historically drawn down in winter "to provide storage capacity for spring run-off", but does not describe that SCE is contractually obligated to release most water stored by the Project annually, for potential use by the Los Angeles Department of Water and Power (LADWP) downstream. State Water Board staff request SCE include in its FLA, all water storage release requirements when discussing its current license terms.

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Volume I – Exhibit B

5. Figure B-1 *Trend for Inflows-Lee Vining Creek (1999-2023)*: State Water Board staff request that SCE clarify what data and averaging was used to develop the figure and whether the red line is intended to indicate a measurable trend over the period of record.

6. Table B-3 *Monthly Precipitation Totals at Ellery Lake Station*: State Water Board staff request that SCE add units to this table and clarify whether it represents both rain and snow. If only rain is included in this table, a new table should be developed which includes snow to accurately reflect precipitation conditions in the Project area.

7. *Below Poole Powerhouse* subsection (iii): *Hydraulic Capacity*, please clarify whether the statement "a minimum hydraulic capacity of approximately 6 cfs in dry periods but matches the natural inflow" is intended to mean that the actual minimum hydraulic capacity of Poole Powerhouse is the same as the lowest natural inflow during dry periods.

Volume I – Exhibit E

8. *Section 3.3.1.2 Water Rights*: This section states SCE worked with FERC to obtain archive records showing it possessed sufficient pre-1914 water rights for Lee Vining Creek. Table 3.3-1 does not list any pre-1914 water rights. State Water Board staff requests SCE clarify which water right it claims as pre-1914 associated with this Project.

   Section 3.1.4 Flowline/Penstock/Conveyance System: This section states the penstock's maximum flow is 110 cubic feet per second (cfs). USGS Gage No. 10287762 (SCE Gage No. 353) data, which measures flow through Poole Powerhouse, shows instream flow has reached a maximum of between 112 and 117 cfs in the months of May, June, July, and August in 2023. Table H-3 of the DLA describes forced outages that occurred within the last five years with the penstock rupturing[1] between the months of August through November. State Water Board staff request SCE include in its FLA an explanation as to why the flow through Poole Powerhouse often exceeds 110 cfs.

9. *Section 3.6.4 Public Safety Plan:* The section states "SCE uses signs to warn the public of hazardous areas and potentially dangerous conditions." Figure 6.4-12 depicts discharge below Poole Powerhouse during hydro-resource optimization events. In the figure, a step curve can be observed in which flow below Poole Powerhouse can suddenly increase from 6 cfs

[1] Poole Powerhouse penstock had a rupture/leak incident in late summer 2020.

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STATE WATER BOARD STAFF COMMENTS ON THE DRAFT LICENSE APPLICATION FOR THE LEE VINING HYDROELECTRIC PROJECT

to over 100 cfs within three hours. This is more clearly represented in Figure 5.5-2. *March 2017 Flow Hydrograph* in the Final Operations Model Technical Report (AQ-5, DLA Volume III), which shows flows increasing from 6 cfs to approximately 60 cfs within an hour.

During SCE's May 2024 Technical Report Review Stakeholder Meeting[2], State Water Board staff observed the campgrounds below Poole Powerhouse. The campgrounds were within 20 feet of Lee Vining Creek with no signs warning recreation users of sudden increases in flow. During hydro-resource optimization events maximum water depth and velocity can increase by an approximate peak of 1.5 feet and 2.5 feet per second, respectively. At maximum event flows of 110 cfs, depth and velocity are expected to increase even more drastically. These changes occur very rapidly and often take place in the late afternoon or early evening, and as such may present a safety concern to recreationists downstream, particularly near high-use recreation zones such as campgrounds. State Water Board staff recommend SCE include signage warning recreation users at both developed campground and dispersed camping areas of potential sudden increases in flows due to hydro-optimization events, and describe the measure in the FLA.

10. *Section 6.3.1.5 Reservoir Shoreline and Streambank Conditions*: This section includes bathymetry for the Project's reservoirs. State Water Board staff requests that the FLA include the rate of sedimentation (if available) for Saddlebag, Tioga, and Ellery Lakes based on current and any historic bathymetry data.

11. *Section 6.3.1.6 Erosion and Sedimentation:* The section includes erosion control measures as required in the Project's current FERC license. Several of the listed measures intended to reduce erosion and sedimentation as part of ongoing Project operation and maintenance appear to be outdated. In 2022, the State Water Board issued Water Quality Order No. 2022-0057-DWQ[3] updating the National Pollutant Discharge Elimination System General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (CGP). The CGP requires the use of best available technologies for selection and implementation of BMPs. The Erosion and Sediment Control Plan should be updated for the term of the new FERC license(s). State Water Board staff request that SCE include in its FLA a proposal to develop and

[2] SCE held a Technical Report Review meeting for Stakeholders at the Lee Vining Community Center on May 14, 2024.

[3] https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2022/wqo_2022-0057-dwq.pdf

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implement a new Erosion and Sediment Control Plan with updated erosion and sediment control measures.

12. *Section 6.3.1.6 Erosion and Sedimentation* states that "Sediment removal at Project impoundments is conducted on an as-needed basis". On October 3, 2017, the Executive Director of the State Water Board issued a water quality certification for Eastern Sierra Hydroelectric Power Projects Ongoing Operations and Maintenance[4]. The United States Army Corps of Engineers (USACE) issued a Regional General Permit (RGP) for the ongoing operations and maintenance, which has been extended through October 15, 2025[5]. If SCE seeks a new USACE action for continued operations and maintenance activities, a new water quality certification action would be needed. The first action in applying for a new certification would be to submit a pre-filing request.

    Additionally, ongoing sediment removal at the Project would be addressed in a water quality certification for relicensing of the Project.

13. *Section 6.4.2.2. Bioaccumulation of Mercury in Fish Tissue and Potential Consumption Guidelines to Avoid Human Health Risks in Project Reservoirs* states that regarding mercury in trout "the consumption frequency for Project reservoirs is higher (more servings per week) than the OEHHA [Office of Environmental Health Hazard Assessment] California statewide advisory for eating fish from California's Lakes and Reservoirs without site-specific advice". While this is true for rainbow trout, brook trout are not included in OEHHA's 2022 *Statewide Health Advisory and Guidelines for Eating Fish from California's Rivers, Streams, and Creeks without Site-Specific Advice*[6], and have no corresponding statewide advisory. State Water Board staff recommend that SCE include a measure in the FLA to notify anglers at Saddlebag Lake and Tioga Lake that consumption of brook trout should be limited, as indicated in Table 6.4-12.

    This section concludes by stating "Based on the analysis discussed above, the results of the aquatics studies, and because the Proposed Action does not include changes to O&M activities, no adverse effects have been identified for Proposed Action." However, the DLA acknowledges that the conditions in Saddlebag and Tioga Lakes have the

[4] https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_quality_cert/wqcert_notices/esp_wqc.pdf
[5] https://www.spl.usace.army.mil/Portals/17/docs/regulatory/RGP/RGP97.pdf
[6] https://oehha.ca.gov/media/downloads/advisories/fishadvisorystatewideriversreport2022.pdf

potential to methylate mercury, leading to the bioaccumulation of mercury in fish. Low dissolved oxygen at the sediment-water interface – one of the pathways identified in the DLA for mercury methylation – is expected to occur more frequently as climate change causes stronger thermal stratification in lakes[7]. Although brook trout fish tissue mercury concentrations do not currently exceed the Sport Fish water quality objective, those concentrations may increase throughout the period of a new FERC license. State Water Board staff request that SCE add a measure to monitor fish tissue mercury concentrations intermittently throughout the period of a new license, and propose actions to address exceedances should they occur.

14. *Section 6.4.2.1 Effects of Project Operations and Maintenance on Water Quality in Project Reservoirs and Project-Affected Stream Reaches* in part states "Based on the analysis discussed above, the results of the studies, and because the Proposed Action does not include changes to O&M activities, no adverse effects have been identified for Proposed Action." Data presented in the DLA demonstrate that there may be exceedances of the Water Quality Control Plan for the Lahontan Region (Basin Plan) water quality objectives within Project waters. These issues have been described by State Water Board staff in previous comment letters, and staff have previously requested that SCE demonstrate that its Project is not the cause of these Basin Plan exceedances. In *Section 6.4.2.3. Consistency with Current Resource Management Objectives (Forest Plans, Basin Plan, etc.)* SCE states that there are "Some inconsistencies with applicable Basin Plan objectives" but that these inconsistencies are "naturally occurring and not associated with the Project". This statement is not supported by the available data and the DLA does not attempt to demonstrate that Project operations have no impact on the potential exceedances.

    Additionally, *Table 6.4-13 Summary of 2022 and 2023 Water Quality Results and Comparison to Basin Plan Numeric Surface Water Quality Objectives* does not list all potential exceedances that are recorded by data presented in the DLA. For pH, data collected in reservoir profiles appear to be excluded, despite pH in Tioga and Saddlebag reservoirs being substantially lower (> 0.5 standard units) than that of reservoir inflow. While it is useful to note pH exceedances by comparison of inflow to reservoir outflow as noted in Table 6.4-13, this neglects the likely cause

[7] Jane, S.F., Hansen, G.J., Kraemer, B.M., Leavitt, P.R., Mincer, J.L., North, R.L., Pilla, R.M., Stetler, J.T., Williamson, C.E., Woolway, R.I. and Arvola, L., 2021. Widespread deoxygenation of temperate lakes. *Nature*, *594*(7861), pp.66-70.

of the exceedance occurring in, and measured in, the Project reservoirs. A high value of fecal coliform that may have exceeded the prior bacterial objective under the Basin Plan (and described below) is also not listed. The high value of fecal coliform measured in 2022 indicates that there may be high values of bacteria that could exceed the Part 3 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Bacteria Provisions and a Water Quality Standards Variance Policy (Statewide Bacterial Provisions) and that additional data are needed in dry years. Notably, SCE identifies reduced dissolved oxygen in Project reservoirs as an exceedance, unlike pH and fecal coliform. State Water Board staff request SCE include in its FLA additional information to substantiate its statements that potential exceedances of applicable Water Quality Control Plans within the Project reaches are not related to the Project and to note any such occurrences.

15. From the information presented in Table 6.4-13, it is not clear which data were used to determine compliance with the Basin Plan turbidity water quality objective, or how data were compared to determine compliance. Table 6.4-13 provides several footnotes to explain which data were used, but these appear to conflict with each other: 1) Footnote *i* states that continuous data were not used to determine frequency of exceedances, but the number of measurements is listed as 846 (implying use of continuous data); 2) the table lists July 2022 as the time of data collection, but footnote f states that data in July 2022 were qualified during data review; 3) footnote *h* states that the turbidity mean presented in the table is based on average turbidity during July 2023 prior to hydropeaking events, but the maximum value in the table is the peak observed during July 2023 hydropeaking events. The maximum value exceeds the mean by several orders of magnitude, yet no exceedances are listed in the table. Additionally, Section 6.4.2.3 further states that “The observed increases in turbidity did not exceed natural levels” – but these sections do not appear to explain how “natural levels” were determined. State Water Board staff request SCE clarify the turbidity data in 6.4-13 and explain how natural levels of turbidity were determined.

16. In relation to dissolved oxygen*, Section 6.4.2.3 Consistency with Current Resource Management Objectives* states: “Hypolimnetic depletion of oxygen in reservoirs is a naturally occurring phenomenon in most temperate lakes with even moderate levels of algal productivity”. As previously addressed in the State Water Board staff June 2024 comment letter on the 2022 – 2023 study findings, and restated below, this is not applicable to Saddlebag or Tioga Lakes as both appear to have very low levels of productivity. In addition, the statement does not distinguish

between hypolimnetic oxygen depletion being a “naturally occurring phenomenon”, and how reservoir construction and operation may promote conditions that allow for oxygen depletion. The DLA does not attempt to determine how Project operations may enhance hypolimnetic oxygen depletion.

The DLA states that despite low dissolved oxygen in the hypolimnia of Saddlebag and Tioga lakes, there is adequate refuge for fish. However, Figure 6.5-7 *Length Frequency and Age Class Distribution for Brook Trout Captured in Saddlebag Lake During 2022 Sampling* indicates that for several years there has been little to no recruitment of brook trout in Saddlebag Lake, and Figure 6.5-6 indicates limited brook trout recruitment in Tioga Lake. Multiple age classes of brook trout are entirely missing from the population in Saddlebag Lake.

In contrast, 2022 stream fish data reported in the DLA indicate recruitment of brown and brook trout in upper Lee Vining Creek. The horizontal spatial extent of reduced dissolved oxygen in Saddlebag and Tioga lakes is not known, but the profiles collected and bathymetric data available indicate a substantial area of the reservoirs are likely not available as habitat in late summer/early fall. Additionally, the occurrence of anoxia and hypoxia in the reservoir hypolimnia during summer/fall after prolonged stratification suggests that this occurs under ice during winter as well. Unlike in summer/fall, the warmest reservoir water during winter is at the bottom of the reservoir which is also the likely preferred habitat for charr and where reduced oxygen limits available habitat[8].

State Water Board staff have included the June 2024 comments discussing the 2022-2023 survey findings here for clarity:

Dissolved Oxygen (DO): *DO concentrations collected near the bottom of Saddlebag and Tioga lakes reached a minimum of 3.4 milligrams per liter (mg/L) and 0 mg/L in 2023, respectively. Dissolved oxygen was similarly low in summer 2022, indicating an ongoing condition which was not eliminated in a wet water year.*

The Lahontan Basin Plan objective for DO states: “The dissolved oxygen concentration, as percent saturation, shall not be depressed by more than 10 percent, nor shall the minimum DO concentration be less than 80 percent saturation.” The Basin Plan further states for waters with

[8] Blanchfield, P.J., Tate, L.S., Plumb, J.M., Acolas, M.L. and Beaty, K.G., 2009. Seasonal habitat selection by lake trout (Salvelinus namaycush) in a small Canadian shield lake: constraints imposed by winter conditions. *Aquatic ecology*, *43*, pp.777-787.

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beneficial uses of COLD with SPWN (such as Lee Vining Creek), the following additional criteria are applicable: (1) a 7 Day Mean concentration of 9.5 mg/L, and (2) a 1 Day Minimum of 8.0 mg/L.

While low DO in Project reservoirs is likely related to decomposition in the hypolimnion and sediments, the extent to which Project operations promote or create these conditions at Tioga and Saddlebag lakes should be analyzed; particularly, maintaining Project reservoirs at maximum depth throughout the summer stratification period.

In addition, the Project does not appear to have a moderate level of algal productivity as implied in the response provided in WQ-1 to the State Water Board's 2023 comment letter. Water quality data collected in 2022 and 2023 as part of WQ-1 demonstrate that Project reservoirs are likely ultra-oligotrophic, as indicated by total phosphorus concentrations which were below the minimum detection limit at all sampling events.

The extent to which Project operations impact DO concentrations is still unclear and needs to be analyzed further.

***pH:** Saddlebag and Tioga lakes had minimum summer 2023 pH values of 5.5 and 5.1, respectively. pH in the hypolimnia of both Saddlebag and Tioga lakes was similarly low in summer 2022, indicating an ongoing condition which did not respond strongly to water year type.*

The Lahontan Basin Plan pH objective states that: "In fresh waters with designated beneficial uses of COLD[9] or WARM[10], changes in normal ambient pH levels shall not exceed 0.5 pH units." Low pH is likely related to decomposition, but as with DO, the extent of which Project operations impact pH should continue to be analyzed. State Water Board staff would still like to discuss the potential of protection, mitigation, and enhancement (PM&E) measures to address the low pH values.

***Bacterial:** Fecal coliform bacteria data collected in 2023 were within the Basin Plan objectives, however, data collected in 2022 ranged from 49 to 540 most probable number per 100 milliliters (MPN/100 mL) on a single sampling date. The Lahontan Basin Plan objective for fecal coliform states*

[9] Cold Freshwater Habitat is defined as beneficial uses of waters that support cold water ecosystems, including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.

[10] Warm Freshwater Habitat is defined as beneficial uses of water that support warm water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish, and wildlife, including invertebrates.

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that "The fecal coliform concentration during any 30-day period shall not exceed a log mean of 20/100 mL, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100mL." Although sampling from 2022 may have been an isolated incident, it is important to understand: (1) under what conditions caused the exceedance; and (2) how frequently exceedances occur.

The results from the studies were inconclusive in determining why the exceedances occurred. State Water Board staff believe further discussions are appropriate to determine PM&E measures to address the high fecal coliform values in Project waters.

Turbidity: *Turbidity sampling data collected within Lee Vining Creek Downstream of Poole Powerhouse (Site LVC-DSPP1) from May through July 2023 ranged from 0 to 50 Nephelometric Turbidity Unit (NTU). Data collected in Lee Vining Creek near Lower Lee Vining Campground (Site LVC-DSPP2) from May through July 2023 ranged from 0 to 150 NTU.*

The Lahontan Basin Plan objective for turbidity states "Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent." From June through August of 2022, turbidity data shows that hydro-resource optimization events caused distinct, significant increases in turbidity. Relative to periods of stable low turbidity during minimum flows, clearly defined hydro-resource optimization events in summer 2022 caused turbidity to increase roughly 100% and 133%, 0.2 mile and 4.3 miles downstream of Poole Powerhouse, respectively.

While equipment malfunctions and fouling can possibly skew data, there is still a concern for the correlation between peak flow rates and increased turbidity. Ongoing discussions between SCE and State Water Board staff should continue moving forward to determine appropriate PM&Es to address the spikes in turbidity and ensure the Project meets the Lahontan Basin Plan's water quality objectives.

17. *Section 6.5.2.1 Effects of Project Operations on Quantity and Quality of Aquatic Habitat for Fish Populations within Project-Affected Streams:* In its 2024 comment letter, State Water Board staff requested additional information in the DLA regarding Project impacts on sediment supply, accumulation, and mobilization; particularly of gravels relevant to fish spawning habitat with additional elaboration on the results from the Aquatic Habitat Sediment (AQ-3) study. The DLA states "Overall, the results of the AQ-3 study suggest current Project operations have little

effect on spawning habitat and reproductive success in Project reservoirs due to the abundance of suitable spawning gravel throughout Project-affected stream reaches." Yet the average quality score of 1.8 for gravel below Poole Powerhouse is much lower than the upstream reaches which received scores of 2.5 between the confluence of Slate Creek and Ellery Lake and 3.1 between Tioga Dam and the confluence of Lee Vining Creek. No explanation is given as to why the quality of sediment decreases downstream of Poole Powerhouse.

Figure 6.5-21 Spawning Gravel Volume by Quality in Project-Affected Stream Reaches of the Lee Vining Creek Hydroelectric Project, 2023 further demonstrates that no "excellent"-scored spawning gravels were observed in Lee Vining Creek downstream of Poole Powerhouse. State Water Board staff request that the FLA include an explanation as to why SCE's operation of the Project has no impact on sediment transport; particularly suitable gravels for fish spawning downstream of Poole Powerhouse given the difference in gravel quality scores.

18. *Section 6.5.2.1. Effects of Project Operations on Quantity and Quality of Aquatic Habitat for Fish Populations within Project-Affected Reaches* provides a brief analysis of the potential for stranding after hydropeaking events. The analysis and its conclusions assume that: a) hydropeaking in spring (February through May) typically varies flows in Lee Vining Creek from 10 to 70 cfs, and b) fish population data collected at site LLVC-F1 is representative of fish throughout the entirety of lower Lee Vining Creek between Poole Powerhouse and the LADWP diversion. Flows through Poole Powerhouse have typically exceeded 70 cfs in spring since SCE began hydropeaking in 2015; daily averages exceed 100 cfs in April or May in 2016, 2017, 2020, and 2021. Sub-daily data in Figure 5.2-1 in AQ-5 indicates that flows likely exceed 100 cfs earlier each year than daily averages capture. Modeled water depth should have assessed stage change including flows up to 100 cfs.

    The section concludes that, in part, because fish population results in AQ-2 indicate a typical age-class distribution at site LLVC-F1, hydropeaking does not appear to have significant adverse impacts on young-of-year fish in spring. Fish population site LLVC-F1 is nearest to Lower Lee Vining Campground in DLA Table 6.5-15, where the maximum increase in stage between 10 and 70 cfs (0.7 feet) is nearly half that of the most upstream site (1.2 feet; Big Bend Campground).

    AQ-2 *Table 4.2-1 Fish Population Estimated Abundance, Density, and Biomass at All Fish Study Sites Sampled in September 2022* demonstrates that there is substantial variability in fish population metrics among sites in upper Lee Vining Creek, presumably responding to

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multiple variables. It should be expected that fish populations surveyed several river miles downstream of Poole Powerhouse, where peaking flows are attenuated, would exhibit a weaker response to those fluctuations than a population sampled near the powerhouse. The section also states that "no stranding has ever been documented", but neglects to note that it has never been systematically surveyed. State Water Board staff request that SCE include in the FLA an expanded analysis of potential fish stranding, as well as analyses of the other potential impacts of hydropeaking on downstream aquatic resources.

19. *Section 6.5.2.2 Effects of Project Operations on Populations of Invasive Aquatic Algae in Project-Affected Stream Reaches*: The section in part states "SCE would continue to operate and maintain the Project in accordance with the terms and conditions of the existing license. Because existing information indicates Project operations do not appear to be contributing to or increasing potential for invasive aquatic plants or Didymo in Project-affected streams…" Although *Didymosphenia geminata* (Didymo) was not observed during Project-related studies, Lee Vining Creek historically has had Didymo present in the system as noted in the DLA. Didymo is notoriously difficult to eradicate once it is established in a system. The available data indicate that Project operations are likely related to the development of nuisance growth of Didymo in Project reaches[11]. The FLA should include a measure which provides for intermittent monitoring of Didymo in upper Lee Vining Creek to determine the frequency and spatial extent of Didymo outbreaks and their relationship to Project operations.

20. *Section 6.9.2.3 Effects of Dispersed-Use Recreational Activities on Yosemite Toad and Habitat:* The section states "Based on the analysis discussed above, the results of the TERR studies, and because the Proposed Action does not include changes to O&M activities, no adverse effects have been identified for Proposed Action."

    The Yosemite Toad (*Anaxyrus canorus*) Technical Report provided as part of the Terrestrial Wildlife (TERR-2) Technical report states "DNA samples collected in 2023 at the two sites within the study are scheduled to be processed and compared against a hybrid genetic panel currently being developed by the El Dorado National Forest. Because the sample and processing analysis are in progress, no results are yet available." If the populations of toad located in Upper Lee Vining Creek and adjacent to

[11] Rost, A.L. and Fritsen, C.H., 2014. Influence of a tributary stream on benthic communities in a Didymosphenia geminata impacted stream in the Sierra Nevada, USA. *Diatom Research*, *29*(3), pp.249-257.

ATTACHMENT A

STATE WATER BOARD STAFF COMMENTS ON THE DRAFT LICENSE APPLICATION FOR THE LEE VINING HYDROELECTRIC PROJECT

Tioga Lake are determined to be *Anaxyrus boreas*, the FLA should include discussion regarding the extent to which Project operations (i.e., flows within Lee Vining Creek and Tioga Lake levels) support habitat for these populations. Additional data collection may be required to understand whether Yosemite toad populations in these two areas are stable, or how they may respond to Project operations under various water year types. Additionally, State Water Board staff are yet to receive the laboratory results for the eDNA sampling of the Yosemite toads found in 2023. It is premature to say the Project has no adverse effects on Yosemite toads until the data is available.

2. DLA – Volume 2

21. Table 3.2-1 indicates that sediment management at "intake areas" is proposed "as needed" as a Project maintenance activity, which is similar to language addressed in Comment 12. It is not clear how or where SCE is specifically proposing to remove sediment from Project facilities. State Water Board staff request SCE clarify the location of sediment removal activities in the FLA.

22. Appendix D *Plan for Control of Erosion, Stream Sedimentation, Soil Mass Movement, and Dust* states that the Lahontan Regional Water Quality Control Board will be consulted, when appropriate, for use of erosion control and soil stabilization measures. This should be updated to include consultation with the State Water Board in a future license, as the State Water Board is the water quality certification authority for the Project.

3. DLA – Volume 3

23. As stated in Section 1, SCE's Final Technical Reports, provided to State Water Board staff in April 2024, documenting results from Project studies in 2022 and 2023 were incomplete. State Water Board staff have yet to receive the eDNA results for the Yosemite Toad (*Anaxyrus canorus)* as described in TERR-2. Additionally, State Water Board staff have yet to receive the Visitor Intercept Survey described in the Recreational User Assessment Report (REC-1). The results from these studies are critical in helping State Water Board staff determine Project-related effects and appropriate PM&E's moving forward.

From:	Teri Tracy
To:	wayne.allen@sce.com; matthew.woodhall@sce.com; martin.ostendorf@sce.com; alisa.ellsworth@wildlife.ca.gov; graham.meese@wildlife.ca.gov; beth.lawson@wildlife.ca.gov; chad_mellison@fws.gov; Tristan.Leong@usda.gov; Sheila.Irons@usda.gov; Garrett.Long@waterboards.ca.gov; Adam.Cohen@waterboards.ca.gov; Carissa Shoemaker; Shannon Luoma; Finlay Anderson
Cc:	Geoffrey McQuilkin; Bartshe Miller; Greg Reis; Robert Di Paolo
Subject:	Mono Lake Committee Comments on DLA for P-1388 Lee Vining Hydroelectric Project
Date:	Monday, November 25, 2024 4:28:06 PM
Attachments:	2024-11-25 MLC comments on DLA for P1388 Lee Vining Hydroelectric Project.pdf

Some people who received this message don't often get email from ttracy@monolake.org. Learn why this is important

Good afternoon,

Please be advised that the attached comments were filed with the Commission on the Draft License Application for the Lee Vining Hydroelectric Project on behalf of the Mono Lake Committee. Should you have any questions regarding this filing, please feel free to reach out.

Sincerely,

Teri Tracy (she/her), Eastern Sierra Policy Coordinator
Mono Lake Committee
(760) 647-6595
Hwy 395 at Third Street, P.O. Box 29, Lee Vining, CA 93541
www.monolake.org | www.monobasinresearch.org
Saving Mono Lake for future generations through
protection, restoration, education, and science.
Long Live Mono Lake!

MONO LAKE
COMMITTEE
P.O. Box 29
Hwy 395 and Third Street
Lee Vining, CA 93541
Phone (760) 647-6595
Fax (760) 647-6377

Board of Directors
Chair:
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Martha Davis
Vireo Gaines
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Gina Radieve
Tom Soto
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Kristine Zeigler
Directors Emeriti
Helen Green
Ed Grosswiler
Richard Lehman
Executive Director
Geoffrey McQuilkin
Southern California Office
1718 Wellesley Ave
Los Angeles, CA
90025-3634
On the Internet
monolake.org
monobasinresearch.org

November 25, 2024

Debbie-Anne Reese
Acting Secretary
Federal Energy Regulatory Commission
888 First Street N.E., Room 1A
Washington, D.C. 20426

Submitted electronically: FERC eFiling

RE: Lee Vining Hydroelectric Project, FERC Project No. 1388; Comments on Draft License Application

Dear Acting Secretary Reese,

The Mono Lake Committee (MLC) submits these comments in response to SCE's Draft License Application (DLA) for the Lee Vining Hydroelectric Project (Project), FERC Project No. 1388, submitted August 27, 2024.

MLC is a non-profit citizens' group dedicated to protecting and restoring Mono Lake and the Mono Basin ecosystem with a focus on education, science, and cooperative solutions. Supported by 16,000 members, the MLC has been active in the Mono Basin since 1978. MLC is an interested party in the Project and appreciates working with SCE and collaborating parties.

As an active participant in the relicensing process, MLC has worked closely with SCE and other stakeholders to develop study plans, investigate Protection, Mitigation, and Enhancement (PME) measures, and to evaluate the Project's operations and implications for stream ecosystem health, sediment dynamics, aquatic habitats, and water quality. Through ongoing discussions, technical reviews, and collaborative efforts, MLC seeks to ensure that hydropower operations are balanced with environmental resource health. The following comments highlight key areas where further analysis, operational adjustments, and collaborative solutions should be explored in the Final License Application (FLA) to adequately understand resource impacts associated with the Project.

The following comments are organized into four topic areas:

1. Hydro-resource optimization
2. Peak flows and restoration goals
3. Public data sharing
4. Vegetation management oversight

MLC will provide comments on the Recreation Use Assessment (REC-1) when completed.

1. The DLA insufficiently describes hydro-resource optimization and associated environmental downstream impacts.

Table 1-1. Consultation Summary—Response to Comments on Draft Technical Reports summarizes comments provided to SCE on the Draft Technical Reports. The following resource reports received comments pertaining to SCE's hydro-resource optimization operations, known in the scientific community as hydropeaking:

- WQ-1 Water Quality
- AQ-2 Stream Fish
- AQ-3 Habitat Mapping
- AQ-5 Operations Model
- AQ-6 Channel Morphology
- TERR-1 Botanical
- TERR-2 Wildlife

While MLC is appreciative of SCE's continued engagement on the concerns raised by stakeholders pertaining to hydropeaking, the DLA fails to analyze key aspects of SCE's hydro-resource optimization events. In so doing, the DLA fails to adequately analyze the incremental and cumulative impacts of hydropeaking in Lee Vining Creek. The following discussions seek to highlight specific ways in which the resource reports in the DLA fail to adequately address stakeholder concerns demonstrated by MLC comments submitted on the Draft Technical Reports and SCE's response to those comments. The following discussions also outline opportunities for SCE to ameliorate these concerns in the FLA.

A. Stream and Reservoir Water Quality (WQ-1) Final Technical Report

In comments submitted on 6/11/24 pertaining to the WQ-1 Draft Technical Report, California State Water Resources Control Board (SWRCB) noted that "from June through August of 2022, turbidity data shows that hydro-resource optimization events caused distinct, significant increases in turbidity" and that there is a "concern for the correlation between peak flow rates and increased turbidity." SCE's response noted the comment, stated that PME discussions are ongoing, and that "no adverse effects on species have been observed." SCE also raised uncertainty about distinguishing Nephelometric Turbidity Unit (NTU) increases associated with hydro-resource optimization events and increases "independent of Hydro-resource Optimization" (Draft License Application Volume III, Table 1-1, Comment 82). This exchange raises questions and demonstrates the need for SCE to clarify the following:

i. <u>Relationship between hydropeaking and turbidity</u>

a. What is the specific relationship between hydropeaking events and observed turbidity increases?

b. How significant are the increases in turbidity during hydropeaking events compared to other flows/ operational configurations?

c. How is hydropeaking affecting turbidity levels across seasons or water year types?

ii. <u>Ecological impacts of turbidity increases</u>

a. What studies or monitoring data support SCE's claim that no adverse effects on species have been observed due to increased turbidity?

b. How are species of benthic macroinvertebrates (BMI) (specifically mayflies, caddisflies, and stoneflies) and each species of observed fish (specifically brown trout, rainbow trout, and brook trout) affected by short-term turbidity spikes?

c. How do repeated hydropeaking events and associated turbidity increases cumulatively affect aquatic

habitats and species over time? The literature suggests winnowing of fine sediments would be occurring due to this operation (see later comments regarding AQ-3 Final Technical Report).

iii. Attribution of turbidity sources

a. How were NTU increases attributed to hydropeaking versus other causes?

b. What data gaps or methodological challenges contribute to the uncertainty in distinguishing turbidity increases caused by hydropeaking from those due to other factors?

c. Are there opportunities to refine the analysis or modeling to address these uncertainties?

iv. Mitigation and operational adjustments

a. What potential PME measures are under discussion to address turbidity spikes resulting from hydropeaking events?

b. Are there operational modifications (e.g., reducing hydropeaking frequency, adjusting seasonal timing of hydropeaking events, and/or reducing hydropeaking magnitudes) that could mitigate turbidity increases and/or mitigate ecological impacts during ecologically critical periods?

v. Monitoring and future studies

a. Could more detailed monitoring of turbidity during hydropeaking events be conducted to reduce uncertainty and clarify impacts?

b. Would continuous monitoring or targeted studies during hydropeaking and during high turbidity periods help differentiate sources and better understand ecological effects?

vi. Historical and regulatory context

a. How do observed hydropeaking events in the WQ-1 Final Technical Report compare to observed hydropeaking events over the last 10 years and potential future hydropeaking events (e.g., hydropeaking frequency, seasonal timing, and magnitude)?

b. How will SWRCB's concerns about turbidity and peak flows be addressed in the licensing process?

To address the uncertainty raised by the WQ-1 Final Technical Report, the FLA should address each of the concerns described above in its Environmental Analysis. Further, SCE should include PME measures and operational changes (e.g., reducing hydropeaking frequency, adjusting seasonal timing of hydropeaking events, and/or reducing hydropeaking magnitudes) necessary to mitigate turbidity increases and/or mitigate ecological impacts during ecologically critical periods. If, however, SCE cannot adequately address the relationship between turbidity and hydro-resource optimization, SCE should undertake a hydropeaking-specific study, with the goal of addressing the questions above.

MLC is concerned that the uncertainty pertaining to the causal relationship between hydropeaking and water quality borne from the WQ-1 Final Technical Report is significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.

B. Stream Fish Populations (AQ-2) Final Technical Report

In comments submitted on 6/11/24 pertaining to the AQ-2 Draft Technical Report, MLC noted that "Kennedy et al. 2016 documents how hydropeaking can prevent viable populations of many aquatic insects from inhabiting rivers. Hydropeaking can eliminate some groups of aquatic insects, such as mayflies, caddisflies, and stoneflies. (…) The authors found that rivers with greater variation in the volumes of discharged water were also home to fewer types of aquatic invertebrates. (…) Reducing hydropeaking during crucial egg-laying periods for aquatic insects could benefit river communities. There does not appear to be a study report addressing these concerns." SCE's response did not address these concerns, emphasizing instead that

"results of [AQ-2] study indicate that the fish populations within Project-affected stream reaches are self-sustaining and in good condition. Condition factors reflect a healthy nutritional state of fish, related to size and growth based on habitat conditions, including water temperature, water quality, flow, and food resources. Additionally, self-sustaining fish populations composed of predominantly insectivorous species (i.e., trout) indicate BMIs in Project-affected reaches are sufficiently abundant to support fish condition." (Draft License Application Volume III, Table 1-1, Comment 1).

While SCE may have produced a study that demonstrates that fish populations in the project-affected area are self-sustaining and in good condition, this does not ameliorate the concern, based on the literature, that SCE's hydro-resource optimizations are having a significant negative impact on BMIs and fish populations. The body of scientific literature on hydropeaking impacts suggests that SCE's hydro-resource optimizations are likely having a negative impact on fish populations. A systematic review of the impacts of hydropeaking incorporating 155 relevant studies determined that "within the studies relating fish and hydropeaking, articles focusing on habitat almost unanimously agree on its degradation (16 studies out of 20). Literature also agrees on the overall negative effect of hydropeaking on fish density (13 studies out of 14), stranding (10 studies), survival (8 studies out of 11), diversity (3 studies out of 4) and spawning (4 studies). On the other hand, the impact of hydropeaking on fish length, growth, and dietary activities is more debated, as the ratio between studies claiming a negative or positive/null effect is more balanced." (Bipa et al., 2024, page 11)

MLC is concerned that SCE is attempting to use current fish population data produced by the AQ-2 Final Technical Report as justification for ignoring how hydro-resource optimization activities have had a likely negative impact on fish populations over the last decade. Since significant hydropeaking did not occur in Lee Vining Creek until 2015, fish population condition and project impacts should be analyzed based on pre-hydropeaking conditions.

Because SCE has not analyzed or ruled out the likely negative impacts of hydro-resource optimization on fish populations in the project-affected area, several key questions remain unanswered:

i. <u>Impacts of hydropeaking on aquatic ecosystems</u>

a. How has hydropeaking affected the diversity, abundance, and life cycles of aquatic insects and fish populations in project-affected reaches?

b. Are there data or studies assessing the specific impacts of hydropeaking on aquatic insects and fish populations before and after the implementation of more intensive hydro-resource optimization activities (2010–2014 and 2015–2023 when activities increased)?

c. How does the presence of self-sustaining fish populations definitively indicate that hydropeaking is not negatively affecting fish or their food supply in terms of both abundance and diversity?

ii. <u>Seasonal and temporal considerations</u>

a. Are there data or studies assessing the impacts of the seasonal timing, frequency, and magnitude of hydropeaking events on aquatic insects and fish populations?

b. Since hydropeaking activities greatly increased in 2015 under the current license, is there a need to analyze potential impacts to fish populations under O&M configurations with additional increases in hydropeaking activities?

iii. <u>Cumulative and long-term effects</u>

a. Could reductions in aquatic insect diversity and abundance due to hydropeaking result in cumulative effects on trout health, such as reduced growth rates, reproductive success, or resilience to environmental stressors?

b. How do repeated hydropeaking events over time cumulatively affect aquatic insects, fish populations, and overall ecosystem health?

iv. Mitigation and operational modifications

a. What operational modifications (e.g., reducing hydropeaking intensity, frequency, or adjusting seasonal or daily timing) could mitigate harm to aquatic insects, fish populations, and their food supply?

b. Could functional flow regimes, including reduced hydropeaking variability, improve conditions for aquatic insects, trout populations, and overall ecosystem health?

c. What PME measures could be implemented to address potential harm caused by hydropeaking (e.g. avoid hydropeaking during fish spawning seasons)?

v. Monitoring and adaptive management

a. Could more detailed and ongoing monitoring of aquatic insects and fish populations during hydropeaking events be conducted to reduce uncertainty and improve understanding of impacts?

b. Can adaptive management be incorporated into the license to allow for operational adjustments based on potential future observed ecological impacts?

MLC believes that the concerns raised from the AQ-2 Final Technical Report are significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.

C. Aquatic Habitat Mapping and Sediment Characterization (AQ-3) Final Technical Report

In comments submitted on 6/11/24 pertaining to the AQ-3 Draft Technical Report, MLC raised concern that "the aquatic habitat mapping study (AQ-3) does not focus on relevant metrics, such as fish habitat at different flow rates, and the effects on fish of rapidly varying those flow rates during sensitive seasons." SCE's response correctly identified that the "DLA includes an evaluation of habitat as a function of streamflow (Appendix E.3, provided in Volume II of this DLA)", but neither this response nor Appendix E.3 address the specific concern of varying flow rates during sensitive seasons as expressly stated (Draft License Application Volume III, Table 1-1, Comment 4). For example, Figure 1-4 in Appendix E.3 demonstrates that there is a very sharp response in percentage of weighted usable area (WUA) for spawning brown trout between minimum flows and 80 cubic feet per second (cfs) in Lee Vining Creek between Poole Powerhouse and the Los Angeles Department of Water and Power (LADWP) Diversion Dam. Rapidly varying flow rates produced from hydro-resource optimization would therefore produce rapidly varying usable area for spawning brown trout. In essence, hydro-resource optimization events likely produce a functionally reduced usable area for spawning brown trout during biologically sensitive time periods, which is inadequately addressed by the current WUA vs. Discharge charts.

Additionally, the AQ-3 Final Technical Report identifies that "Spawning gravel in lower Lee Vining Creek decreased in abundance from upstream to downstream, but the quality was lower in the upstream section of the reach (Figure 4.2-4). Gravel deposits in lower Lee Vining Creek were primarily semiactive. In Glacier Creek, large, deep deposits of excellent and good quality spawning gravel were evenly distributed and mostly active throughout the reach (Figure 4.2-5). Spawning gravel particle size distribution and individual patch size are included in Appendix D." (Draft License Application Volume III, AQ-3 Final Technical Report, Page 14). These observations are not adequately discussed or interpreted and should address whether spawning gravel abundance or quality could limit fish populations.

Furthermore, the findings in the AQ-3 Final Technical Report regarding the spatial distribution and quality of spawning gravel in Lee Vining Creek raise questions about sediment dynamics that warrant further

exploration, particularly considering hydropeaking's influence. Bipa et al. (2024) identifies several ways in which hydropeaking influences sediment transport in ways that should be addressed in the AQ-3 Final Technical Report and Environmental Analysis section of the FLA:

> *In the case of particles entrainment under frequent hydropeaking, López et al. (2020) provided circumstantial evidence that the hydropower station's peak discharge primarily impacted the adjacent downstream river section, causing the entrainment of fine to medium-sized gravels. The movement of finer sediment fractions from the riverbed termed as partial transport, involving selective transportation downstream of the hydropower plant. This process gradually shifted sand and smaller gravel to more distant points downstream. The effects of hydropeaks on river-bed particle mobility was also observed by Vericat et al. (2020). (…) Hydropeaking induces frequent and selective bed movement, depleting fine sediment patches on the riverbed and causing the gradual loss of intermediate fractions, including medium-sized gravel. While the substantial structural components like boulders within the channel remain stationary, sand and finer gravel in bed patches are consistently washed away, and intermediate to larger gravel fractions eroded from inner spaces. Bucek et al. (2021) also stated that hydropeaking had negligible effect on the bedload transport in the studied cross section, located 23.42 km downstream from power plant. On the other hand, López et al. (2023) stated that the peak discharge from the hydropower plant mainly affected the most distant downstream portion, situated at approximately 17 km downstream. There, finer fractions of the riverbed were entrained, including coarse gravels. Hydropeaking induced size-based selective partial transport downstream, shifting sand and small gravel, enhancing armor on the riverbed, and decreasing fine sediment presence. (Bipa et al., 2024, page 10).*

The observed decrease in gravel abundance downstream and the lower quality of upstream gravel deposits are consistent with documented patterns of sediment entrainment and selective transport under hydropeaking conditions, as highlighted by studies such as López et al. (2020) and Vericat et al. (2020) stated above. These studies describe hydropeaking-induced mobility of fine to medium-sized gravel leading to downstream sediment depletion and altered particle size distributions. However, the AQ-3 report does not provide sufficient interpretation of how these patterns relate to hydropeaking or how they interact with the findings from the AQ-6 Channel Morphology Final Technical Report. A more integrated analysis is needed to clarify how hydropeaking influences sediment characterization, functional fish habitat availability, and the broader geomorphic processes shaping Lee Vining Creek.

SCE should address comments to focus and guide further discussion and efforts pertaining to fish habitat concerns borne from hydro-resource optimization. Additional efforts are needed to adequately understand results from the AQ-3 Final Technical Report as they relate to other resource reports, specifically the AQ-6 Channel Morphology Final Technical Report and perhaps the AQ-5 Operations Model Final Technical Report. The questions raised from the AQ-3 Final Technical Report are significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.

D. Operations Model (AQ-5) Final Technical Report

The AQ-5 Operations Model Final Technical Report provides an important framework for understanding the operational patterns of the Project, including the significant escalation in hydropeaking activity since 2015. However, the report fails to adequately address how hydropeaking will be managed under the new license or to assess its long-term ecological consequences. This omission is alarming given the substantial increases in both the magnitude and frequency of hydropeaking events in recent years and the well-documented impacts of hydropeaking on downstream fish populations and habitat quality in scientific literature.

The AQ-5 Final Technical Report highlights a dramatic increase in hydropeaking activity after 2015, with

significant growth in the frequency, duration, and magnitude of events across all seasons. This operational shift raises serious concerns about the long-term sustainability of the affected downstream ecosystem, particularly given that these practices and their environmental impacts were not thoroughly analyzed during the previous licensing process. The AQ-5 Final Technical Report underscores the need for greater clarity on future operational practices, leaving critical questions unanswered about how hydro-resource optimization events might evolve under a new license if not explicitly addressed and regulated.

Specifically, SCE should define clear thresholds for hydro-resource optimization under the current license that will not be exceeded under the new license. These thresholds should include specific limits on hydropeaking frequency (e.g., the number of hydro-peaking events per month), magnitude (e.g., maximum flow change allowable in a hydro-peaking event), and seasonal timing (e.g., whether or not SCE will attempt to avoid hydropeaking during critical periods such as fish spawning or sediment transport seasons).

Hydropeaking has well-documented effects on river ecosystems, including altered flow regimes, increased sediment mobility, and habitat degradation. At the 5/24/21 Aquatic Resources Technical Working Group Meeting, SCE outlined a plan to analyze hydropeaking with "slight expansions of existing studies and integrating those studies into a framework for looking at [the] relationship between flows and resources." The AQ-5 Final Technical Report acknowledges that the HEC-RAS intraday model was developed to capture the effects of hydropeaking events but does not extend this analysis to evaluate how these effects interact with ecological resources downstream of the Poole Powerhouse. For example, the report's hydraulic modeling focuses on physical parameters such as water surface elevation, depth, and velocity but does not link these findings to biological outcomes such as impacts on spawning habitat, benthic macroinvertebrates, or fish populations. This gap is especially concerning given the documented shifts in sediment distribution downstream, where semi-active gravel deposits and reduced spawning habitat quality have already been observed.

The lack of a hydropeaking-specific study undermines the utility of the AQ-5 Operations Model as a tool for guiding adaptive management. While the model provides a useful baseline for understanding operational patterns, the AQ-5 Final Technical Report does not discuss alternative scenarios that could mitigate ecological impacts caused by hydropeaking. For example, the report does not evaluate how hydro-resource optimization events could be modified in terms of flow magnitudes, seasonal timing, or event frequency to improve sediment retention, maintain habitat during ecologically significant periods, or reduce the risk of fish stranding. Without this analysis, stakeholders are left without a clear understanding of how hydropeaking could be optimized to balance energy generation with ecological resource health.

MLC provided a Lee Vining Relicensing Study Request on Hydropower Peaking Operations, as documented in SCE's Preliminary Application Document (Volume II, P170-176 out of 502 in PDF), which was not incorporated into the DLA. Given the substantial operational changes documented in the AQ-5 Final Technical Report under the current license, it is crucial for SCE to conduct a hydropeaking-specific study as part of the relicensing process. This study should examine the ecological effects of hydropeaking on sediment transport, habitat quality, and aquatic species health while exploring management strategies to minimize these impacts. Addressing these concerns in the FLA will not only help meet FERC's requirements for evaluating project impacts but also facilitate compliance with the National Environmental Policy Act (NEPA). Providing this information upfront will streamline the NEPA process, ensuring FERC has the necessary data to finalize its environmental review and develop effective mitigation measures that protect downstream ecosystems.

E. Lower Lee Vining Creek Morphology (AQ-6) Final Technical Report

The AQ-6 Final Technical Report provides a valuable assessment of channel morphology and sediment dynamics in lower Lee Vining Creek. However, it fails to adequately address stakeholder concerns regarding

the specific influence of hydropeaking on channel morphology, fluvial processes, and coarse sediment transport rates. Given the documented increase in hydropeaking activity during the current license term, this omission represents a critical gap in understanding how project operations may continue to alter geomorphic and ecological processes under the new license.

While the AQ-6 Final Technical Report characterizes sediment transport dynamics at three sites and provides valuable data on substrate compositions and bed mobility, it does not explicitly evaluate how rapid flow fluctuations from hydropeaking events influence these data. For instance, tracer rock data presented in the report show evidence of particle mobility at Sites LLV-G1, LLV-G2, and LLV-G3 following the seasonal peak flow. However, the analysis does not differentiate between mobility caused by normal operations and mobility caused by hydro-resource optimization events. This distinction is critical because hydropeaking creates artificial, frequent, and short-duration pulses that can disrupt sediment deposition and transport patterns in ways that less-variable operations do not.

Additionally, the report does not adequately connect sediment transport findings to broader fluvial processes and channel morphology. For example, the presence of semi-active gravel deposits identified in the AQ-3 Final Technical Report and armored gravel deposits identified in the AQ-6 Final Technical report raise questions about the cumulative impacts of repeated hydropeaking events on habitat quality, sediment availability, and channel stability. Peer-reviewed studies have documented hydropeaking's capacity to selectively mobilize fine to medium-sized gravels while leaving larger particles in place, leading to sediment depletion downstream and reduced habitat value (see MLC comments under AQ-3 Final Technical Report). Despite these established patterns, the AQ-6 Final Technical report does not investigate whether similar processes are occurring in lower Lee Vining Creek.

Moreover, the report does not incorporate an analysis of how hydropeaking might exacerbate or mitigate sediment transport rates during critical ecological periods, such as spawning seasons. Stakeholders have emphasized the importance of understanding these seasonal dynamics, as hydropeaking's impacts on sediment movement could affect turbidity and the availability and quality of spawning gravel.

Finally, while the AQ-6 study acknowledges the need to evaluate geomorphic changes downstream of Poole Powerhouse, it stops short of recommending operational modifications to reduce adverse effects. Without such recommendations or additional modeling of alternative operational scenarios, the report does not fully inform on how the Project could balance energy generation with ecological resource health.

In light of these deficiencies, the Final AQ-6 Report does not adequately address the relationship between hydropeaking and channel morphology. A hydropeaking-specific analysis is needed to fill these gaps. This analysis should:

1. Quantify the effects of hydropeaking on sediment mobility and deposition patterns, distinguishing these from less-variable operations that characterized the Project prior to 2015 when the current license was issued.
2. Examine how hydropeaking impacts habitat quality and sediment availability during critical ecological periods, particularly for aquatic species dependent on stable substrate conditions.
3. Evaluate the cumulative impacts of repeated hydropeaking events on channel morphology and fluvial processes over time.
4. Explore alternative operational scenarios that mitigate hydropeaking's adverse effects while maintaining project objectives.

SCE should address comments to focus and guide further discussion and efforts pertaining to fish habitat concerns borne from hydro-resource optimization. Additional efforts are needed to adequately understand

results from the AQ-6 Final Technical Report as they relate to other resource reports. The questions raised here from the AQ-6 Final Technical Report are significant enough to warrant a hydropeaking-specific study. The FLA should address these concerns in the Environmental Analysis section.

F. In Conclusion

The substantive comments above should inform and guide the relicensing process for the Project, specifically the importance of addressing the cumulative ecological and hydrological impacts of hydropeaking operations. Across multiple technical reports, including those on water quality, fish populations, habitat conditions, sediment transport, and channel morphology, MLC has identified critical gaps in analysis and has concerns about the Project's environmental impacts. These concerns indicate the need for a dedicated hydropeaking-specific study to evaluate the cumulative and long-term effects of hydro-resource optimization on downstream ecosystems.

MLC urges SCE to address these gaps comprehensively in the FLA, addressing the concerns and questions raised in this comment letter. Critically, SCE should clearly define thresholds for hydro-resource optimization under the current license that will not be exceeded under the new license. With a clear proposal of hydro-resource optimization events, the FLA should also include a hydropeaking-specific study that examines the relationships between flow variability, sediment dynamics, aquatic species health, and habitat quality, as outlined in our comments above. This study should include robust analyses of pre- and post-hydropeaking conditions, identify potential mitigation strategies, and ensure alignment with the requirements of the Federal Power Act, which mandates consideration of environmental, recreational, and economic impacts, including those downstream of the Project. This effort should also support a more streamlined NEPA process for FERC. Lastly, given the dynamic and evolving nature of hydropeaking impacts, the FLA should establish a framework for ongoing monitoring of hydropeaking effects. This monitoring would provide the necessary data to adaptively manage operations, refine mitigation measures, and ensure sustained ecological health over the life of the license.

As an active participant in this relicensing process, MLC remains committed to working collaboratively with SCE and other stakeholders to ensure that the Project's hydro-resource optimization operations occur in a manner that is balanced with environmental stewardship and resource management goals. We look forward to continued discussions and operational adjustments that balance the Project with the health and resilience of Lee Vining Creek.

2. SCE should continue to explore operational adjustments to enhance peak flows and support Lee Vining Creek restoration goals.

Historically, the Lee Vining Hydropower Project has been operated to store water in three reservoirs during the spring snowmelt runoff. This operation impairs the peak flows, reducing the energy and stage needed for the maintenance of the alluvial reaches of the creek.

In recent meetings, SCE has proposed changes that would reduce the impairment of the snowmelt peak flow by slowing down the filling of reservoirs on the dates of the highest springtime peak flows to achieve desired peak flow recurrence intervals. MLC supports SCE making operational changes to the Project where feasible to facilitate an increase in the frequency of annual snowmelt peak flow magnitudes above 250 cfs as outlined in the 2010 Synthesis Report Figure 4-6 and Table 4-2, to facilitate the maintenance of the stream ecosystem upstream and downstream of the diversion dam.

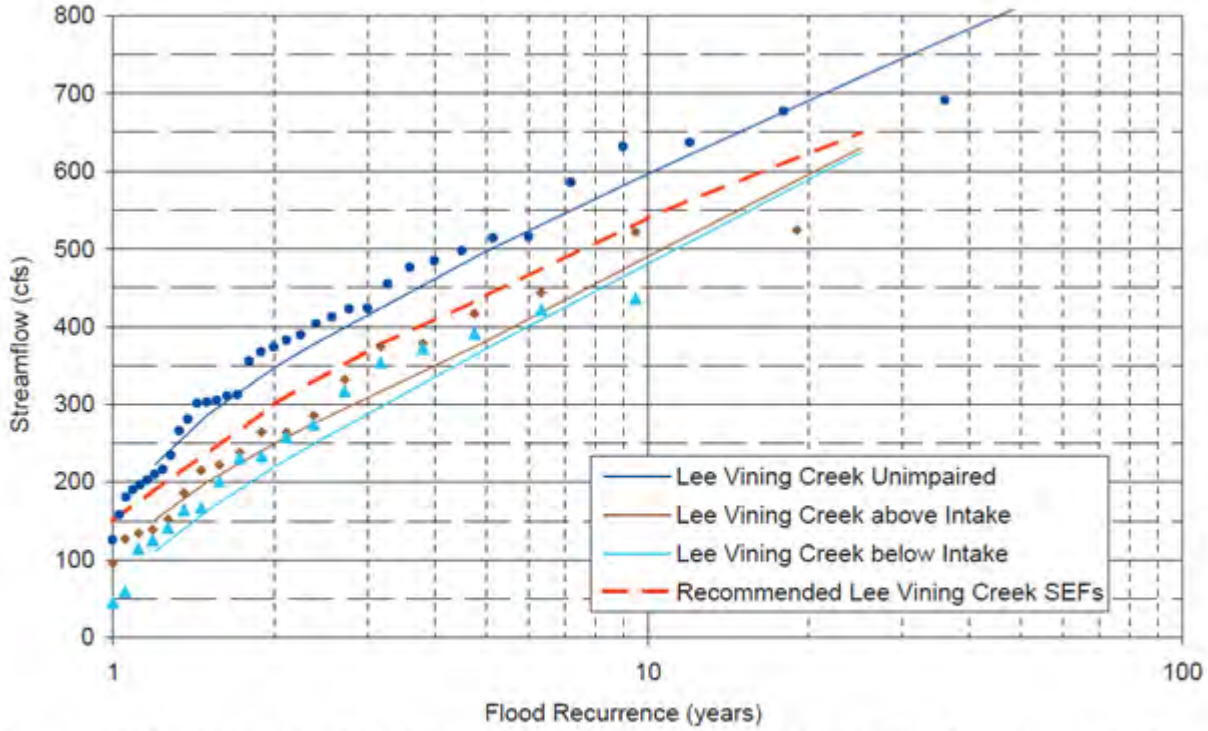

Figure 4-6. Lee Vining Creek flood frequency curves computed for RYs 1973 to 2008 (unimpaired), and RYs 1990 to 2008 (above and below Intake).

Table 4-2. Recommended minimum flood peak magnitudes and recurrence intervals for Lee Vining Creek.

Recurrence Interval (years)	Lee Vining Creek Unimpaired (cfs)	Lee Vining Creek above Intake (cfs)	Lee Vining Creek Recommended SEFs (cfs)
2	373	260	300
3	420	300	370
5	510	380	440
10	630	475	540
25	680	630	650

Figure 1: The 2010 Synthesis Report identified desired peak flow recurrence intervals. The difference between the dark blue line and the brown line in Fig 4-6 is entirely due to SCE's operations, and modification of SCE's operations (i.e. storing less runoff during the peak flow) is required to raise the brown line to the dashed red line. SEF stands for Stream Ecosystem Flow, and the intake is at the LADWP diversion for the Lee Vining Conduit (LVC). In order to maximize geomorphic benefits of peak flows downstream, no LADWP diversions are permitted when flows at the gauge above the LVC (LADWP gauge 5008) exceed 250 cfs. This removes any effect of LADWP's operations on peak flow magnitudes in excess of 250 cfs, with the remaining impairment wholly due to SCE's operations. Therefore, in order to benefit as much of the creek as possible all the way to Mono Lake, any augmented releases from Tioga and/or Saddlebag reservoirs should be timed for when flows exceed approximately 250 cfs at the gauge above the LVC.

Slightly modifying SCE operations to increase peak flow magnitude in years when Tioga Lake Reservoir will fill would not impact hydro generation and could have minimal impacts on generation in other years, with no impacts in dry years. Higher peak flow releases from Saddlebag Lake Reservoir also would benefit the long reach of stream below Saddlebag Dam and further improve conditions downstream. For example, the AQ4

study conducted in 2023 suggests that the distribution and presence of Didymo is reduced during wet water year types, which is consistent with the findings of many studies that show more natural flows limit all types of invasive species in rivers. Prolonged low flow conditions due to SCE's Project operations mimic drier water year types, and higher peak flows below Saddlebag Lake Reservoir could limit the spread of this invasive diatom. We recommend that SCE manage flows below its reservoirs to mimic the natural snowmelt peak flow as far as feasible and monitor for Didymo in non-wet years to see if the flow improvement has a limiting effect on this invasive species.

Downstream of the LADWP diversion dam, the SWRCB's goal is to maintain "functional and self-sustaining stream systems with healthy riparian ecosystem components" and "trout in good condition" (McBain & Trush, Inc., 2010). Lee Vining Creek above the LADWP diversion and below SCE's FERC project area should be managed in a consistent manner in order to comply with California Fish & Game Code Section 5937 and keep fish in good condition. This reach can also benefit from the studies that already have been conducted downstream.

The nexus between the Lee Vining Hydropower Project and the maintenance of the stream ecosystem is articulated in the 2010 Synthesis Report (p73):

Premise No.2. Annual snowmelt and baseflow hydrograph components for Lee Vining Creek above Intake (5008) are moderately regulated by SCE. Annual snowmelt flood peak magnitude and duration in the SCE annual hydrographs have been diminished compared to unregulated annual snowmelt peaks; fall and winter baseflows in the SCE annual hydrographs are elevated compared to unimpaired baseflows (Figure 4-1).

Premise No.3. Some portions of the SCE regulated hydrographs can mimic unimpaired streamflows. SCE annual hydrographs selectively preserve the magnitude, duration, frequency, timing, and/or rate of a few unregulated annual hydrograph components. Most notably, the fast and slow snowmelt recession limbs in the SCE annual hydrographs are extremely similar to the fast and slow unregulated snowmelt recession limbs (Figure 4-1). Also, the timing of snowmelt peaks does not appear significantly altered by SCE operations.

Premise No.3 identifies portions of the SCE hydrograph that should not be impaired by changes to SCE operations. This means the intact hydrograph components mentioned in Premise No.3—the timing of the snowmelt peak, and the recession limb of the hydrograph—should be preserved. The pre-2010 (period analyzed by the Synthesis Report) management of the daily reservoir storage change between the time of the peak flow and the end of August should be preserved as much as possible.

In addition, SCE should maintain the seasonal unimpaired hydrograph pattern as much as possible. 2019 is an example of a year when the April–August flow from Saddlebag was low, and much higher after August. This pattern, evident in many wet years due to temporary variances from FERC requirements, is the inverse of the natural flow pattern and should be avoided. For extremely wet years like 2017 and 2023, instead of the release of a high August flow, that high flow could be added to the snowmelt peak to increase the magnitude and extend the duration earlier in the summer when higher flows would be more beneficial to the stream ecosystem.

Additional considerations include ramping rates and seasonal baseflows. These are important components that should be evaluated and added to the license conditions.

3. Better transparency in public data sharing and coordination in SCE operations is needed to support downstream management and restoration efforts.

In a comment submitted on 6/11/24 (Draft License Application Volume III, Table 1-1, Comment 29), MLC raised the following concern:

> *SCE should publicly share real-time data for reservoir storage and flows, including the hourly and telemetry requirements found here (https://www.waterboards.ca.gov/waterrights/water_issues/programs/diversion_use/water_measurement.html#who-needs-to). Reporting these data to SWRCB appears to be required by state law, and these data are also essential for LADWP reporting and operations downstream. SCE's FERC license should have provisions that do not conflict with SWRCB requirements and where possible facilitate LADWP compliance with its water rights licenses. The California Department of Water Resources is seeking to add daily storage information from this project to the California Data Exchange Center, and as with other projects, can add a time lag that has addressed any market manipulation concerns at other projects. This is important for runoff tracking, downstream LADWP operations, restoration, and monitoring license requirements, as well as public recreation.*

SCE's response to this comment was "SCE is in compliance with SB88 water rights reporting requirements. This information can be found on the referenced Website in your comment."

We were unable to identify the exception on the Website to which SCE is referring. SCE should be more specific about what it is required to report. Based on the size of the diversion, it appears SCE is subject to the telemetry requirements found at: *https://www.waterboards.ca.gov/waterrights/water_issues/programs/measurement_regulation/telemetry_requirements.html*.

Regardless of whether SCE is subject to SB88, due to the high level of public interest in this Project, FERC should require SCE to publicly share real-time, daily, or weekly data on reservoir storage and flows or provide documentation explaining why it cannot. SCE's reservoir storage data is essential for calculating unimpaired runoff, ensuring accurate runoff forecasts, and managing downstream operations at Los Angeles Department of Water & Power (LADWP) facilities. Both MLC and LADWP rely on timely SCE reservoir storage data to anticipate flow fluctuations at the LADWP diversion dam, including the timing and magnitude of peak flows. Additional data on flow, snowpack, and meteorology are also critical for operations and forecasting, while reservoir stage and streamflow data are of significant interest to the public due to the area's recreational and research values.

Prior to the year 2000, SCE shared operations, flow, and storage data more openly with MLC and LADWP, including preliminary daily data and future reservoir storage and release projections. Providing timely notifications of sudden flow changes would improve downstream management and compliance with regulatory requirements.

Since deregulation in 2000, the only publicly accessible SCE data from the Lee Vining Project are posted on the following two websites:

1. California Data Exchange Center (CDEC): snow surveys, weather stations, and end-of-month Saddlebag Lake Reservoir level
2. United States Geological Survey (USGS): daily reservoir storage and flows posted approximately six months after the end of the water year (e.g. 2024 water year data is posted by April 2025).

Public interest considerations in favor of timely data sharing and notifications of sudden flow changes and planned operations to interested parties include:

1. The California Department of Water Resources is seeking to add daily storage information from this project to the California Data Exchange Center. With other projects it has added a time lag when necessary to address concerns that the data might be used for market manipulation.
2. In order to calculate unimpaired flows (for use in forecasting and comparing observed to forecasted runoff), SCE's reservoir storage data is necessary. Currently, SCE's data aren't available until they are posted on the USGS Website about six months after the end of the water year. This delay reduces the effectiveness of water management and requires guesswork and estimation. Over the past twenty years MLC has estimated SCE storage based on in-person visits to reservoirs, satellite and aerial photos, and the use of past years with similar hydrology. This additional effort would be unnecessary if SCE shared data in real-time.
3. LADWP's water rights licenses require it to coordinate with SCE, and coordination and communication allow better management of LADWP's system and the streamflows it releases; better management would likely benefit the ecosystem in the restoration reaches of Lee Vining Creek from the LADWP diversion downstream to Mono Lake. For example, the operation of the Lee Vining Creek diversion dam (diversions, releases, and peak flow and sediment bypass) is more efficient when LADWP can anticipate upstream operations. LADWP installed a Langemann gate in 2005, allowing LADWP to mitigate many of the biggest problems caused by upstream flow fluctuations. However, communication with LADWP about expected flow changes is still helpful in the operation of that facility.
4. Certain years have large error in LADWP's runoff forecast. Sharing of SCE's data in real-time could ground truth and improve runoff forecasts. Improved forecasting would help avoid problems such as the extremely low Grant Lake Reservoir levels (relevant because Lee Vining Creek diversions enter this reservoir) that resulted from an over-forecast in 2008. A 2013 settlement agreement between LADWP, CDFW, Cal Trout, and MLC requires monthly reporting of unimpaired flows by LADWP in order to compare observed to forecasted runoff and to identify errors in forecasting as quickly as possible, so that water management changes can be made.
5. In years when Aerial Snow Observatory data are available, pairing that data with unimpaired flow is necessary to generate a runoff efficiency curve for that year. Delays in the release of SCE storage data hamper efforts to use the best available snowmelt monitoring and forecasting techniques.
6. Public safety and recreation considerations would be better informed by anticipated reservoir levels, when dams are expected to spill, or when sudden flow fluctuations are expected. Expected operations as well as real-time data would allow recreationists to better plan their activities (e.g. fishing, boating, hiking, camping). MLC operates an Information Center in Lee Vining that is also the Lee Vining Chamber of Commerce, providing visitor information to thousands of recreationists each year. MLC also has a newsletter and a blog that disseminates information about the conditions in the area. Timely data from the Project would allow MLC to better serve the public.
7. MLC conducts monitoring in Lee Vining Creek and coordinates with other researchers who would also benefit from the sharing of SCE's real-time information. For example, in May 2018, researchers studying the April 5–7, 2018 rain event that produced "spectacular hydrological and geomorphic impacts" (Sue Burak, May 29, 2018 personal communication) were looking for observations of debris flows and flooding in order to quantify how anomalous the event was. They tried to access USGS discharge data for Lee Vining Creek below Rhinedollar Dam, but learned that current discharge data were not available until the following year.

We recommend that as a PME measure, SCE share the following provisional data:

1. On a real-time website: Planned and actual daily reservoir storage and flows. Example from SCE's Big Creek Project: *https://www2.kisters.net/scepublic/*.
2. With agencies and stakeholders: monthly data sheets containing daily reservoir storage and flows as was routinely shared upon request during the decade when the Project was last relicensed.
3. Annually in April: Forecasted runoff and planned operations and anticipated monthly storages for the year.
4. With LADWP: notifications of changes to planned operations and sudden flow changes.

This PME measure would protect the public interest in timely access to the best available information on hydrology and Project operations for recreationists and researchers. Especially when paired with the same PME on Rush Creek, it would improve management of Rush and Lee Vining creeks downstream of the LADWP diversion, Grant Lake Reservoir, and Mono Lake by facilitating informed decision making and flow tracking.

4. Better oversight of vegetation management is needed to mitigate impacts to riparian vegetation

The Botanical Technical Study, on page 6-150 of Volume I of the DLA, notes that despite California Department of Fish & Wildlife, US Forest Service, and SWRCB consultations, Population 2 of Black Cottonwood (*Populus trichocarpa*) was unintentionally removed during large scale vegetation removal in fall 2022. We commented on this on 6/11/24 (Draft License Application Volume III, Table 1-1, Comment 34) and SCE's response was "All tree removal conducted in the vicinity of Poole Powerhouse was done in consultation with CDFW and USFS as part of the Wildfire Mitigation Plan."

We are concerned that despite this consultation, 8 healthy cottonwood saplings were "unintentionally" cut down (despite being more than 200 feet away from the nearest structure). The lack of care in this clearing indicates there may be a need for additional license conditions that protect important riparian species. We also recommend mitigation for the loss of these black cottonwoods in the form of tree planting and an explicit review of the CDFW/USFS consultation and contractor procedures to understand what went wrong and how this can be avoided in the future.

In addition, there is a population of Rocky Mountain Maple (*Acer glabrum*) (one of only two such populations in the Mono Basin) on the hillside above the Poole Powerplant, and this population should also be protected from fuel reduction efforts taken to reduce risks to project facilities (i.e. powerhouse and power lines).

Thank you for considering these comments. Please contact me at *robbie@monolake.org* or (760) 647-6595 with questions or for additional information.

Sincerely

Robbie Di Paolo
Restoration Field Technician

CC:

Southern California Edison

Wayne P. Allen
Wayne.allen@sce.com

Matthew Woodhall
Matthew.woodhall@sce.com

Martin Ostendorf
Martin.Ostendorf@sce.com

California Department of Fish and Wildlife

Alisa Ellsworth
Alisa.Ellsworth@wildlife.ca.gov

Graham Meese
Graham.Meese@wildlife.ca.gov

Beth Lawson
Beth.Lawson@wildlife.ca.gov

United States Fish and Wildlife Service

Chad Mellison
Chad_Mellison@fws.gov

United States Forest Service

Tristan Leong
Tristan.Leong@usda.gov

Sheila Irons
Sheila.Irons@usda.gov

California State Water Resources Control Board

Garrett Long, Water Resources Control Engineer
Garrett.Long@waterboards.ca.gov

Adam Cohen
Adam.Cohen@waterboards.ca.gov

Kleinschmidt Group

Carissa Shoemaker
Carissa.Shoemaker@kleinschmidtgroup.com

Shannon Luoma
Shannon.Luoma@kleinschmidtgroup.com

Finlay Anderson
Finlay.Anderson@kleinschmidtgroup.com

References:

Bipa, N.J., Stradiotti, G., Righetti, M., Pisaturo, G.R. (2024). Impacts of hydropeaking: A systematic review. *Science of the Total Environment*, 912, 169251.

Bucek, D., Orfánus, M., Dušička, P., Šulek, P. (2021). The impact of hydropeaking on sediment transport. *Pollack Periodica*, 16(1), 120-125.

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López, R., Garcia, C., Vericat, D., Batalla, R.J. (2020). Downstream changes of particle entrainment in a hydropeaked river. *Science of the Total Environment*, 745, 140952.

López, R., Ville, F., Garcia, C., Batalla, R.J., Vericat, D. (2023). Bed-material entrainment in a mountain river affected by hydropeaking. *Science of the Total Environment*, 856, 159065.

McBain & Trush, Inc. and Ross Taylor and Associates (2010). Mono Basin Stream Restoration and Monitoring Program: Synthesis of Instream Flow Recommendations to the State Water Resources Control Board and the Los Angeles Department of Water and Power Final Report.

Vericat, D., Ville, F., Palau-Ibars, A., Batalla, R.J. (2020). Effects of Hydropeaking on Bed Mobility: Evidence from a Pyrenean River. *Water*, 12(1), 178.

E-06.1_Discussion re USFS comments on DLA, Forestwide Invasive Plants Treatment Project

From:	Carissa Shoemaker
To:	sheila.irons@usda.gov
Cc:	Shannon Luoma
Subject:	Lee Vining DLA - Forest-wide Invasive Plants Treatment Project EA (2019)
Date:	Tuesday, December 17, 2024 12:37:00 PM
Attachments:	image001.jpg

Hi Sheila,
I'm reviewing the USFS comments on the Lee Vining DLA. I haven't been able to find this document online: Forest-wide Invasive Plants Treatment Project EA (2019). Could you provide it or send a link so we can use it in the FLA?

Here is the comment it is referenced in:

Appendix E:
4.5.3.1. Invasive Plant Management
15: This section states that, *Herbicide usage (chemical control) is not permitted within the Inyo National Forest*. This statement is incorrect. Herbicide utilization for invasive plant management can be applied with INF approval under specific conditions, and consistent with the Forest-wide Invasive Plants Treatment Project EA (2019). The listed BMPs in this section do not constitute sufficient management for invasive plant management control. The FLA should describe or propose that SCE will develop an invasive weed management plan that will include among other things, the BMPs listed in this section as well as other actions as discussed and approved by the INF to address the control and spread of potential invasive plant species arising from Project activities.

Thank you!

Carissa Shoemaker
Licensing Coordinator

C: 907-575-0294
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TJ Wiggs

From: Rowe, Courtney - FS, CA <Courtney.Rowe@usda.gov>
Sent: Monday, January 13, 2025 9:34 AM
To: Leong, Tristan - FS, CA; Carissa Shoemaker
Cc: Shannon Luoma; Sill, Nathan - FS, CA
Subject: RE: [External Email]FW: Lee Vining DLA - Forest-wide Invasive Plants Treatment Project EA (2019)

Here you go: https://www.fs.usda.gov/project/inyo/?project=38912

From: Leong, Tristan - FS, CA <tristan.leong@usda.gov>
Sent: Sunday, January 12, 2025 8:20 PM
To: Carissa Shoemaker <Carissa.Shoemaker@KleinschmidtGroup.com>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Sill, Nathan - FS, CA <nathan.sill@usda.gov>; Rowe, Courtney - FS, CA <Courtney.Rowe@usda.gov>
Subject: RE: [External Email]FW: Lee Vining DLA - Forest-wide Invasive Plants Treatment Project EA (2019)

Let me see if we can find the reference. I've copied staff at the Forest who may have a copy or access to it.

From: Carissa Shoemaker <Carissa.Shoemaker@KleinschmidtGroup.com>
Sent: Friday, January 10, 2025 3:41 PM
To: Leong, Tristan - FS, CA <tristan.leong@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: [External Email]FW: Lee Vining DLA - Forest-wide Invasive Plants Treatment Project EA (2019)

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Hi Tristan,
I sent this request to Sheila a while ago and haven't heard back. Do you have this document?

Thank you!

Carissa Shoemaker
Licensing Coordinator
www.kleinschmidtgroup.com
907-575-0294

From: Carissa Shoemaker
Sent: Tuesday, December 17, 2024 11:38 AM
To: sheila.irons@usda.gov
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: Lee Vining DLA - Forest-wide Invasive Plants Treatment Project EA (2019)

Hi Sheila,
I'm reviewing the USFS comments on the Lee Vining DLA. I haven't been able to find this document online: Forest-wide Invasive Plants Treatment Project EA (2019). Could you provide it or send a link so we can use it in the FLA?

Here is the comment it is referenced in:

Appendix E:
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Thank you!

Carissa Shoemaker
Licensing Coordinator
Kleinschmidt
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RECORD OF CONSULTATION JANUARY 2021 THROUGH JANUARY 2024

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Post-Pre-Application Document, Not Study Plan Related

Item #	Date Sent	Stakeholder Group	Type of Correspondence/ Consultation Event	Document Type
A-01	7/21/2021	USFS	Discussion re Inyo National Forest vegetation data sets	Email
A-02.1	8/13/2021	All stakeholders	Notification of PAD filing	Email
A-02.2	8/13/2021	CDFW	Discussion w/ CDFW re TLP process	Email
A-03	8/19/2021	Mono Lake Kootzaduka'a Tribe	Discussion re Tribe roles re May 2021 TWG minutes	Email
A-04.1	8/23/2021	All stakeholders	Relicensing update for Sept 2021 Site Visit	Email
A-04.2	8/25/2021	Paul Rose	Discussion re coordination of Sept 2021 site visit	Email
A-05	9/13/2021	CDFW	Comment letter from CDFW on licensing process preference	Letter
A-06	9/15/2021	FERC	Coordination for Joint Agency Meeting	Email
A-07.1	9/24/2021	All stakeholders	Sept 2021 site visit information	Email
A-07.2	9/24/2021	NPS	Sept 2021 site visit coordination	Email
A-07.3	9/24/2021	CDFW	Sept 2021 site visit coordination	Email
A-07.4	9/26/2021	USFS	Sept 2021 site visit coordination	Email
A-08	9/26/2021	All stakeholders	Weather update for Sept 2021 site visit	Email
A-09	9/27/2021	USFS	Discussion re air quality for Sept 2021 site visit	Email
A-10.1	9/28/2021	All stakeholders	Meeting invitation for Sept 2021 site visit	Email
A-10.2	9/28/2021	All stakeholders	Meeting invitation placeholder for Sept 2021 site visit	Email
A-11.1	10/12/2021	USFS	Sept 2021 site visit questionnaire response	Email
A-11.2	11/1/2021	Mono Lake Committee	Sept 2021 site visit questionnaire response	Email
A-11.3	11/16/2021	Mono Lake Committee	Sept 2021 site visit questionnaire response	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/ Consultation Event	Document Type
A-12.1	10/19/2021	FERC	FERC letter inviting Big Pine Paiute Tribe of Owens Valley to participate in LV relicensing	Letter
A-12.2	10/19/2021	FERC	FERC letter inviting Bishop Paiute Tribe to participate in LV relicensing	Letter
A-12.3	10/19/2021	FERC	FERC letter inviting Bridgeport Paiute Indian Colony to participate in LV relicensing	Letter
A-12.4	10/19/2021	FERC	FERC letter inviting Fort Independence Community of Paiute to participate in LV relicensing	Letter
A-12.5	10/19/2021	FERC	FERC letter inviting North Fork Rancheria of Mono Indians of California to participate in LV relicensing	Letter
A-12.6	10/19/2021	FERC	FERC letter inviting Tuolumne Band of Me-Wuk Indians to participate in LV relicensing	Letter
A-12.7	10/19/2021	FERC	FERC letter inviting Walker River Paiute Tribes to participate in LV relicensing	Letter
A-12.8	10/19/2021	FERC	FERC letter inviting Washoe Tribe of Nevada and California to participate in LV relicensing	Letter
A-13	10/19/2021	CA State Water Board	Notice of staff change	Email
A-14.1	10/29/2021	The Sheet	Notice of public meeting	Email
A-14.2	10/29/2021	Mammoth Times	Notice of public meeting	Email
A-15.1	11/12/2021	All stakeholders	Joint Agency Meeting reminder and materials	Email
A-15.2	11/12/2021	USFS	Discussion re Joint Agency Meeting	Email
A-15.3	11/15/2021	CA State Water Board	Discussion re Joint Agency Meeting	Email
A-15.4	11/16/2021	North Fork Rancheria of Mono Indians of CA	Discussion re Joint Agency Meeting	Email
A-16.1	11/16/2021	All stakeholders	Meeting invitation for Joint Agency Meeting	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/ Consultation Event	Document Type
A-16.2	11/16/2021	All stakeholders	Meeting invitation placeholder for Joint Agency Meeting	Email
A-16.3	11/16/2021	All stakeholders	Joint Agency Meeting Agenda	Email
A-16.4	11/16/2021	All stakeholders	Joint Agency Meeting Attendance List	Email
A-16.5	11/16/2021	All stakeholders	Joint Agency Meeting Presentation	Email
A-17.1	11/22/2021	USFS, CDFW	Botanical data and reports provided to CDFW, USFS	Email
A-17.2	12/10/2021	USFS, CDFW	Follow up re USFS data request	Email
A-17.3	1/12/2022	USFS	Follow up discussion re USFS data request	Email
A-18	11/23/2021	FERC, Washoe Tribe of NV and CA	Consultation with Washoe Tribe of NV and CA	Telephone
A-19	12/3/2021	FERC, Tuolumne Band of Me-Wuk Indians	Consultation with Tuolumne Band of Me-Wuk Indians	Telephone
A-20	12/8/2021	SCE	FERC Filing for Lee Vining JAM & Virtual Site Tour Summary	Letter
A-21	12/9/2021	North Fork Rancheria of Mono Indians of CA	Request for consultation on LV relicensing	Letter
A-22.1	1/11/2022	SCE, SHPO	SHPO Consultation letter re proposed APE	Letter
A-22.2	3/23/2022	SHPO	SHPO receipt of Jan 11, 2022 consultation letter	Letter
A-23	1/20/2022	Mono Lake Committee	Request for additional info from Terrestrial and Botanical TWG	Email
A-24	5/11/2022	California Coastal Commission	Coastal Zone Consistency Determination	Email
A-25	5/23/2022	USFS	Discussion re motorboats in reservoirs	Email
A-26	2/1/2023	USFS	USFS contact list update for Cultural and Tribal TWG	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/ Consultation Event	Document Type
A-27	3/5/2024	Mono Lake Tufa State Natural Reserve	Discussion re reservation of meeting space	Email
A-28	3/28/2024	USFS	Discussion re USFS contact included in meeting requests and correspondence	Email
A-29	4/19/2024	All stakeholders	Notice of upcoming stakeholder meetings for May 2024	Email
A-30	5/8/2024	USFWS	Information re upcoming May 2024 stakeholder meetings	Email
A-31	6/25/2024	Mono Lake Committee	Survey response re LV relicensing information	Email

APE = Area of Potential Effects; CA = California; CDFW = California Department of Fish and Wildlife; FERC = Federal Energy Regulatory Committee; JAM = Joint Agency Meeting; LV = Lee Vining; NPS = National Park Service; NV = Nevada; PAD = Pre-Application Document; SCE = Southern California Edison; SHPO = State Historic Preservation Office; TLP = Traditional Licensing Process; TWG = Technical Working Group; USFS = U.S. Forest Service; USFWS = U.S. Fish and Wildlife Service

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From:	Allison Rudalevige
To:	Engelhardt, Blake -FS
Cc:	Carissa Shoemaker; Shannon Luoma; Brad Blood
Subject:	RE: [External Email]RE: Inyo National Forest vegetation layer
Date:	Wednesday, July 21, 2021 7:47:09 AM
Attachments:	image001.png image002.png image003.png image004.png

Thank you.

Allison D. Rudalevige

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

From: Engelhardt, Blake -FS <blake.engelhardt@usda.gov>
Sent: Tuesday, July 20, 2021 10:58 AM
To: Allison Rudalevige <allison.rudalevige@psomas.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Brad Blood <bblood@psomas.com>
Subject: RE: [External Email]RE: Inyo National Forest vegetation layer

Hi Allison,
You can access the existing vegetation dataset and explanations of the types here: https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192

Sounds like that “alpine grasses and forbs” is more of an upland community, although it might be worth comparing where it occurs to how the veg looks in an aerial photo. I agree that if it is the only veg type around the perimeter of a lake or stream edge it could be indeed riparian associated.

Blake

Blake M Engelhardt (she/her)
Forest Botanist

Forest Service
Inyo National Forest

p: 760-873-2495
f: 760-873-2458
blake.engelhardt@usda.gov
bmengelhardt@fs.fed.us

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

Caring for the land and serving plants

From: Allison Rudalevige <allison.rudalevige@psomas.com>
Sent: Friday, July 9, 2021 9:55 AM
To: Engelhardt, Blake -FS <blake.engelhardt@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Brad Blood <bblood@psomas.com>
Subject: [External Email]RE: Inyo National Forest vegetation layer

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Hi Blake-
Just following up on this. Thanks.

Allison D. Rudalevige

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

From: Allison Rudalevige
Sent: Thursday, June 24, 2021 12:08 PM
To: Engelhardt, Blake -FS <blake.engelhardt@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Brad Blood <bblood@psomas.com>
Subject: Inyo National Forest vegetation layer

Hello Blake-

I was hoping you could point me in the direction of the Inyo National Forest vegetation layer. I have the vegetation descriptions but I want to make sure I'm accessing the correct layer.

Also, do you know if all "alpine grasses and forbs" are considered riparian habitats? The vegetation description lists multiple species that occur in the alliance but *Juncus mertensianus* is the only one classified as an Obligate wetland species. Most of the species listed are classified as Upland or Facultative Upland. If the alliance within the FERC boundary is closely associated with a creek/lake, I feel it would be justified calling it a riparian habitat. But if it's away from the creek I'm thinking we should not include it with the other riparian habitats. Would you concur with this approach?

Thank you.

Allison D. Rudalevige

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

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A-02.1_Notification of PAD filing

From:	Carissa Shoemaker
To:	Carissa Shoemaker
Subject:	FW: PAD Filing for Lee Vining (FERC P-1388) Relicensing
Date:	Friday, July 8, 2022 3:19:00 PM
Attachments:	image001.png

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, August 13, 2021 10:28 AM
To: culture@bridgeportindiancolony.com; events@mammothmuseum.org; frontierpacktrain@gmail.com; FERC Case Admin <FERCCaseAdmin@sce.com>; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; jonathan.aguayo@psomas.com; victor.aguirreorozco@usda.gov; Wayne Allen <Wayne.Allen@sce.com>; Oroville@DWR <talpaugh@kearnswest.com>; holly@inyo-monowater.org; dawn.alvarez@usda.gov; Philipana@aol.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; nayanake@comcast.net; kutzanuumu@yahoo.com; markbagley02@gmail.com; kathybncrft@yahoo.com; Rose.Banks@wildlife.ca.gov; adam.barnett@usda.gov; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Jacqueline.beidl@usda.gov; bbell@co.tuolumne.ca.us; ethan@stillwatersci.com; hydroesq@schat.net; monty.bengochia@bishoppaiute.org; lbergeron@pcta.org; paiute11@aol.com; Brad Blood <bblood@psomas.com>; ashley.blythehaverstock@usda.gov; stephen_bowes@nps.gov; t.braithwaite@bentonpaiutereservation.org; nativearchdoc@yahoo.com; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com; Holly Burger <burger@stillwatersci.com>; bburman@usbr.gov; Seth Carr <Seth.Carr@sce.com>; ssmiwuknation@gmail.com; sandra47roy@gmail.com; Adam Cohen <acohen@stillwatersci.com>; apcohen@umail.ucsb.edu; rcollins@caltrout.org; lcompas@hrassoc.com; darrel.cruz@washoetribe.us; lisa@monolake.org; businesscommittee@fortindependence.com; cdaly@mackaysposito.com; shellydk@frontiernet.net; tilford.denver@bishoppaiute.org; Robert Di Paolo <robbie@monolake.org>; matt.driscoll@sierranevada.ca.gov; durhamdthvlly@aol.com; hpo@timbisha.com; Lauren@stillwatersci.com; gardenofegan@suddenlink.net; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; James.Erdman@wildlife.ca.gov; Stephanie Fincher <stephanie.fincher@sce.com>; efink@nfr-nsn.gov; jora@friendsoftheinyo.org; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; nora.gamino@usda.gov; nordich2o@gmail.com; george@timbisha.com; chair@bridgeportindiancolony.com; Rwgoode911@hotmail.com; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; Nicole Greenberg <Nicole.Greenberg@erm.com>; pgunsolley@gmail.com; d.gutierrez@bigpinepaiute.org; env@bridgeportindiancolony.com; ed.hancock@waterboards.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; Michael Harty <jmharty@kearnswest.com>; jenny@sierranevadaalliance.org; bryan.hatchell@colorado.edu; Haverstock, Gregory J <ghaverst@blm.gov>; Kelly Henderson <Kelly.Henderson@sce.com>; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; Nuria Holmes <nuria.holmes@kleinschmidtgroup.com>; Michael.Hross@KleinschmidtGroup.com; Irons, Sheila -FS <sheila.irons@usda.gov>; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; dfjohnso@blm.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com;

jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon Kulik <Brandon.Kulik@KleinschmidtGroup.com>; claire@monolake.org; char54lange@gmail.com; Kelly.Larimer@KleinschmidtGroup.com; tristan.leong@usda.gov; c.levine@bigpinepaiute.org; Russell Liebig <russ@stillwatersci.com>; info@rockcreekpackstation.com; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; s.manning@bigpinepaiute.org; alyssa.marquez@wildlife.ca.gov; gordon.martin@usda.gov; cmcdonald@northforkrancheria-nsn.gov; pmcfarland395@gmail.com; Geoffrey McQuilkin <geoff@monolake.org>; Chad_Mellison@fws.gov; bartshe@monolake.org; Heather Miller <hmiller@hrassoc.com>; dave.moore@sce.com; Patricia.Moyer@Wildlife.ca.gov; easternsierraartist@gmail.com; megan.mullowney@usda.gov; Heather Bowen Neff <heather@stillwatersci.com>; steve.norton@psomas.com; steven.orihuela@bishoppaiute.org; Krista Orr <krista@stillwatersci.com>; Martin Ostendorf <Martin.Ostendorf@sce.com>; Fatima.Oswald@Kleinschmidtgroup.com; jon@mewuk.com; lucy_basket4@yahoo.com; steve.parmenter@wildlife.ca.gov; Charles Partridge <Charles.Partridge@sce.com>; mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; j.rambeau@bigpinepaiute.org; marshmistress@msn.com; andrea@mewuk.com; greg@monolake.org; claymiwumati@gmail.com; Jillian Roach <Jillian.Roach@erm.com>; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; Calvin Rossi <Calvin.Rossi@sce.com>; allison.rudalevige@psomas.com; monique.sanchez@usda.gov; shanesaulque@hotmail.com; kary.schlick@usda.gov; wendy@friendsoftheinyo.org; falconkeeper22@gmail.com; thpo@fortindependence.com; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; cshutes@calsport.org; nathan.sill@usda.gov; barb@farwestern.com; Emily Smith <Emily.Smith@erm.com>; serrell.smokey@washoetribe.us; Eric Sommerauer <esommerauer@stillwatersci.com>; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; daniel.sussman@waterboards.ca.gov; shawna_theisen@fws.gov; jjthompson@timbisha.com; lthurston@stillwatersci.com; eric.tillemans@ladwp.com; dtonenna@gmail.com; chairman@wrpt.org; thomas.torres@usda.gov; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; Nicolas Von Gersdorff <Nicolas.Von@sce.com>; curator@monobasinhistory.org; Jameisha.Washington@usda.gov; jennifer.watts@waterboards.ca.gov; johnwentworth@mltpa.org; eric@friendsoftheriver.org; chair@lppsr.org; paiute11@aol.com; Vince White <Vince.White@sce.com>; Scott@stillwatersci.com; Audry Williams <Audry.Williams@sce.com>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; daniel.yarborough@usda.gov; Andrew.Yoder@kleinschmidtgroup.com

Subject: PAD Filing for Lee Vining (FERC P-1388) Relicensing

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Dear Lee Vining Relicensing Project Interested Party:

Southern California Edison's (SCE) has filed a Preliminary Application Document (PAD) with FERC as part of the relicensing of the Lee Vining Hydroelectric Project (FERC Project No. 1388). This filing includes a request to FERC to use the Traditional Licensing Process (TLP). The filing may be accessed

on FERC's public website under docket P-1388 at www.ferc.gov or via the direct link below: https://elibrary.ferc.gov/eLibrary/filelist?accession_num=20210812-5130

You are invited to provide comments on the SCE's request to use the TLP. Pursuant to 18 CFR § 5.3(d)(1), comments must be filed with FERC within 30 days of the filing date of this request, which is Monday, September 13, 2021. Comments on the request should address, as appropriate:

- Likelihood of timely license issuance;
- Complexity of the resource issues;
- Level of anticipated controversy;
- Relative cost of the traditional process compared to the integrated process; and
- The amount of available information and potential for significant disputes over studies; and
- Other factors believed by the commenter to be pertinent.

As a general reminder, all stakeholders have the option to register and subscribe on FERC's public website to receive communication directly from FERC throughout the upcoming relicensing process. This will ensure timely receipt of all filings made by FERC, SCE, and stakeholders. Future communications related to this relicensing will arrive primarily via FERC communications, therefore, it is important that interested parties register on FERC's website https://www.ferc.gov/docs-filing/esubscription.asp.

Thank you in advance for your assistance in SCE's relicensing process for the Lee Vining Project. Please contact me at (626) 302-9596 or matthew.woodhall@sce.com if you have any questions about the process or need assistance on registering on FERC's website.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

Carissa Shoemaker

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, August 13, 2021 3:44 PM
Subject: RE: (External):RE: PAD Filing for Lee Vining (FERC P-1388) Relicensing

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Hello Patricia –
SCE did receive your comment letter and appreciate CDFW's position. SCE continues to believe the TLP process is appropriate for this project and has addressed your agency's specific concerns in our request to FERC (linked here). Ultimately, it will be FERC's decision and we are prepared to work collaboratively with stakeholders regardless of the process. We encourage participants who wish to comment on the process to do so via the FERC's website at http://www.ferc.gov.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Sent: Friday, August 13, 2021 11:39 AM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>; culture@bridgeportindiancolony.com; events@mammothmuseum.org; frontierpacktrain@gmail.com; FERC Case Admin <FERCCaseAdmin@sce.com>; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; jonathan.aguayo@psomas.com; victor.aguirreorozco@usda.gov; Wayne Allen <Wayne.Allen@sce.com>; Oroville@DWR <talpaugh@kearnswest.com>; holly@inyo-monowater.org; dawn.alvarez@usda.gov; Philipana@aol.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; nayanake@comcast.net; kutzanuumu@yahoo.com; markbagley02@gmail.com; kathybncrft@yahoo.com; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; adam.barnett@usda.gov; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Jacqueline.beidl@usda.gov; bbell@co.tuolumne.ca.us; ethan@stillwatersci.com; hydroesq@schat.net; monty.bengochia@bishoppaiute.org; lbergeron@pcta.org; paiute11@aol.com; Brad Blood <bblood@psomas.com>; ashley.blythehaverstock@usda.gov; stephen_bowes@nps.gov; t.braithwaite@bentonpaiutereservation.org; nativearchdoc@yahoo.com; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com; burger@stillwatersci.com; bburman@usbr.gov; Seth Carr <Seth.Carr@sce.com>; ssmiwuknation@gmail.com; sandra47roy@gmail.com; acohen@stillwatersci.com; apcohen@umail.ucsb.edu; rcollins@caltrout.org; lcompas@hrassoc.com; darrel.cruz@washoetribe.us; lisa@monolake.org; businesscommittee@fortindependence.com; cdaly@mackaysposito.com; shellydk@frontiernet.net; tilford.denver@bishoppaiute.org; Robert Di Paolo <robbie@monolake.org>; Driscoll, Matt@SNC <Matt.Driscoll@sierranevada.ca.gov>; durhamdthvlly@aol.com; hpo@timbisha.com; Lauren@stillwatersci.com; gardenofegan@suddenlink.net; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Stephanie Fincher <Stephanie.Fincher@sce.com>; efink@nfr-nsn.gov; jora@friendsoftheinyo.org; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; nora.gamino@usda.gov; nordich2o@gmail.com; george@timbisha.com; chair@bridgeportindiancolony.com; Rwgoode911@hotmail.com; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; nicole.greenberg@erm.com; pgunsolley@gmail.com; d.gutierrez@bigpinepaiute.org; env@bridgeportindiancolony.com; Hancock, Ed@Waterboards

<Ed.Hancock@waterboards.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com; Michael Harty <jmharty@kearnswest.com>; jenny@sierranevadaalliance.org; bryan.hatchell@colorado.edu; Haverstock, Gregory J <ghaverst@blm.gov>; Kelly Henderson <Kelly.Henderson@sce.com>; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; Nuria Holmes <nuria.holmes@kleinschmidtgroup.com>; Michael.Hross@KleinschmidtGroup.com; Irons, Sheila -FS <sheila.irons@usda.gov>; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; dfjohnso@blm.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com; jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon Kulik <Brandon.Kulik@KleinschmidtGroup.com>; claire@monolake.org; char54lange@gmail.com; Kelly.Larimer@KleinschmidtGroup.com; tristan.leong@usda.gov; c.levine@bigpinepaiute.org; russ@stillwatersci.com; INFO@ROCKCREEKPACKSTATION.COM; Shannon.Luoma@KleinschmidtGroup.com; s.manning@bigpinepaiute.org; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; gordon.martin@usda.gov; cmcdonald@northforkrancheria-nsn.gov; pmcfarland395@gmail.com; Geoffrey McQuilkin <geoff@monolake.org>; Chad_Mellison@fws.gov; bartshe@monolake.org; Heather Miller <hmiller@hrassoc.com>; dave.moore@sce.com; easternsierraartist@gmail.com; megan.mullowney@usda.gov; Heather Bowen Neff <heather@stillwatersci.com>; steve.norton@psomas.com; steven.orihuela@bishoppaiute.org; Krista@stillwatersci.com; Martin Ostendorf <Martin.Ostendorf@sce.com>; Fatima.Oswald@Kleinschmidtgroup.com; jon@mewuk.com; lucy_basket4@yahoo.com; Parmenter, Steve@Wildlife <Steve.Parmenter@wildlife.ca.gov>; Charles Partridge <Charles.Partridge@sce.com>; mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; j.rambeau@bigpinepaiute.org; marshmistress@msn.com; andrea@mewuk.com; greg@monolake.org; claymiwumati@gmail.com; Jillian Roach <Jillian.Roach@erm.com>; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; Calvin Rossi <Calvin.Rossi@sce.com>; allison.rudalevige@psomas.com; monique.sanchez@usda.gov; shanesaulque@hotmail.com; kary.schlick@usda.gov; wendy@friendsoftheinyo.org; falconkeeper22@gmail.com; thpo@fortindependence.com; carissa.shoemaker@erm.com; cshutes@calsport.org; nathan.sill@usda.gov; barb@farwestern.com; emily.smith@erm.com; serrell.smokey@washoetribe.us; esommerauer@stillwatersci.com; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; Sussman, Daniel@Waterboards <daniel.sussman@waterboards.ca.gov>; shawna_theisen@fws.gov; jjthompson@timbisha.com; lthurston@stillwatersci.com; eric.tillemans@ladwp.com; dtonenna@gmail.com; chairman@wrpt.org; thomas.torres@usda.gov; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; Nicolas Von Gersdorff <Nicolas.Von@sce.com>; curator@monobasinhistory.org; Jameisha.Washington@usda.gov; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; johnwentworth@mltpa.org; eric@friendsoftheriver.org; chair@lppsr.org; paiute11@aol.com; Vince White <Vince.White@sce.com>; Scott@stillwatersci.com; Audry Williams <Audry.Williams@sce.com>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; daniel.yarborough@usda.gov; Andrew.Yoder@kleinschmidtgroup.com

Subject: (External):RE: PAD Filing for Lee Vining (FERC P-1388) Relicensing

***** EXTERNAL EMAIL - Use caution when opening links or attachments *****

Greetings Matt,

I'm checking in with you to make sure you received CDFW's comment letter. As stated in our attached letter dated June 21, 2021, CDFW does not support the TLP process.

Best regards,

Trisha
Trisha A. Moyer
CDFW- Desert Inland Region 6
Habitat Conservation Program Supervisor
787 North Main Street Suite 220
Bishop, CA 93514
(760) 835-4304

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, August 13, 2021 10:28 AM
To: culture@bridgeportindiancolony.com; events@mammothmuseum.org; frontierpacktrain@gmail.com; FERC Case Admin <FERCCaseAdmin@sce.com>; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; jonathan.aguayo@psomas.com; victor.aguirreorozco@usda.gov; Wayne Allen <Wayne.Allen@sce.com>; Oroville@DWR <talpaugh@kearnswest.com>; holly@inyo-monowater.org; dawn.alvarez@usda.gov; Philipana@aol.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; nayanake@comcast.net; kutzanuumu@yahoo.com; markbagley02@gmail.com; kathybncrft@yahoo.com; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; adam.barnett@usda.gov; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Jacqueline.beidl@usda.gov; bbell@co.tuolumne.ca.us; ethan@stillwatersci.com; hydroesq@schat.net; monty.bengochia@bishoppaiute.org; lbergeron@pcta.org; paiute11@aol.com; Brad Blood <bblood@psomas.com>; ashley.blythehaverstock@usda.gov; stephen_bowes@nps.gov; t.braithwaite@bentonpaiutereservation.org; nativearchdoc@yahoo.com; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com; burger@stillwatersci.com; bburman@usbr.gov; Seth Carr <Seth.Carr@sce.com>; ssmiwuknation@gmail.com; sandra47roy@gmail.com; acohen@stillwatersci.com; apcohen@umail.ucsb.edu; rcollins@caltrout.org; lcompas@hrassoc.com; darrel.cruz@washoetribe.us; lisa@monolake.org; businesscommittee@fortindependence.com; cdaly@mackaysposito.com; shellydk@frontiernet.net; tilford.denver@bishoppaiute.org; Robert Di Paolo <robbie@monolake.org>; Driscoll, Matt@SNC <Matt.Driscoll@sierranevada.ca.gov>; durhamdthvlly@aol.com; hpo@timbisha.com; Lauren@stillwatersci.com; gardenofegan@suddenlink.net; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Stephanie Fincher <Stephanie.Fincher@sce.com>; efink@nfr-nsn.gov; jora@friendsoftheinyo.org; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; nora.gamino@usda.gov; nordich2o@gmail.com; george@timbisha.com; chair@bridgeportindiancolony.com; Rwgoode911@hotmail.com; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; nicole.greenberg@erm.com; pgunsolley@gmail.com; d.gutierrez@bigpinepaiute.org; env@bridgeportindiancolony.com; Hancock, Ed@Waterboards <Ed.Hancock@waterboards.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com; Michael Harty <jmharty@kearnswest.com>; jenny@sierranevadaalliance.org; bryan.hatchell@colorado.edu; Haverstock, Gregory J <ghaverst@blm.gov>; Kelly Henderson <Kelly.Henderson@sce.com>; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; Nuria Holmes <nuria.holmes@kleinschmidtgroup.com>; Michael.Hross@KleinschmidtGroup.com; Irons, Sheila -FS <sheila.irons@usda.gov>; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; dfjohnso@blm.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com; jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon Kulik <Brandon.Kulik@KleinschmidtGroup.com>; claire@monolake.org; char54lange@gmail.com; Kelly.Larimer@KleinschmidtGroup.com; tristan.leong@usda.gov;

c.levine@bigpinepaiute.org; russ@stillwaterssci.com; INFO@ROCKCREEKPACKSTATION.COM; Shannon.Luoma@KleinschmidtGroup.com; s.manning@bigpinepaiute.org; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; gordon.martin@usda.gov; cmcdonald@northforkrancheria-nsn.gov; pmcfarland395@gmail.com; Geoffrey McQuilkin <geoff@monolake.org>; Chad_Mellison@fws.gov; bartshe@monolake.org; Heather Miller <hmiller@hrassoc.com>; dave.moore@sce.com; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; easternsierraartist@gmail.com; megan.mullowney@usda.gov; Heather Bowen Neff <heather@stillwaterssci.com>; steve.norton@psomas.com; steven.orihuela@bishoppaiute.org; Krista@stillwaterssci.com; Martin Ostendorf <Martin.Ostendorf@sce.com>; Fatima.Oswald@Kleinschmidtgroup.com; jon@mewuk.com; lucy_basket4@yahoo.com; Parmenter, Steve@Wildlife <Steve.Parmenter@wildlife.ca.gov>; Charles Partridge <Charles.Partridge@sce.com>; mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; j.rambeau@bigpinepaiute.org; marshmistress@msn.com; andrea@mewuk.com; greg@monolake.org; claymiwumati@gmail.com; Jillian Roach <Jillian.Roach@erm.com>; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; Calvin Rossi <Calvin.Rossi@sce.com>; allison.rudalevige@psomas.com; monique.sanchez@usda.gov; shanesaulque@hotmail.com; kary.schlick@usda.gov; wendy@friendsoftheinyo.org; falconkeeper22@gmail.com; thpo@fortindependence.com; carissa.shoemaker@erm.com; cshutes@calsport.org; nathan.sill@usda.gov; barb@farwestern.com; emily.smith@erm.com; serrell.smokey@washoetribe.us; esommerauer@stillwaterssci.com; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; Sussman, Daniel@Waterboards <daniel.sussman@waterboards.ca.gov>; shawna_theisen@fws.gov; jjthompson@timbisha.com; lthurston@stillwaterssci.com; eric.tillemans@ladwp.com; dtonenna@gmail.com; chairman@wrpt.org; thomas.torres@usda.gov; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; Nicolas Von Gersdorff <Nicolas.Von@sce.com>; curator@monobasinhistory.org; Jameisha.Washington@usda.gov; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; johnwentworth@mltpa.org; eric@friendsoftheriver.org; chair@lppsr.org; paiute11@aol.com; Vince White <Vince.White@sce.com>; Scott@stillwaterssci.com; Audry Williams <Audry.Williams@sce.com>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; daniel.yarborough@usda.gov; Andrew.Yoder@kleinschmidtgroup.com

Subject: PAD Filing for Lee Vining (FERC P-1388) Relicensing

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Dear Lee Vining Relicensing Project Interested Party:

Southern California Edison's (SCE) has filed a Preliminary Application Document (PAD) with FERC as part of the relicensing of the Lee Vining Hydroelectric Project (FERC Project No. 1388). This filing includes a request to FERC to use the Traditional Licensing Process (TLP). The filing may be accessed on FERC's public website under docket P-1388 at www.ferc.gov or via the direct link below:

https://elibrary.ferc.gov/eLibrary/filelist?accession_num=20210812-5130

You are invited to provide comments on the SCE's request to use the TLP. Pursuant to 18 CFR § 5.3(d)(1), comments must be filed with FERC within 30 days of the filing date of this request, which is Monday, September 13, 2021. Comments on the request should address, as appropriate:

- Likelihood of timely license issuance;
- Complexity of the resource issues;
- Level of anticipated controversy;
- Relative cost of the traditional process compared to the integrated process; and
- The amount of available information and potential for significant disputes over studies; and
- Other factors believed by the commenter to be pertinent.

As a general reminder, all stakeholders have the option to register and subscribe on FERC's public website to receive communication directly from FERC throughout the upcoming relicensing process. This will ensure timely receipt of all filings made by FERC, SCE, and stakeholders. Future communications related to this relicensing will arrive primarily via FERC communications, therefore, it is important that interested parties register on FERC's website https://www.ferc.gov/docs-filing/esubscription.asp.

Thank you in advance for your assistance in SCE's relicensing process for the Lee Vining Project. Please contact me at (626) 302-9596 or matthew.woodhall@sce.com if you have any questions about the process or need assistance on registering on FERC's website.

Matthew C. Woodhall

Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

Ethan Muhlestein

From: Audry Williams <Audry.Williams@sce.com>
Sent: Thursday, August 19, 2021 10:47 AM
To: charlotte Lange
Cc: Matthew Woodhall; Carissa Shoemaker; lcompas@hrassoc.com; Finlay Anderson; Kelly.Larimer@kleinschmidtgroup.com; Shannon Luoma; Shelly Davis-King; Jocelyn Sheltraw; jason small
Subject: RE: (External):Re: Lee Vining Cultural and Tribal May TWG Meeting Summary

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Thank you for the corrected information. We will fix our records and meeting notes. I apologize for the mix up.

Audry Williams
Senior Archaeologist
Environmental Services
T. 626-302-5104 | M. 661-331-8523

2244 Walnut Grove Ave., Rosemead, CA 91770

From: charlotte Lange <char54lange@gmail.com>
Sent: Wednesday, August 18, 2021 5:24 PM
To: Audry Williams <Audry.Williams@sce.com>
Cc: Matthew Woodhall <Matthew.Woodhall@sce.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lcompas@hrassoc.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Kelly.Larimer@kleinschmidtgroup.com; Shannon.Luoma@kleinschmidtgroup.com; Shelly Davis-King <shellydk@frontiernet.net>; Jocelyn Sheltraw <jocelynsheltraw@gmail.com>; jason small <monolakepaiute@gmail.com>
Subject: (External):Re: Lee Vining Cultural and Tribal May TWG Meeting Summary

***** EXTERNAL EMAIL - Use caution when opening links or attachments *****

Dear Ms. Williams,
Thank you for continuing to keep the Mono Lake Kutzadika Tribe informed on this project. In reviewing the attached minutes and those from previous emails, I would like to make an important clarification regarding the Mono Lake Kutzadika Indian Community Cultural Preservation Association (Association). Jocelyn Sheltraw is the Chairperson for the Association. Jason Small is the Vice Chairperson and Damon Dondero is Secretary/Treasurer. The Association has no president. Mr. Raymond Andrews is in no way affiliated with the Association and cannot speak in any way on behalf of the Association or the Mono Lake Kutzadika Tribe. The Association's Vice Chairperson, Jason Small will represent the Association for this project. Please ensure all SCE staff and contractors working on this project are aware of this clarification. Please update previous minutes to reflect this correction.
We look forward to continued consultation on this project.
Please feel free to contact me if you have any further questions.

Charlotte Lange, Chairperson

On Wed, Jul 14, 2021 at 12:01 PM Audry Williams <Audry.Williams@sce.com> wrote:

> Good Afternoon
>
> Please find attached the Lee Vining Cultural and Tribal Meeting Summary from May. Please let me or Carissa Shoemaker <Carissa.Shoemaker@erm.com> know if you have any comments by COB July 16th. Thank you!
>
> **Audry Williams**
>
> Senior Archaeologist
>
> Environmental Services
>
> T. 626-302-5104 | M. 661-331-8523
>
> 2244 Walnut Grove Ave., Rosemead, CA 91770
>
> ---
>
> **From:** Carissa Shoemaker <Carissa.Shoemaker@erm.com>
> **Sent:** Thursday, June 24, 2021 4:21 PM
> **To:** Audry Williams <Audry.Williams@sce.com>
> **Cc:** Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Shelly Davis-King <shellydk@frontiernet.net>; lcompas@hrassoc.com
> **Subject:** (External):Lee Vining Cultural and Tribal May TWG Meeting Summary
>
> ***** EXTERNAL EMAIL - Use caution when opening links or attachments *****
>
> Hi Audry,
>
> Could you send these draft meeting notes out to the Lee Vining Cultural/Tribal TWG for their review? I'd like to get them posted to the website after the July 4 holiday. Folks can let me know if they'd like to see any edits to the notes.
>
> TWG list:

culture@bridgeportindiancolony.com; events@mammothmuseum.org; nayanake@comcast.net; kutzanuumu@yahoo.com; kathybancroft@gmail.com; adam.barnett@usda.gov; monty.bengochia@bishoppaiute.org; paiute11@aol.com; sheila.irons@usda.gov; t.braithwaite@bentonpaiutereservation.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; Rwgoode911@hotmail.com; d.gutierrez@bigpinepaiute.org; sheila.irons@usda.gov; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; cmcdonald@northforkrancheria-nsn.gov; megan.mullowney@usda.gov; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; j.rambeau@bigpinepaiute.org; claymiwumati@gmail.com; monique.sanchez@usda.gov; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; serrell.smokey@washoetribe.us; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; curator@monobasinhistory.org; chair@lppsr.org; paiute11@aol.com

Thanks!

Carissa Shoemaker

Senior Project Scientist

Pronouns: she/her

I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM

1050 SW 6th Ave, Suite 1650 | Portland, OR 97204

M 907 575 0294

E carissa.shoemaker@erm.com | **W** www.erm.com

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A-04.1_Relicensing update for Sept 2021 Site Visit

From:	Carissa Shoemaker
To:	jstarost@blm.gov
Subject:	FW: IMPORTANT: Bishop Creek and Lee Vining Hydro Projects Relicensing UPDATES
Date:	Wednesday, August 25, 2021 3:04:00 PM
Attachments:	image001.png
Importance:	High

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Monday, August 23, 2021 4:03 PM
Subject: IMPORTANT: Bishop Creek and Lee Vining Hydro Projects Relicensing UPDATES
Importance: High

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Dear Stakeholders for the Bishop Creek and Lee Vining Hydro Relicensing Projects:

I am writing with an update on upcoming meetings for both projects.
The COVID-19 pandemic continues to keep us on our toes and require flexibility as the situation remains in flux. SCE takes the health and safety of our stakeholders, staff, and meeting participants very seriously. We believe that the Lee Vining Site Visit can be safely carried out as planned because it is outside and physically distancing along with other safeguards can be implemented. On the other hand, the Bishop Creek Effects Meeting, originally planned inside in much closer quarters would be best to move to a virtual platform. More information can be found about each meeting below:

Lee Vining Hydro Project site Visit

At this time, because this site visit is primarily outside, SCE believes that this in-person meeting can move forward as planned on September 28 ,2021. We will follow Centers for Disease Control (CDC) guidance, including masks and social distancing at each stop. Attendees are expected to provide their own transportation and we will caravan to each project feature. We will meet at Gus Hess Community Park at 9am. Please dress for the weather, bring a lunch, water and a mask. SCE will provide handouts at the park, including maps, project description and you can download them in advance from the project licensing website: www.sce.com/leevining. Please RSVP to the meeting, either by replying to this email or accepting the calendar invite that has been sent to you, we would like to have a head count in advance to help plan for the day. Should conditions or policies change, SCE reserves the option to host the site visit virtually and will communicate appropriately if that time comes. Likewise, if your work-place policies or situation changes, please let us know and we can plan accordingly.

Bishop Hydro Project

Due to rising concerns surrounding COVID and indoor-meetings setting, the Effects Meeting that was scheduled for September 30th inside a meeting room at the Bishop County Fairgrounds is being moved to a virtual forum to be held later in October. SCE believes that this is not only the safest

option at this time but we are also confident we can accomplish meaningful discussions in an online platform as we have been doing. The goal of this meeting is to inform stakeholders of the progress made on the study plans to date and begin to discuss potential project effects in preparation for the Draft License Application, which will be filed in early 2022. The meeting is being planned for two 4-hour time slots (9am-1pm or 1pm-5pm PST) , spread over two days in October. Please provide your availability for this meeting at THIS LINK by no later than Monday, August 30th so we can send out a revised invite to participants. An agenda, the Bishop Creek Potential Effects Report and other meeting materials will be sent prior to the meeting.

Thank you for your flexibility on this matter and continued support of the SCE relicensing efforts. Please do not hesitate to contact me with any questions.
Sincerely,

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From:	Carissa Shoemaker
To:	Paul Rose
Cc:	Paul Rose; Shannon Luoma
Subject:	RE: Lee Vining In-Person Site Visit- ACCEPT
Date:	Wednesday, August 25, 2021 2:58:00 PM
Attachments:	image001.png

Hi Paul,

Thanks for your response! Yes it will be a "guided" site visit. You'll follow a caravan of cars around and at each stop (e.g., each project feature like a dam or the powerhouse etc.) we will all get out and talk about what you're seeing. It's all one group though, we are meeting at 9:00 at the Gus Hess Park and driving the project area together.
This email is fine for RSVP, I'll mark you as attending with your +1.

Thanks Paul.

Carissa Shoemaker

I am currently working Mon & Tues; off Weds, Thurs, & Fri. This schedule will change in September.

ERM
M 907 575 0294

From: Paul Rose <paulew7777@earthlink.net>
Sent: Sunday, August 22, 2021 4:29 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Paul Rose <paulr4shopping@verizon.net>
Subject: Re: Lee Vining In-Person Site Visit- ACCEPT

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I plan to attend this site visit. There will be myself and one other person.

Is this a "tour" type visit? Or will we just be wandering around?
Also, if there will be a tour guide, will there be specific times that tours start?

On the SCE website section about this project, it says to contact Matthew.Woodhall@sce to confirm attendance. Will this email to you suffice?

Thank you and be well!

Paul

> On Aug 20, 2021, at 11:19 AM, Carissa Shoemaker <Carissa.Shoemaker@erm.com> wrote:

Hello Lee Vining Relicensing Participants,

This is the **real** invitation for our Lee Vining facility in-person site visit. Details are included below and are also posted on the Project's website:https://www.sce.com/regulatory/hydro-licensing/leevining

> SCE invites all interested parties to participate in the site visit, which will occur on September 28, 2021, starting at 9:00 a.m. and ending at or about 4:00 p.m. All participants should meet at the Gus Hess Community Park located at 129 Mattly Avenue, Lee Vining, California. Participants are responsible for their own transportation as well as food, water, and other supplies including appropriate outdoor clothing and footwear.

Please "Accept" this invitation if you plan to attend and let me know if you have questions.

Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Boulevard, Suite C-220
Ontario, CA 91764
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

Via e-mail

September 13, 2021

Kimberly D. Bose, Secretary
Nathaniel J. Davis, Sr., Deputy Secretary
Federal Energy Regulatory Commission
825 First Street, NE
Washington, DC 20426

Subject: Comments on the Lee Vining Hydroelectric Project FERC Relicensing Process (FERC Project # 1388)

Dear Secretary Bose,

Thank you for giving the California Department of Fish and Wildlife (CDFW) the opportunity to comment on Southern California Edison's (SCE) proposal to use the Traditional Licensing Process (TLP) for the Lee Vining Hydroelectric Federal Energy Regulatory Commission (FERC) Relicensing Project (FERC Project No. 1388) (Project). CDFW submitted a letter to FERC's e-Library repository and to the Licensing party members on July 21, 2021, regarding SCE's intent to use the TLP process and a request for comments and questions. CDFW is providing this subsequent letter to provide specific examples of CDFW's rational for supporting the Integrated Licensing Process (ILP) over the TLP.

AUTHORITIES

CDFW is the relevant State fish and wildlife agency for resource consultation pursuant to the Federal Power Act Section 10(j) (16U.S.C. section 803(j)). The fish and wildlife resources of the State of California are held in trust for the people of the State by and through CDFW (Fish and G. Code § 711.7). CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species (Fish and G. Code § 1802). The mission of CDFW is to manage California's diverse fish, wildlife, and plant resources, and the habitats on which they depend, for their ecological values and for their use and enjoyment by the public.

COMMENTS AND RECOMMENDATIONS

CDFW believes the ILP will be a more effective process for the Lee Vining Hydroelectric FERC Relicensing for the following reasons:

- **Complexity of the resource issues and level of anticipated controversy:** CDFW drafted and submitted to SCE several Study Plans relating to reservoir

and stream fish populations and wildlife resources in the Project area that may be impacted by the proposed Project operations. CDFW proposed Study Plans to assess potential impacts from Project operations on two state listed endangered species, the Yosemite toad (*Anaxyrus canorus*) and the willow flycatcher (*Empidonax traillii*). The ILP provides the appropriate platform for CDFW to provide SCE with species specific feedback and expertise on what studies may be required and how such studies should be implemented. Specifically, through the ILP, CDFW can ensure that studies are gathering the needed information and that data gathered is analyzed in a way that informs next steps.

In addition, the level of public, agency, stake holder and tribal controversy in the Mono Basin is high. CDFW anticipates a high level of public, agency, stake holder and tribal participation in the Lee Vining FERC relicensing process that would be best served by the ILP. Complex water rights issues and Settlement Agreements have been trying to direct activities in the Mono Basin for over 30 years, some of which require restoration of Mono Basin streams and restoration of Mono Lake levels. Several legal decisions and agreements have been issued for the Mono Basin since the issuance of the original FERC license in 1939:

- 1994 State Water Resources Control Board (SWRCB) decision 1631 included flows for channel maintenance.
- 1997 Settlement Agreement presented to SWRCB. The Settlement Agreement specifically called out the need for the City of Los Angeles, Department of Water and Power (LADWP) to coordinate with SCE to maximize the legally required 'Channel Maintenance Flows': '*DWP will in all years attempt to maximize Channel Maintenance Flows (CMFs) through coordination with Southern California Edison ("SCE"), and may include encouraging SCE to coordinate their spills and releases at the same time Grant Lake is spilling; granting SCE waivers, as appropriate, from the 5 % storage rule; developing annual operating plans only after consultation with SCE; encouraging SCE to spill Tioga at the same time that Lee Vining Creek flows are peaking*.'
- 1998 SWRCB ordered the implementation of stream and waterfowl habitat restoration measures in the Mono Basin (Orders 98-05 and 98-07).

These complex challenges unique to the Mono Basin need to be considered when evaluating Project operations and resulting impacts. The availability of sufficient water for restorative flows required by the Settlement Agreement may be affected by SCE's Project operations upstream. These complex issues need to be studied and evaluated to ensure collaboration of all involved parties and achieving the goal of restoring and maintaining the Mono Basin streams, Mono Lake and associated aquatic and wildlife habitats and ecosystems.

- **The amount of available information and potential for significant disputes**: During the Pre-Application Document (PAD) consultation, local, state, and federal agencies, interested stakeholders and local tribes identified additional information that may be needed on the existing environment in the Project area. CDFW believes there are several unresolved topics, including the extent of the FERC Project boundary, sharing, and accessing information between all parties and accessing the SCE Operations model, that would be more appropriately addressed in the ILP.

- **Likelihood of timely license issuance**: The more structured and predictable ILP, with clearly specified timelines over the course of the licensing process, will provide CDFW with a better platform to manage and prioritize its workload and complete reviews and comments letters in a timely manner.

- **Other factors believed by the applicant to be pertinent**: CDFW participated in and supported the development and adoption of the ILP and believes the ILP provides for more effective and efficient collaboration between stakeholders, and thus ultimately results in better protection of CDFW trust resources.

CONCLUSION

The purpose of the ILP is to provide an efficient and timely licensing process that ensures appropriate resource protections through better coordination with interested federal and state agencies and tribes. 18 CFR, Ch 1B, §5.1(f) provides that the ILP is the default process unless the applicant receives authorization to use the traditional process.

Due to the presence of state listed species in the Project area, the high level of public, agency, stakeholder, and tribal controversy in the Mono Basin and due to the need to integrate complex water rights and Settlement Agreements into the relicensing process, CDFW believes the default ILP process is better designed to achieve the stated goals of better coordination of agencies and tribes, while also providing an efficient and timely licensing process.

CDFW looks forward to further discussion and coordination with the Lee Vining FERC Relicensing Technical Working Group members.

If you have any question pertaining to this letter, please contact Alyssa Marquez, at (760) 567-0332 or Alyssa.Marquez@Wildlife.ca.gov

Sincerely,

DocuSigned by:
Alisa Ellsworth
84FBB8273E4C480...

Alisa Ellsworth
Environmental Program Manager

ec: California Department of Fish and Wildlife
Patricia Moyer, Patricia.Moyer@Wildlife.ca.gov
Alyssa Marquez, Alyssa.Marquez@Wildlife.ca.gov
Nick Buckmaster, Nick.Buckmaster@Wildlife.ca.gov

California Sportfishing Protection Alliance
Chris Shutes, blancapaloma@msn.com

United States Department of Agriculture, Forest Service
Sheila Irons, Sheila.irons@usda.gov

United States Fish and Wildlife Service
Chad Mellison, Chad_Mellison@fws.gov

Mono Lake Committee
Bartshe Miller, bartshe@monolake.org

State Water Resources Control Board
Chase Hildeburn, chase.hildeburn@waterboards.ca.gov

Southern California Edison
Matthew Woodhall, Matthew.Woodhall@sce.com

Los Angeles Department of Water and Power
Jorat Saeed. Saeed.Jorat@ladwp.com

Lahontan Regional Water Quality Control Board
Ed Hancock, Ed.hancock@waterboards.ca.gov

Carissa Shoemaker

From: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Sent: Wednesday, September 15, 2021 4:49 AM
To: Matthew Woodhall
Cc: Timothy Konnert; Finlay Anderson; Shannon Luoma; Carissa Shoemaker
Subject: RE: (External):Re: Lee Vining Process Plan and Schedule / Date for JAM

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Hi Matt,

Apologies for the delayed response; I was out of the office through Monday and am still catching up. Our current COVID-related travel restrictions are still in place, so any alternate arrangements, such as the information packet or virtual meeting platform that you mentioned, would be appreciated.

As far as Bishop Creek goes, I'm planning on being out of the office on extended leave from October 22-December 2nd for a vacation (that was planned/booked pre-pandemic!) and barring any last-minute travel restrictions/lockdowns is still a "go." I will work out coverage for myself for the meeting, either with other project team members, or with another terrestrial biologist who will stand in for me in the meeting.

Thanks,
Kelly

Kelly A. Wolcott
Environmental Biologist
Division of Hydropower Licensing
West Branch
Federal Energy Regulatory Commission
(202) 502-6480

In the interest of minimizing paper waste, please consider the environment before printing this email.

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, September 10, 2021 2:41 PM
To: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Cc: Timothy Konnert <Timothy.Konnert@ferc.gov>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: (External):Re: Lee Vining Process Plan and Schedule / Date for JAM

Hi Kelly,

It has been awhile since we corresponded on the site visit for Lee Vining but just wanted to check back in to see if the current Covid-19 protocols at FERC would allow you to participate in person on the 28th? If not, we are working on an informational packet that we can provide to those that cannot attend and we may even hold a virtual meeting to review that content if warranted or desired by those who missed the in person meeting. We would love to see you guys in person, if possible!

Also, a quick availability question related to our Bishop Creek USR meeting (virtual) that we are planning for Nov. 18th. We just want to make sure you have availability on that date before we lock it in?

Thank you!

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Sent: Friday, June 11, 2021 11:47 AM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Cc: Matthew Woodhall <Matthew.Woodhall@sce.com>; Timothy Konnert <Timothy.Konnert@ferc.gov>
Subject: (External):Re: Lee Vining Process Plan and Schedule / Date for JAM

***** EXTERNAL EMAIL - Use caution when opening links or attachments *****

Hi Finlay!

Of course! Our ability to attend would be dependent on our COVID-19 protocols, but at this point, it looks unlikely that we would be able to go.

Happy Friday and have a great weekend!

Cheers,
Kelly

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Friday, June 11, 2021 2:34 PM
To: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Cc: Matthew Woodhall <matthew.woodhall@sce.com>
Subject: RE: Lee Vining Process Plan and Schedule / Date for JAM

Thanks for the response. Would FERC be interested in Joining the site visit? We are planning for September 28. That way if for some reason the process becomes ILP, you've at least seen it.

The Virtual JAM would be (likely) November 16.

Have a great weekend1

From: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Sent: Thursday, June 10, 2021 8:29 AM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>

Cc: Matthew Woodhall <matthew.woodhall@sce.com>
Subject: RE: Lee Vining Process Plan and Schedule / Date for JAM

Hi Finlay,

Apologies for the delayed response on closing the loop on this; I was out unexpectedly for part of the week. I just talked to Tim regarding your latest email and this approach seems reasonable to both of us. Good idea!

Thanks,
Kelly

Kelly A. Wolcott
Environmental Biologist
Division of Hydropower Licensing
West Branch
Federal Energy Regulatory Commission
(202) 502-6480
In the interest of minimizing paper waste, please consider the environment before printing this email.

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Thursday, June 10, 2021 11:15 AM
To: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Cc: Matthew Woodhall <matthew.woodhall@sce.com>
Subject: RE: Lee Vining Process Plan and Schedule / Date for JAM

Hi Kelly – following up on this with an idea: the key goal here is site visit before the snow flies. What if SCE offers a site visit the week of September 27, but plans a virtual Joint Agency Meeting (per 18CFR 16.8). The virtual meeting could be planned to be consistent with the regs as far as giving FERC time to make its decision around the use of the TLP (so, mid-October). We would still Notice the Site Visit as well as the JAM but clarify that they are on different time frames. The virtual JAM might be better anyway from a COVID perspective.

Thoughts?

From: Finlay Anderson
Sent: Friday, June 4, 2021 7:25 AM
To: Kelly Wolcott <Kelly.Wolcott@ferc.gov>
Cc: Matthew Woodhall <matthew.woodhall@sce.com>
Subject: Lee Vining Process Plan and Schedule / Date for JAM

Hi Kelly --

As we are preparing the Lee Vining PAD and NOI on August 3, we are trying to secure meeting location and venue for a possible Joint Agency Meeting the week of September 27. This presumes that FERC would rule on a TLP request shortly after the closure of a comment period in early September. We are trying to accelerate this because a site visit is most feasible before October. After this time, the project may be less accessible because of snow.

Is it reasonable to assume FERC would be able to approve the TLP in that timeframe? Agencies will be on board and no stakeholder (NGO, Tribe or otherwise) has objected to the proposal for the use of the TLP in any of our discussions to date.

We also make the following statement *"SCE proposes to hold the JAM at the Lee Vining Community Center during the week of September 27, 2021. The date and location of the meeting may be altered after consultation with jurisdictional agencies and other licensing participants and pending FERC's decision regarding SCE's request to utilize the TLP. If the request is denied and SCE begins the ILP, FERC will hold a scoping meeting in accordance with CFR § 5.8 within a similar timeframe*". I wanted to make sure that is a reasonable statement to make, recognizing you may need to make your own determination of best dates.

Thanks for any suggestions you have.

FMA

Finlay Anderson
Sr. Regulatory Advisor
Kleinschmidt
O: 503.345.0517 C: 503.329.3586
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From:	Carissa Shoemaker
To:	sb@snowhydrology.com; Paul Rose; claire@monolake.org; greg@monolake.org; James.Erdman@wildlife.ca.gov; katie@accessfund.org; Lawson.reif@usda.gov; Saeed.Jorat@ladwp.com; Jacqueline.beidl@usda.gov; Monty Bengochia; geoff@monolake.org; bartshe@monolake.org; monique.sanchez@usda.gov; alyssa.marquez@wildlife.ca.gov; ed.hancock@waterboards.ca.gov; Nick.Buckmaster@wildlife.ca.gov; Patricia.Moyer@Wildlife.ca.gov; Rose.Banks@wildlife.ca.gov; shawna_theisen@fws.gov; ashley.blythehaverstock@usda.gov; tristan.leong@usda.gov; falconkeeper22@gmail.com; Paul.Pau@ladwp.com; jennifer.watts@waterboards.ca.gov; jjthompson@timbisha.com; lilian_jonas@contractor.nps.gov; pmcfarland395@gmail.com; Erin.Moore@usda.gov; triplepointh2o@gmail.com; Richard.McNeill@usda.gov; jbethel@northforkrancheria-nsn.gov
Cc:	Finlay Anderson; Shannon Luoma; Matthew Woodhall; Kelly.Larimer@KleinschmidtGroup.com; Audry Williams; Shelly Davis-King; Matthew Harper; Allison Rudalevige; steve.norton@psomas.com; bblood@psomas.com; Heather Bowen Neff; seth.carr@sce.com; marshmistress@msn.com; acohen@stillwatersci.com; jmharty@kearnswest.com; Terra Alpaugh; martin.ostendorf@sce.com
Subject:	Lee Vining site visit - Tuesday
Date:	Friday, September 24, 2021 1:50:00 PM
Attachments:	image001.png

Hello Lee Vining relicensing site visit attendees!

We are all looking forward to meeting you in-person next week. You may find it helpful to review project information on the SCE Lee Vining website before the visit. We will have a few handouts to pass around in the morning (i.e., Agenda, Map Book, Site Visit Booklet).

Also we want everyone to be aware that we will all be following the Center for Disease Control (CDC) current guidelines for COVID-19. Please see the current COVID-19 guidelines for social distancing and masking here.

Some reminders:

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- Participants are responsible for their own transportation as well as food, water, and other supplies including appropriate outdoor clothing and footwear.
- We will stop for lunch (bring your own) around 12:00 at one of the campgrounds.
- There will be limited walking, but at least one site will be up to a 0.25-mile away from vehicle parking.

Let me know if you have any questions.
Thanks all, see you Tuesday!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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M 907 575 0294

E carissa.shoemaker@erm.com | **W** www.erm.com

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From: Matthew Woodhall
To: Jonas, Lilian M
Cc: Finlay Anderson; Shannon Luoma; Carissa Shoemaker
Subject: RE: (External):Re: [EXTERNAL] RE: (External):Re: Lee Vining Hydroelectric Project (P-1388) site visit
Date: Friday, September 24, 2021 8:36:13 AM
Attachments: image001.png

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Great, look forward to meeting you on Tuesday. We will add your email to all future meeting invites and correspondences moving forward.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From: Jonas, Lilian M <lilian_jonas@contractor.nps.gov>
Sent: Friday, September 24, 2021 8:07 AM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: (External):Re: [EXTERNAL] RE: (External):Re: Lee Vining Hydroelectric Project (P-1388) site visit

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Thank you Matthew,

I plan to attend and represent the National Park Service in the licensing process, at least in the short term. Steve Bowes from the NPS's San Francisco office was planning to be involved, but he is relocating to another office, and I will take his place until the NPS backfills his position.

Lil Jonas
Lilian Jonas, PhD
Jonas Consulting
PO Box 915
Red Bluff, California 96080
541-441-5045

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, September 24, 2021 8:02 AM
To: Jonas, Lilian M <lilian_jonas@contractor.nps.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: [EXTERNAL] RE: (External):Re: Lee Vining Hydroelectric Project (P-1388) site visit

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Hi Lilian,
My apologies, I passed your email off to the relicensing team leads in planning this visit but didn't catch within your message a need for a specific response. The site visit is occurring next Tuesday and is open to anyone who wants to attend. We are meeting in Lee Vining at Gus Hess Community Park at 9:00 am.
I will forward you the official calendar invite which has additional info but if you have any further questions please let us know.
Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From: Jonas, Lilian M <lilian_jonas@contractor.nps.gov>
Sent: Friday, September 24, 2021 7:44 AM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: (External):Re: Lee Vining Hydroelectric Project (P-1388) site visit

***** EXTERNAL EMAIL - Use caution when opening links or attachments *****

Hello Matthew,
I sent you an email earlier this week expressing my interest in attending the Lee Vining Hydroelectric Project's site visit next week, but I did not receive a confirmation that you received my email or that the site visit is still scheduled. Please let me know if you did receive my email.
Thank you,
Lil Jonas
Lilian Jonas, PhD
Jonas Consulting
PO Box 915
Red Bluff, California 96080
541-441-5045

From: Jonas, Lilian M
Sent: Monday, September 20, 2021 5:21 PM
To: Matthew.Woodhall@sce.com <Matthew.Woodhall@sce.com>
Subject: Lee Vining Hydroelectric Project (P-1388) site visit

Hello Matthew,
I am interested in attending the in-person site visit for the Lee Vining Hydroelectric Project (P-1388) scheduled to be held on September 28, 2021, from 9:00 am-4:00 pm. I am a private contractor working with the National Park Service's (NPS's) Hydropower Assistance Program and will be representing the NPS during the FERC licensing process.

Thank you,
Lil Jonas

Lilian Jonas, PhD
Jonas Consulting
PO Box 915
Red Bluff, California 96080
541-441-5045

From: Moyer, Patricia (Trisha)@Wildlife
To: Carissa Shoemaker
Subject: RE: Lee Vining site visit - Tuesday
Date: Friday, September 24, 2021 1:56:14 PM
Attachments: image002.jpg
image003.png

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Hi Carissa,
I have to be back in Bishop at 1 pm, which means I have to leave LeeVining around 11:30. I believe I'd only be able to attend for a short hour or so, and not sure about logistics. What are your thoughts?
Trisha A. Moyer
CDFW- Desert Inland Region 6
Habitat Conservation Program Supervisor
787 North Main Street Suite 220
Bishop, CA 93514
(760) 835-4304

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, September 24, 2021 1:51 PM
To: sb@snowhydrology.com; Paul Rose <paulr4shopping@verizon.net>; claire@monolake.org; greg@monolake.org; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; katie@accessfund.org; Lawson.reif@usda.gov; Saeed.Jorat@ladwp.com; Jacqueline.beidl@usda.gov; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; geoff@monolake.org; bartshe@monolake.org; monique.sanchez@usda.gov; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Hancock, Ed@Waterboards <Ed.Hancock@waterboards.ca.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; shawna_theisen@fws.gov; ashley.blythehaverstock@usda.gov; tristan.leong@usda.gov; falconkeeper22@gmail.com; Paul.Pau@ladwp.com; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; jjthompson@timbisha.com; lilian_jonas@contractor.nps.gov;

pmcfarland395@gmail.com; Erin.Moore@usda.gov; triplepointh2o@gmail.com; Richard.McNeill@usda.gov; jbethel@northforkrancheria-nsn.gov
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Kelly.Larimer@KleinschmidtGroup.com; Audry Williams <Audry.Williams@sce.com>; Shelly Davis-King <shellydk@frontiernet.net>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; steve.norton@psomas.com; bblood@psomas.com; Heather Bowen Neff <heather@stillwatersci.com>; seth.carr@sce.com; marshmistress@msn.com; Adam Cohen <acohen@stillwatersci.com>; jmharty@kearnswest.com; Terra Alpaugh <talpaugh@kearnswest.com>; martin.ostendorf@sce.com
Subject: Lee Vining site visit - Tuesday

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Hello Lee Vining relicensing site visit attendees!

We are all looking forward to meeting you in-person next week. You may find it helpful to review project information on the SCE Lee Vining website before the visit. We will have a few handouts to pass around in the morning (i.e., Agenda, Map Book, Site Visit Booklet).

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Some reminders:

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- We will stop for lunch (bring your own) around 12:00 at one of the campgrounds.
- There will be limited walking, but at least one site will be up to a 0.25-mile away from vehicle parking.

Let me know if you have any questions.

Thanks all, see you Tuesday!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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E carissa.shoemaker@erm.com | **W** www.erm.com

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From:	Carissa Shoemaker
To:	Reif, Lawson -FS
Cc:	Barnett, Adam -FS; Finlay Anderson; Shannon Luoma
Subject:	Re: [External Email]Lee Vining site visit - Tuesday
Date:	Sunday, September 26, 2021 3:57:18 PM
Attachments:	image002.png image003.png image004.png image005.png image006.png

Oh no! Hope you are okay. We appreciate you taking precautions. Thanks for letting us know.

Carissa

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From: Reif, Lawson -FS <lawson.reif@usda.gov>
Sent: Sunday, September 26, 2021 12:20:38 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Barnett, Adam -FS <adam.barnett@usda.gov>
Subject: RE: [External Email]Lee Vining site visit - Tuesday

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Carissa, unfortunately I got COVID and the 28th/29th is 10 days after symptoms began. Medical professionals say I wouldn't be contagious after that date but the fact it is so close to that 10 day mark gives me a bit of pause. I think, due to all this, I am going to sit this one out. Sorry about this and I can follow up if you need anything from me
THANKS

Lawson Reif
Recreation Management Specialist
Forest Service
Inyo National Forest - Mammoth & Mono Lake
Ranger Districts
p: 760-914-1933
lawson.reif@usda.gov
2510 Highway 203, PO Box 148
Mammoth Lakes, CA 93546
www.fs.fed.us

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From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, September 24, 2021 1:51 PM
To: sb@snowhydrology.com; Paul Rose <paulr4shopping@verizon.net>; claire@monolake.org; greg@monolake.org; James.Erdman@wildlife.ca.gov; katie@accessfund.org; Reif, Lawson -FS <lawson.reif@usda.gov>; Saeed.Jorat@ladwp.com; Beidl, Jacqueline -FS <jacqueline.beidl@usda.gov>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; geoff@monolake.org; bartshe@monolake.org; Sanchez, Monique - FS <monique.sanchez@usda.gov>; alyssa.marquez@wildlife.ca.gov; ed.hancock@waterboards.ca.gov; Nick.Buckmaster@wildlife.ca.gov; Patricia.Moyer@Wildlife.ca.gov; Rose.Banks@wildlife.ca.gov; shawna_theisen@fws.gov; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; Leong, Tristan -FS <tristan.leong@usda.gov>; falconkeeper22@gmail.com; Paul.Pau@ladwp.com; jennifer.watts@waterboards.ca.gov; jjthompson@timbisha.com; lilian_jonas@contractor.nps.gov; pmcfarland395@gmail.com; Moore, Erin - FS, BISHOP, CA <Erin.Moore@usda.gov>; triplepointh2o@gmail.com; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; jbethel@northforkrancheria-nsn.gov
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Kelly.Larimer@KleinschmidtGroup.com; Audry Williams <Audry.Williams@sce.com>; Shelly Davis-King <shellydk@frontiernet.net>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; steve.norton@psomas.com; bblood@psomas.com; Heather Bowen Neff <heather@stillwatersci.com>; seth.carr@sce.com; marshmistress@msn.com; Adam Cohen <acohen@stillwatersci.com>; jmharty@kearnswest.com; Terra Alpaugh <talpaugh@kearnswest.com>; martin.ostendorf@sce.com
Subject: [External Email]Lee Vining site visit - Tuesday

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Let me know if you have any questions.
Thanks all, see you Tuesday!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

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M 907 575 0294
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A-08_Weather update for Sept 2021 site visit

From: Carissa Shoemaker
To: Sue Burak
Subject: Re: Lee Vining site visit - Tuesday
Date: Sunday, September 26, 2021 3:49:17 PM
Attachments: image001.png

Thank you, Sue!

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From: Sue Burak <triplepointh2o@gmail.com>
Sent: Sunday, September 26, 2021 11:51:46 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Paul Rose <paulr4shopping@verizon.net>; claire@monolake.org <claire@monolake.org>; greg@monolake.org <greg@monolake.org>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; katie@accessfund.org <katie@accessfund.org>; Lawson.reif@usda.gov <Lawson.reif@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; Jacqueline.beidl@usda.gov <Jacqueline.beidl@usda.gov>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; geoff@monolake.org <geoff@monolake.org>; bartshe@monolake.org <bartshe@monolake.org>; monique.sanchez@usda.gov <monique.sanchez@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; Patricia.Moyer@Wildlife.ca.gov <Patricia.Moyer@wildlife.ca.gov>; Rose.Banks@wildlife.ca.gov <Rose.Banks@wildlife.ca.gov>; shawna_theisen@fws.gov <shawna_theisen@fws.gov>; ashley.blythehaverstock@usda.gov <ashley.blythehaverstock@usda.gov>; tristan.leong@usda.gov <tristan.leong@usda.gov>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; jennifer.watts@waterboards.ca.gov <jennifer.watts@waterboards.ca.gov>; jjthompson@timbisha.com <jjthompson@timbisha.com>; lilian_jonas@contractor.nps.gov <lilian_jonas@contractor.nps.gov>; pmcfarland395@gmail.com <pmcfarland395@gmail.com>; Erin.Moore@usda.gov <Erin.Moore@usda.gov>; Richard.McNeill@usda.gov <Richard.McNeill@usda.gov>; jbethel@northforkrancheria-nsn.gov <jbethel@northforkrancheria-nsn.gov>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Kelly.Larimer@KleinschmidtGroup.com <Kelly.Larimer@kleinschmidtgroup.com>; Audry Williams <Audry.Williams@sce.com>; Shelly Davis-King <shellydk@frontiernet.net>; Matthew Harper <Matthew.Harper@kleinschmidtgroup.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; steve.norton@psomas.com <steve.norton@psomas.com>; bblood@psomas.com <bblood@psomas.com>; Heather Bowen Neff <heather@stillwatersci.com>; seth.carr@sce.com <seth.carr@sce.com>; marshmistress@msn.com <marshmistress@msn.com>; Adam Cohen <acohen@stillwatersci.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>; Terra Alpaugh <talpaugh@kearnswest.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>
Subject: Re: Lee Vining site visit - Tuesday

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Hi all,
Just a reminder that Tuesday's temperatures at Saddlebag and Ellery Lk will be in the upper 40's accompanied by strong southwest winds of 30 mph, gusting to 45 mph. Come prepared for a Sept blast of winter.
Best,
Sue

On Fri, Sep 24, 2021 at 1:50 PM Carissa Shoemaker <Carissa.Shoemaker@erm.com> wrote:

> Hello Lee Vining relicensing site visit attendees!
>
> We are all looking forward to meeting you in-person next week. You may find it helpful to review project information on the SCE Lee Vining website before the visit. We will have a few handouts to pass around in the morning (i.e., Agenda, Map Book, Site Visit Booklet).
>
> Also we want everyone to be aware that we will all be following the Center for Disease Control (CDC) current guidelines for COVID-19. Please see the current COVID-19 guidelines for social distancing and masking here.
>
> Some reminders:
>
> - We are meeting at the Gus Hess Community Park (129 Mattly Ave, Lee Vining, CA) at 9:00am Tuesday Sept 28 and will depart shortly after to the project, with the tour beginning up north at Saddlebag Lake.
> - Participants are responsible for their own transportation as well as food, water, and other supplies including appropriate outdoor clothing and footwear.
> - We will stop for lunch (bring your own) around 12:00 at one of the campgrounds.
> - There will be limited walking, but at least one site will be up to a 0.25-mile away from vehicle parking.
>
> Let me know if you have any questions.
>
> Thanks all, see you Tuesday!
>
> Carissa Shoemaker
>
> *Senior Project Scientist*

Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM

1050 SW 6th Ave, Suite 1650 | Portland, OR 97204

M 907 575 0294

E carissa.shoemaker@erm.com | **W** www.erm.com

The business of sustainability

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A-09_Discussion re air quality for Sept 2021 site visit

From: Finlay Anderson
To: Carissa Shoemaker; kary.schlick@usda.gov
Cc: Shannon Luoma
Subject: Re: [External Email]Lee Vining In-Person Site Visit
Date: Monday, September 27, 2021 5:30:21 PM
Attachments: image001.png
image002.png
image003.png
image004.png

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Hi Kary-

We are meeting with the team to discuss tomorrow at 6:00. If the decision is made to cancel I will let you know ASAP. If you get me a mobile number I could call that?

I expect that under most conditions we will proceed- there will be limited exertion and even the 1/4 mile we had planned to walk to the toad habitat could be skipped.

Sent from my iPhone

> On Sep 27, 2021, at 5:18 PM, Carissa Shoemaker <Carissa.Shoemaker@erm.com> wrote:
>
> Air quality question below
> Carissa Shoemaker
>
> *I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.*
>
> **ERM**
> **M** 907 575 0294
> -----Original Appointment-----
> **From:** Schlick, Kary -FS <kary.schlick@usda.gov>
> **Sent:** Monday, September 27, 2021 10:05 AM
> **To:** Carissa Shoemaker
> **Cc:** Irons, Sheila -FS
> **Subject:** Tentative: [External Email]Lee Vining In-Person Site Visit
> **When:** Tuesday, September 28, 2021 9:00 AM-4:00 PM (UTC-08:00) Pacific Time (US & Canada).
> **Where:** Meet at Gus Hess Community Park, Lee Vining, CA
>
> **WARNING:** The sender of this email could not be validated and may not match the person in the "From" field.
>
> **CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.
>
> Will this be cancelled if the smoke and air quality continue to increase? I will attend on behalf of Thomas Torres wildlife biologist who is on leave. Please let me know ASAP as I have a doctors appt that I will need to reschedule tomorrow. Thank You
>
> <image001.png> **Kary Schlick**

Fish & Wildlife Biologist

Forest Service

Inyo National Forest

p: 707-845-3444
c: 707-845-3444
kary.schlick@usda.gov

351 Pacu Lane
bishop, CA 93514
www.fs.fed.us
<image002.png>
<image003.png>
<image004.png>

Caring for the land and serving people

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<image001.png>
<image002.png>
<image003.png>
<image004.png>

A-10.1_Meeting invitation for Sept 2021 site visit

From: Carissa Shoemaker
To: Adam_Cohen; adam.barnett@usda.gov; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; alyssa.marquez@wildlife.ca.gov; apcohen@umail.ucsb.edu; ARoesberry@caltrout.org; Audry.Williams@sce.com; bartshe@monolake.org; bbell@co.tuolumne.ca.us; bblood@psomas.com; bburman@usbr.gov; blake.engelhardt@usda.gov; Brandy.Wood@Wildlife.ca.gov; bryan.hatchell@colorado.edu; calweb@tnc.org; cdaly@mackaysposito.com; Chad_Mellison@fws.gov; chair@toiyabe.sierraclub.org; Chase.Hildeburn@Waterboards.ca.gov; cknight@caltrout.org; claire@monolake.org; comdev@mono.ca.gov; conservation@bristleconecnps.org; cshutes@calsport.org; curator@monobasinhistory.org; daniel.sussman@waterboards.ca.gov; daniel.yarborough@usda.gov; dawn.alvarez@usda.gov; dfjohnso@blm.gov; easternsierraartist@gmail.com; ed.hancock@waterboards.ca.gov; eric.tillemans@ladwp.com; eric@friendsoftheriver.org; events@mammothmuseum.org; fercaseadmin@sce.com; finlay.anderson@kleinschmidtgroup.com; FOMLR@bodiefoundation.org; frontierpacktrain@gmail.com; gardenofegan@suddenlink.net; geoff@monolake.org; ghaverst@blm.gov; gordon.martin@usda.gov; greg@monolake.org; GRoff@caltrout.org; heather@stillwatersci.com; holly@inyo-monowater.org; hydroesq@schat.net; info@friendsoftheinyo.org; info@monolake.org; info@rockcreekpackstation.com; Jacqueline.beidl@usda.gov; James.Erdman@wildlife.ca.gov; jennifer.watts@waterboards.ca.gov; jenny@sierranevadaalliance.org; jkrclr@gmail.com; jmharty@kearnswest.com; johnwentworth@mltpa.org; jonklusmire@yahoo.com; jora@friendsoftheinyo.org; jstrickland@tu.org; justin_barrett@fws.gov; kary.schlick@usda.gov; katie@accessfund.org; kelly.henderson@sce.com; Kelly.Larimer@KleinschmidtGroup.com; kquinlan16@gmail.com; Lawson.reif@usda.gov; lbergeron@pcta.org; lcompas@hrassoc.com; lisa@monolake.org; lprimosc@blm.gov; markbagley02@gmail.com; marshmistress@msn.com; martin.ostendorf@sce.com; maryroper51@gmail.com; matt.driscoll@sierranevada.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; matthew.woodhall@sce.com; megan.mullowney@usda.gov; monique.sanchez@usda.gov; mparuolo@mammothlakesrecreation.org; Mparuolo@mono.ca.gov; naomi@teambishop.com; nate@esavalanche.org; office@esavalanche.org; nathan.sill@usda.gov; Nick.Buckmaster@wildlife.ca.gov; nicolas.von@sce.com; nora.gamino@usda.gov; nosmog@yahoo.com; Patricia.Moyer@Wildlife.ca.gov; Paul.Pau@ladwp.com; paulR4shopping@verizon.net; pgunsolley@gmail.com; Philipana@aol.com; pmcfarland395@gmail.com; president@esaudubon.org; pstickells@gmail.com; rcollins@caltrout.org; robbie@monolake.org; Rose.Banks@wildlife.ca.gov; saddlebaglake@gmail.com; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; seth.carr@sce.com; Shannon.Luoma@KleinschmidtGroup.com; shawna_theisen@fws.gov; sheila.irons@usda.gov; ashley.blythehaverstock@usda.gov; shellydk@frontiernet.net; SJacobson@caltrout.org; stephen_bowes@nps.gov; steve.norton@psomas.com; steve.parmenter@wildlife.ca.gov; talpaugh@kearnswest.com; thomas.torres@usda.gov; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; todd.ellsworth@usda.gov; tristan.leong@usda.gov; victor.aguirreorozco@usda.gov; wendy@friendsoftheinyo.org; wsugimura@mono.ca.gov; Jameisha.Washington@usda.gov; Lyle Laven; Charles.partridge@sce.com; vince.white@sce.com
Cc: Jessica Strickland; Sellers, Andrea@Waterboards; falconkeeper22@gmail.com; Tilford Denver; Barbara Durham; Monty Bengochia; Christina McDonald; claymiwumati@gmail.com
Subject: Lee Vining In-Person Site Visit
Start: Tuesday, September 28, 2021 9:00:00 AM
End: Tuesday, September 28, 2021 4:00:00 PM
Location: Meet at Gus Hess Community Park, Lee Vining, CA
Attachments: image001.png

Hello Lee Vining Relicensing Participants,

This is the real invitation for our Lee Vining facility in-person site visit. Details are included below and are also posted on the Project's website: https://www.sce.com/regulatory/hydro-licensing/leevining

SCE invites all interested parties to participate in the site visit, which will occur on September 28, 2021, starting at 9:00 a.m. and ending at or about 4:00 p.m. All participants should meet at the Gus Hess Community Park located at 129 Mattly Avenue, Lee Vining, California. Participants are responsible for their own transportation as well as food, water, and other supplies including appropriate outdoor clothing and footwear.

Please "Accept" this invitation if you plan to attend and let me know if you have questions.

Thank you!

Carissa Shoemaker

Senior Project Scientist

Pronouns: she/her

I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM

1050 SW 6th Ave, Suite 1650 | Portland, OR 97204

M 907 575 0294

E carissa.shoemaker@erm.com <mailto:carissa.shoemaker@erm.com> | W www.erm.com <https://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7C8cf0de052c774d5632ab08d83257e8d8%7C2f2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637314700440303507&sdata=YyP%2BKemtIsdd4pWb%2F85kJCaUXjcucIVMn%2FZx06QnSZU%3D&reserved=0>

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Carissa Shoemaker

Subject: Lee Vining Site Visit - placeholder
Location: Lee Vining, CA

Start: Tue 9/28/2021 9:00 AM
End: Tue 9/28/2021 3:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Carissa Shoemaker
Required Attendees Adam Cohen; adam.barnett@usda.gov; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; alyssa.marquez@wildlife.ca.gov; apcohen@umail.ucsb.edu; ARoesberry@caltrout.org; Audry.Williams@sce.com; bartshe@monolake.org; bbell@co.tuolumne.ca.us; bblood@psomas.com; bburman@usbr.gov; blake.engelhardt@usda.gov; Brandy.Wood@Wildlife.ca.gov; bryan.hatchell@colorado.edu; calweb@tnc.org; cdaly@mackaysposito.com; Chad_Mellison@fws.gov; chair@toiyabe.sierraclub.org; Chase.Hildeburn@Waterboards.ca.gov; cknight@caltrout.org; claire@monolake.org; comdev@mono.ca.gov; conservation@bristleconecnps.org; cshutes@calsport.org; curator@monobasinhistory.org; daniel.sussman@waterboards.ca.gov; daniel.yarborough@usda.gov; dawn.alvarez@usda.gov; dfjohnso@blm.gov; easternsierraartist@gmail.com; ed.hancock@waterboards.ca.gov; eric.tillemans@ladwp.com; eric@friendsoftheriver.org; events@mammothmuseum.org; ferccaseadmin@sce.com; finlay.anderson@kleinschmidtgroup.com; FOMLR@bodiefoundation.org; frontierpacktrain@gmail.com; gardenofegan@suddenlink.net; geoff@monolake.org; ghaverst@blm.gov; gordon.martin@usda.gov; greg@monolake.org; GRoff@caltrout.org; heather@stillwatersci.com; holly@inyo-monowater.org; hydroesq@schat.net; info@friendsoftheinyo.org; info@monolake.org; info@rockcreekpackstation.com; Jacqueline.beidl@usda.gov; James.Erdman@wildlife.ca.gov; jennifer.watts@waterboards.ca.gov; jenny@sierranevadaalliance.org; jkrclr@gmail.com; jmharty@kearnswest.com; johnwentworth@mltpa.org; jonklusmire@yahoo.com; jora@friendsoftheinyo.org; jstrickland@tu.org; justin_barrett@fws.gov; kary.schlick@usda.gov; katie@accessfund.org; kelly.henderson@sce.com; Kelly.Larimer@KleinschmidtGroup.com; kquinlan16@gmail.com; Lawson.reif@usda.gov; lbergeron@pcta.org; lcompas@hrassoc.com; lisa@monolake.org; lprimosc@blm.gov; markbagley02@gmail.com; marshmistress@msn.com; martin.ostendorf@sce.com; maryroper51@gmail.com; matt.driscoll@sierranevada.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; matthew.woodhall@sce.com; megan.mullowney@usda.gov; monique.sanchez@usda.gov; mparuolo@mammothlakesrecreation.org; Mparuolo@mono.ca.gov; naomi@teambishop.com; nate@esavalanche.org; office@esavalanche.org; nathan.sill@usda.gov; Nick.Buckmaster@wildlife.ca.gov; nicolas.von@sce.com; nora.gamino@usda.gov; nosmog@yahoo.com; Patricia.Moyer@Wildlife.ca.gov; Paul.Pau@ladwp.com; paulR4shopping@verizon.net; pgunsolley@gmail.com; Philipana@aol.com; pmcfarland395@gmail.com; president@esaudubon.org; pstickells@gmail.com; rcollins@caltrout.org; robbie@monolake.org; Rose.Banks@wildlife.ca.gov; saddlebaglake@gmail.com; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; seth.carr@sce.com; Shannon.Luoma@KleinschmidtGroup.com; shawna_theisen@fws.gov; sheila.irons@usda.gov; ashley.blythehaverstock@usda.gov; shellydk@frontiernet.net; SJacobson@caltrout.org; stephen_bowes@nps.gov; steve.norton@psomas.com; steve.parmenter@wildlife.ca.gov; talpaugh@kearnswest.com; thomas.torres@usda.gov; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; todd.ellsworth@usda.gov; tristan.leong@usda.gov;

A-10.2_Meeting invitation placeholder for Sept 2021 site visit

Required Attendeesvictor.aguirreorozco@usda.gov; wendy@friendsoftheinyo.org; wsugimura@mono.ca.gov; 'Jameisha.Washington@usda.gov'; Lyle Laven; Charles.partridge@sce.com; vince.white@sce.com

Hello Lee Vining Relicensing Participants,

This is a placeholder for our Lee Vining facility site visit. Details will follow soon and will also be posted to the Project's website: https://www.sce.com/regulatory/hydro-licensing/leevining

Please let me know if you have questions.
Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

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1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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A-11.1_Sept 2021 site visit questionnaire response

From: Wufoo
To: Carissa Shoemaker
Subject: Lee Vining Site Visit Questionnaire [#8]
Date: Tuesday, October 12, 2021 6:54:44 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Name	rick mcneill
Orginization	Inyo NF
Title/Role	botanist
Email	ricahrd.mcneill@usda.gov
Did you attend the Lee Vining Hydroelectric Project Site Visit on September 28, 2021?	• Yes
After attending the workshop, what new questions or observations do you have about the project's operations or facilities?	I would like a central repository for all data collected, created, and studies conducted regarding plant operations and licensensing from SCE, BLM, USFS and any other agency or organization. Everytime I ask a question, it takes me 3 weeks and six emails to find out who is the correct person to ask and then it takes another week to get an answer. This doesn't mean that I get my question answered, just an answer.
Are you aware of resources, management plans or data that the relicensing team should review as part of the study plan development?	In the meeting, the consultant mentioned that some salmonids might be reproducing naturally in Lee Vining creek, but they are not going to include that in the study, just the effects of flow regulation on riparian zones. It seems like that might be an important thing to know when making decisions about management of a resource.

A-11.2_Sept 2021 site visit questionnaire response

From: Wufoo
To: Carissa Shoemaker
Subject: Lee Vining Site Visit Questionnaire [#9]
Date: Monday, November 1, 2021 12:41:23 AM

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Name	Greg Reis
Orginization	Mono Lake Committee
Title/Role	Information and Restoration Specialist
Email	greg@monolake.org
Did you attend the Lee Vining Hydroelectric Project Site Visit on September 28, 2021?	• Yes

After attending the workshop, what new questions or observations do you have about the project's operations or facilities?

Observation: At the LADWP diversion dam, I failed to mention the dry year operation where Lee Vining Creek water is diverted and released directly into Rush Creek to provide cooler water in Rush Creek below Grant Dam. I noted the diversion operation tends to dampen the effects of hydropeaking downstream on Lee Vining Creek, however I failed to mention that when this dry year operation occurs (when Grant Lake Reservoir is below 25,000 AF of storage July 1–Sep 30) the hydropeaking pattern is transferred to Rush Creek. Therefore the hydrologic analysis should include effects on both creeks below the LA Aqueduct.

Are you aware of resources, management plans or data that the relicensing team should review as part of the study plan development?	Yes, previously noted.

A-11.3_Sept 2021 site visit questionnaire response

From: Wufoo
To: Carissa Shoemaker
Subject: Lee Vining Site Visit Questionnaire [#9]
Date: Monday, November 1, 2021 12:41:23 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Name	Greg Reis
Orginization	Mono Lake Committee
Title/Role	Information and Restoration Specialist
Email	greg@monolake.org
Did you attend the Lee Vining Hydroelectric Project Site Visit on September 28, 2021?	• Yes

After attending the workshop, what new questions or observations do you have about the project's operations or facilities?

Observation: At the LADWP diversion dam, I failed to mention the dry year operation where Lee Vining Creek water is diverted and released directly into Rush Creek to provide cooler water in Rush Creek below Grant Dam. I noted the diversion operation tends to dampen the effects of hydropeaking downstream on Lee Vining Creek, however I failed to mention that when this dry year operation occurs (when Grant Lake Reservoir is below 25,000 AF of storage July 1–Sep 30) the hydropeaking pattern is transferred to Rush Creek. Therefore the hydrologic analysis should include effects on both creeks below the LA Aqueduct.

Are you aware of resources, management plans or data that the relicensing team should review as part of the study plan development?	Yes, previously noted.

A-11.3_Sept 2021 site visit questionnaire response

From: Wufoo
To: Carissa Shoemaker
Subject: Lee Vining Site Visit Questionnaire [#8]
Date: Tuesday, October 12, 2021 6:54:44 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Name	rick mcneill
Orginization	Inyo NF
Title/Role	botanist
Email	ricahrd.mcneill@usda.gov
Did you attend the Lee Vining Hydroelectric Project Site Visit on September 28, 2021?	• Yes
After attending the workshop, what new questions or observations do you have about the project's operations or facilities?	I would like a central repository for all data collected, created, and studies conducted regarding plant operations and licensensing from SCE, BLM, USFS and any other agency or organization. Everytime I ask a question, it takes me 3 weeks and six emails to find out who is the correct person to ask and then it takes another week to get an answer. This doesn't mean that I get my question answered, just an answer.
Are you aware of resources, management plans or data that the relicensing team should review as part of the study plan development?	In the meeting, the consultant mentioned that some salmonids might be reproducing naturally in Lee Vining creek, but they are not going to include that in the study, just the effects of flow regulation on riparian zones. It seems like that might be an important thing to know when making decisions about management of a resource.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

James Rambeau, Chairman
Big Pine Paiute Tribe of Owens Valley
j.rambeau@bigpinepaiute.org

Reference: Project Consultation with Big Pine Paiute of Owens Valley

Dear Mr. Rambeau,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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to follow-up on this lette

cc: VIA Electı

Matthew Woodha
Relicensing Proje
Southern Californ
matthew.woodhal

[1] 18 C.F.R. § 385

Document Content(s)

P-1388-081 Tribal Consult Letter Big Pine Paiute.pdf.....1

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

Tilford P. Denver, Chairman
Bishop Paiute Tribe
tilford.denver@bishoppaiute.org

Reference: Project Consultation with Bishop Paiute Tribe

Dear Mr. Denver,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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Matthew Woodhal
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Southern Californi
matthew.woodhall

[1] 18 C.F.R. § 385.

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P-1388-081 Tribal Consult Letter Bishop Paiute.pdf.....1

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

John Glazier, Chairman
Bridgeport Paiute Indian Colony
chair@bridgeportindiancolony.com

Reference: Project Consultation with Bridgeport Paiute Indian Colony

Dear Mr. Glazier,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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Matthew Woodha
Relicensing Proje
Southern Californ
matthew.woodhal

[1] 18 C.F.R. § 385.

Document Content(s)

P-1388-081 Tribal Consult Letter Bridgeport Paiute.pdf.....1

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

Carl Dahlberg, Chairman
Fort Independence Community of Paiute Indians
carl@fortindependence.com

Reference: Project Consultation with Fort Independence Community of Paiute Indians

Dear Mr. Dahlberg,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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Matthew Woodha
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Southern Californ

[1] 18 C.F.R. § 385.

matthew.woodhall@sce.com

Document Content(s)

P-1388-081 Tribal Consult Letter Fort Independence.pdf.....1

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

Fred Beihn, Chairperson
North Fork Rancheria of Mono Indians of California
fbeihn@nfr-nsn.gov

Reference: Project Consultation with North Fork Rancheria of Mono Indians of California

Dear Mr. Beihn,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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Relicensing Projec
Southern Californi

[1] 18 C.F.R. § 385.

matthew.woodhall@sce.com

Document Content(s)

P-1388-081 Tribal Consult Letter North Fork Rancheria.pdf.....1

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

Andrea Reich, Tribal Chairman
Tuolumne Band of Me-Wuk Indians
amdrea@mewuk.com

Reference: Project Consultation with Tuolumne Band of Me-Wuk Indians

Dear Ms. Reich,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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[1] 18 C.F.R. § 385.

Document Content(s)

P-1388-081 Tribal Consult Letter Tuolumne Band of Me-Wuk.pdf.....1

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

Amber Torres, Chairman
Walker River Paiute Tribe
chairman@wrpt.us

Reference: Project Consultation with Walker River Paiute Tribe

Dear Ms. Torres,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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A-12.7_FERC invite letter to Walker River Paiute Tribes

Document Accession #: 20211019-3007 Filed Date: 10/19/2021

Document Content(s)

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON D.C. 20426
October 19, 2021

OFFICE OF ENERGY PROJECTS

Project No. 1388-081 – California
Lee Vining Hydroelectric Project
Southern California Edison

VIA Electronic Mail

Serrell Smokey, Chairman
Washoe Tribe of Nevada and California
executive.assistant@washoetribe.us

Reference: Project Consultation with Washoe Tribe of Nevada and California

Dear Mr. Smokey,

Southern California Edison (SCE) is in the process of relicensing the Lee Vining Hydroelectric Project, located on Lee Vining Creek, near Lee Vining, California. Specifically, SCE is using the Commission's Traditional Licensing Process to prepare the license application to relicense the project. SCE's current license for the Lee Vining Hydroelectric Project expires January 31, 2027; an application for a new license must be filed by January 31, 2025.

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matthew.woodhal

[1] 18 C.F.R. § 385.

Document Content(s)

P-1388-081 Tribal Consult Letter Washoe Tribe.pdf.....1

A-13_Notice of staff change

From:	Hildeburn, Chase@Waterboards
To:	matthew.woodhall@sce.com; Terra Alpaugh; Julie Smith; finlay.anderson@kleinschmidtgroup.com; Martin.Ostendorf@sce.com; Carissa Shoemaker; Edward Bianchi; David Moore; Jason Lambert
Subject:	Moving on from the WQC Unit
Date:	Tuesday, October 19, 2021 1:33:59 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear SCE FERC Projects Team,

I want to let you know that I've accepted a new position at the Department of Water Resources doing groundwater recharge modeling in the Central Valley area and my last day with the Water Quality Certifications Unit will be this Friday the 22nd. Moving forward, please use my supervisor Parker Thaler (Parker.Thaler@waterboards.ca.gov) as the SWB contact for Kaweah, Bishop Creek, Lee Vining, Rush Creek, and Eastern Sierra O&M Projects until a new staff has been officially assigned to each one (I think multiple projects may be managed by one staff person, as has been the case with me, but management might want to assign the Projects in a different way than before). It really has been a pleasure working with you all over the last few years and I've learned so much from you along the way. I hope our paths cross again in the future.

All the best,

Chase Hildeburn

From: lunch@thesheetnews.com
To: Carissa Shoemaker
Cc: juneatthesheet@gmail.com
Subject: Re: Public meeting notice - Lee Vining Hydro Project
Date: Friday, October 29, 2021 7:25:47 PM

WARNING: The sender of this email could not be validated and may not match the person in the "From" field.

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No problen.

It will run in the Nov. 6 & 13 issues.

T

----- Original Message -----
From:
"Carissa Shoemaker" <Carissa.Shoemaker@erm.com>

To:
"lunch@thesheetnews.com" <lunch@thesheetnews.com>
Cc:

Sent:
Fri, 29 Oct 2021 18:51:28 +0000
Subject:
Public meeting notice - Lee Vining Hydro Project

Hi Ted,

I have a public meeting notice to run in The Sheet. The meeting is on Nov 16, so we are hoping the notice can run 2x before then. Attached is a Word doc of the text. Does that work for you?

Thanks!

Carissa Shoemaker

Senior Project Scientist

Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM

1050 SW 6th Ave, Suite 1650 | Portland, OR 97204

M 907 575 0294

E carissa.shoemaker@erm.com | **W** www.erm.com

A-14.1_Notice of public meeting

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From: Carissa Shoemaker
To: "Mammoth Times"
Subject: RE: Public meeting notice - Lee Vining Hydro Project
Date: Friday, October 29, 2021 12:23:00 PM
Attachments: image001.png

Wonderful, thank you!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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M 907 575 0294

From: Mammoth Times <sales@mammothtimes.com>
Sent: Friday, October 29, 2021 12:20 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Re: Public meeting notice - Lee Vining Hydro Project

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Hello Carissa,

I've got the notice scheduled to print on Nov. 4th and 11th. We'll mail the proof of publication along with the invoice after the final print.

Thank you,

Rina Bruno
Classifieds/Sales
Inyo Register & Mammoth Times
Ph: 760-934-3929
Fx: 760-934-3951

On 10/29/2021 11:54 AM, Carissa Shoemaker wrote:

> Hi Rina,
> I have a public meeting notice to run in The Mammoth Times. The meeting is on Nov 16, so we are hoping the notice can run 2x before then. Attached is a Word doc of the text. Does that work for you?
>
> Thanks!
>
> Carissa Shoemaker
> *Senior Project Scientist*

Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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A-15.1_Joint Agency Meeting reminder and materials

From:	Carissa Shoemaker
Bcc:	adam.barnett@usda.gov; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; alyssa.marquez@wildlife.ca.gov; apcohen@umail.ucsb.edu; Ashley Overhouse; ashley.blythehaverstock@usda.gov; Audry.Williams@sce.com; bartshe@monolake.org; bblood@psomas.com; blake.engelhardt@usda.gov; Brandon.Kulik@KleinschmidtGroup.com; Bret Hoffman; BryAnna.Vaughan@bishoppaiute.org; businesscommittee@fortindependence.com; c.levine@bigpinepaiute.org; Chad_Mellison@fws.gov; chair@bridgeportindiancolony.com; chair@lppsr.org; chairman@wrpt.org; char54lange@gmail.com; Charles.partridge@sce.com; Chase.Hildeburn@Waterboards.ca.gov; Chris Shutes; Christina McDonald; claire@monolake.org; claymiwumati@gmail.com; cmcdonald@northforkrancheria-nsn.gov; conservation@bristleconecnps.org; cshutes@calsport.org; culture@bridgeportindiancolony.com; curator@monobasinhistory.org; d.gutierrez@bigpinepaiute.org; darrel.cruz@washoetribe.us; dtonenna@gmail.com; durhamdthvlly@aol.com; thpo@timbisha.com; easternsierraartist@gmail.com; ed.hancock@waterboards.ca.gov; efink@nfr-nsn.gov; eric.tillemans@ladwp.com; events@mammothmuseum.org; falconkeeper22@gmail.com; thpo@fortindependence.com; Finlay Anderson; geoff@monolake.org; george@timbisha.com; greg@monolake.org; heather@stillwatersci.com; Iav1@humboldt.edu; Jameisha.Washington@usda.gov; James.Erdman@wildlife.ca.gov; Jessica Strickland; Jill.north@waterboards.ca.gov; jjthompson@timbisha.com; jmharty@kearnswest.com; jon@mewuk.com; jora@friendsoftheinyo.org; justin_barrett@fws.gov; kathybncrft@yahoo.com; katie@accessfund.org; Kelly.Larimer@KleinschmidtGroup.com; kutzanuumu@yahoo.com; l.stewart@bigpinepaiute.org; Lawson.reif@usda.gov; lcompas@hrassoc.com; lilian_jonas@contractor.nps.gov; lprimosc@blm.gov; LTryba@kearnswest.com; lucy_basket4@yahoo.com; Lyle Laven; marshmistress@msn.com; martin.ostendorf@sce.com; Matthew Woodhall; Matthew.Harper@Kleinschmidtgroup.com; megan.mullowney@usda.gov; monique.sanchez@usda.gov; Monty Bengochia; naomi@teambishop.com; nathan.sill@usda.gov; nayanake@comcast.net; Nick.Buckmaster@wildlife.ca.gov; nora.gamino@usda.gov; Jill.North@waterboards.ca.gov; paiute11@aol.com; parker.thaler@Waterboards.ca.gov; Patricia.Moyer@Wildlife.ca.gov; Paul.Pau@ladwp.com; rfuller@mewuk.com; Richard.McNeill@usda.gov; Rwgoode911@hotmail.com; s.manning@bigpinepaiute.org; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; secretary@southernsierramiwuknation.org; serrell.smokey@washoetribe.us; seth.carr@sce.com; shanesaulque@hotmail.com; Shannon Luoma; shawna_theisen@fws.gov; sheila.irons@usda.gov; shellydk@frontiernet.net; slrapp@ucsc.edu; ssmiwuknation@gmail.com; sandra47roy@gmail.com; stephen_bowes@nps.gov; steve.norton@psomas.com; steven.orihuela@bishoppaiute.org; t.braithwaite@bentonpaiutereservation.org; parker.thaler@waterboards.ca.gov; thomas.torres@usda.gov; Tilford Denver; todd.ellsworth@usda.gov; tristan.leong@usda.gov; vince.white@sce.com
Subject:	Lee Vining Joint Agency Meeting reminder and materials
Date:	Friday, November 12, 2021 2:17:00 PM
Attachments:	image001.png Lee Vining JAM Agenda_20211116.pdf

Hello Lee Vining Relicensing Participants,

This is a reminder for the Joint Agency and Public Meeting (JAM), next Tuesday, November 16.

You should have received a meeting invitation for the main JAM (9am-1pm) and an Optional Virtual Site Visit (8am-9am). These both use the same Teams link. The virtual site visit is intended for those who were unable to attend the in-person visit; however, everyone is welcome to attend. **Click here to join the meeting**
The JAM agenda is attached to this email.

The purpose of the JAM is to review Project information, operations, potential effects, and proposed studies. We will also review the relicensing process and key milestones. This is a good opportunity to ask the relicensing team questions. Following the meeting, stakeholders will have 60 days to provide comments on the PAD, identify additional information, and request studies (or modifications of studies that have been discussed).

The SCE Lee Vining website includes many Project documents, including the Preliminary Application Document (PAD). Section 6.0 of the PAD includes potential issues and the proposed studies.
https://www.sce.com/regulatory/hydro-licensing/leevining

Please reach out if you have questions.

See you next week!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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E carissa.shoemaker@erm.com | **W** www.erm.com

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A-15.2_Joint Agency Meeting reminder and materials

From:	McNeill, Richard - FS, BISHOP, CA
To:	Carissa Shoemaker
Cc:	Finlay Anderson; Shannon Luoma
Subject:	Re: [External Email]Lee Vining Joint Agency Meeting reminder and materials
Date:	Friday, November 12, 2021 2:58:50 PM
Attachments:	image002.png image003.png Outlook-Forest Ser.png

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Thank you Carissa

Rick McNeill
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, November 12, 2021 14:46
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: RE: [External Email]Lee Vining Joint Agency Meeting reminder and materials

Hi Rick,

This meeting will only be on Teams, no in-person option. Thanks for checking!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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M 907 575 0294

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Friday, November 12, 2021 2:31 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Re: [External Email]Lee Vining Joint Agency Meeting reminder and materials

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Hi Carissa
Is the JAM a teams only meeting, or will there also be an in person meeting available?
rick

Rick McNeill
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, November 12, 2021 14:18
Subject: [External Email]Lee Vining Joint Agency Meeting reminder and materials

[External Email]
If this message comes from an **unexpected sender** or references a **vague/unexpected topic;**
Use caution before clicking links or opening attachments.
Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

Hello Lee Vining Relicensing Participants,
This is a reminder for the Joint Agency and Public Meeting (JAM), next Tuesday, November 16.
You should have received a meeting invitation for the main JAM (9am-1pm) and an Optional Virtual Site Visit (8am-9am). These both use the same Teams link. The virtual site visit is intended for those who were unable to attend the in-person visit; however, everyone is welcome to attend. **Click here to join the meeting**
The JAM agenda is attached to this email.
The purpose of the JAM is to review Project information, operations, potential effects, and proposed studies. We will also review the relicensing process and key milestones. This is a good opportunity to ask the relicensing team questions. Following the meeting, stakeholders will have 60 days to provide comments on the PAD, identify additional information, and request studies (or modifications of studies that have been discussed).

The SCE Lee Vining website includes many Project documents, including the Preliminary Application Document (PAD). Section 6.0 of the PAD includes potential issues and the proposed studies.
https://www.sce.com/regulatory/hydro-licensing/leevining
Please reach out if you have questions.
See you next week!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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From: North, Jill@Waterboards
To: Carissa Shoemaker
Subject: RE: Lee Vining Joint Agency Meeting reminder and materials
Date: Monday, November 15, 2021 1:46:42 PM
Attachments: image001.png

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Well I DEFINITELY have it now!!!! We'll just chalk that up to weirdness!!! Thank you!
Jill

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Monday, November 15, 2021 1:37 PM
To: North, Jill@Waterboards <Jill.North@waterboards.ca.gov>
Subject: RE: Lee Vining Joint Agency Meeting reminder and materials

EXTERNAL:

Curious… it appears correct, but I just resent the reminders email (the same one that you already got from Parker) and two meeting invites for Tuesday.
Thanks!
Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: North, Jill@Waterboards <Jill.North@waterboards.ca.gov>
Sent: Monday, November 15, 2021 1:29 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Lee Vining Joint Agency Meeting reminder and materials

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Hi Carissa,
I did not receive that 11/12 email. Perhaps there is a typo in my email address? Some ppl miss the "s" at the end of waterboards. Just a thought.
Jill.north@waterboards.ca.gov

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Monday, November 15, 2021 1:20 PM
To: North, Jill@Waterboards <Jill.North@waterboards.ca.gov>
Subject: RE: Lee Vining Joint Agency Meeting reminder and materials

EXTERNAL:

Hi Jill,
Thanks for your interest in the project! I believe I added you to email communications last week, did you get an email from me on 11/12 at 2:18pm? If you didn't I will need to double check your contact info in my list.
Thanks!
Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: North, Jill@Waterboards <Jill.North@waterboards.ca.gov>
Sent: Monday, November 15, 2021 8:33 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Fwd: Lee Vining Joint Agency Meeting reminder and materials

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Hi Carissa,
Please add me to all distribution lists and inform others if needed.
Thank you and have a great start to your week!
Jull
Get Outlook for Android

From: Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>
Sent: Monday, November 15, 2021, 8:03 AM
To: North, Jill@Waterboards
Subject: FW: Lee Vining Joint Agency Meeting reminder and materials
Good morning Jill,
I wanted to confirm that you got the below email? If you didn't can you please follow up with Carissa to be added to the Lee Vining distribution list.
Parker

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, November 12, 2021 2:18 PM
To: Lee Vining Joint Agency Meeting reminder and materials

EXTERNAL:

Hello Lee Vining Relicensing Participants,
This is a reminder for the Joint Agency and Public Meeting (JAM), next Tuesday, November 16.
You should have received a meeting invitation for the main JAM (9am-1pm) and an Optional Virtual Site Visit (8am-9am). These both use the same Teams link. The virtual site visit is intended for those who were unable to attend the in-person visit; however, everyone is welcome to attend. **Click here to join the meeting**
The JAM agenda is attached to this email.
The purpose of the JAM is to review Project information, operations, potential effects, and proposed studies. We will also review the relicensing process and key milestones. This is a good opportunity to ask the relicensing team questions. Following the meeting, stakeholders will have 60 days to provide comments on the PAD, identify additional information, and request studies (or modifications of studies that have been discussed).
The SCE Lee Vining website includes many Project documents, including the Preliminary Application Document (PAD). Section 6.0 of the PAD includes potential issues and the proposed studies.
https://www.sce.com/regulatory/hydro-licensing/leevining
Please reach out if you have questions.

See you next week!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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E carissa.shoemaker@erm.com | **W** www.erm.com

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From:	Ron W. Goode
To:	Carissa Shoemaker
Cc:	shellydk@frontiernet.net; Audry.Williams@sce.com; Finlay Anderson; Shannon Luoma
Subject:	Re: Lee Vining Joint Agency Meeting reminder and materials
Date:	Tuesday, November 16, 2021 2:39:32 PM
Attachments:	image001.png

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Ron

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Monday, November 15, 2021 2:16 PM
To: Ron W. Goode <rwgoode911@hotmail.com>
Cc: shellydk@frontiernet.net <shellydk@frontiernet.net>; Audry.Williams@sce.com <Audry.Williams@sce.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: RE: Lee Vining Joint Agency Meeting reminder and materials

Hi Ron,

Yes, the Teams link is the same for both meeting start times. We'd be happy to have you join at 8 for the virtual site visit.

Thanks!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Ron W. Goode <rwgoode911@hotmail.com>
Sent: Saturday, November 13, 2021 4:30 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Re: Lee Vining Joint Agency Meeting reminder and materials

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Might try the 8 to 9 Site Tour, will the Virtual link work for that as well? On the west side of the Mountain, we have a Tribal Forum with the SNF from 9 to 12.

Ron

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, November 12, 2021 3:18 PM
Subject: Lee Vining Joint Agency Meeting reminder and materials

Hello Lee Vining Relicensing Participants,

This is a reminder for the Joint Agency and Public Meeting (JAM), next Tuesday, November 16.

You should have received a meeting invitation for the main JAM (9am-1pm) and an Optional Virtual

Site Visit (8am-9am). These both use the same Teams link. The virtual site visit is intended for those who were unable to attend the in-person visit; however, everyone is welcome to attend. Click here to join the meeting
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https://www.sce.com/regulatory/hydro-licensing/leevining
Please reach out if you have questions.
See you next week!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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A-16.1_Meeting invitation for Joint Agency Meeting

From: Carissa Shoemaker
To: claire@monolake.org; bartshe@monolake.org; kary.schlick@usda.gov; Paul Rose; stephanie.heller@usda.gov; slrapp@ucsc.edu; marshmistress@msn.com; sheila.irons@usda.gov; Matthew Woodhall; Shelly Davis-King; geoff@monolake.org; lilian_jonas@contractor.nps.gov; Finlay Anderson; Carissa Shoemaker; Shannon Luoma; James.Erdman@wildlife.ca.gov; alyssa.marquez@wildlife.ca.gov; Allison Rudalevige; steve.norton@psomas.com; Heather Bowen Neff; greg@monolake.org; michael.wiese@usda.gov; Richard.McNeill@usda.gov; Erin.Moore@usda.gov; Matthew Harper; Kelly.Larimer@KleinschmidtGroup.com; seth.carr@sce.com; acohen@stillwatersci.com; Audry Williams; Brandon.Kulik@KleinschmidtGroup.com; sb@snowhydrology.com; bblood@psomas.com; nathan.sill@usda.gov; adam.barnett@usda.gov; ashley.blythehaverstock@usda.gov; Jacqueline.beidl@usda.gov
Subject: Lee Vining (OPTIONAL) virtual site tour before JAM
Start: Tuesday, November 16, 2021 8:00:00 AM
End: Tuesday, November 16, 2021 9:00:00 AM
Location: Microsoft Teams
Attachments: image001.png

Hello Lee Vining Relicensing Participants,

This is a 1-hour OPTIONAL meeting in which we will give a virtual site tour, immediately before the Joint Agency Meeting (JAM). This has been set up particularly for stakeholders who were unable to attend the in-person site visit on September 28. However, feel free to join us if you would like to have a more detailed Project refresher. The Teams link below is the same as the JAM invite, so you will not need to flip between two meetings, just stay on for the 9:00 AM start of the JAM.

Please let me know if you have questions.

Thank you!

Microsoft Teams meeting

Join on your computer or mobile app

Click here to join the meeting <https://teams.microsoft.com/l/meetup-join/19%3ameeting_NDdkMmRiMDAtMTY1NS00N2Q1LTgxMDAtOGU2YzExODFiNTAw%40thread.v2/0?context=%7b%22Tid%22%3a%22f2fe6bd3-9c4a-485b-ae69-e18820a88130%22%2c%22Oid%22%3a%22008911b3-c470-4526-a040-fc31729944f9%22%7d>

Join with a video conferencing device

195471110@teams.bjn.vc <mailto:195471110@teams.bjn.vc>

Video Conference ID: 129 387 446 8

Alternate VTC dialing instructions <https://support.bluejeans.com/knowledge/vtc-dial-in-options-for-teams>

Or call in (audio only)

+1 469-423-0864,,177375467# <tel:+14694230864,,177375467#> United States, Dallas

Phone Conference ID: 177 375 467#

Find a local number <https://dialin.teams.microsoft.com/96f17e09-9285-40a2-8a11-d9b38cd39faf?id=177375467> | Reset PIN <https://mysettings.lync.com/pstnconferencing>

<https://www.erm.com/static/images/logo-erm.gif>

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Carissa Shoemaker

Senior Project Scientist

Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM

1050 SW 6th Ave, Suite 1650 | Portland, OR 97204

M 907 575 0294

E carissa.shoemaker@erm.com <mailto:carissa.shoemaker@erm.com> | W www.erm.com <https://eur01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.erm.com%2F&data=02%7C01%7C%7C8cf0de052c774d5632ab08d83257e8d8%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637314700440303507&sdata=YyF%2BKemtIsdd4pWb%2F85kJCaUXjcucIVMn%2FZx06QnSZU%3D&reserved=0>

Click here to view the 2021 ERM Sustainability Report <https://www.erm.com/sustainability-report/> and the ERM Foundation Annual Review <https://www.erm.com/globalassets/documents/erm-foundation/erm-foundation-annual-review-2021.pdf>

Carissa Shoemaker

Subject: Lee Vining Joint Agency Meeting - placeholder
Location: Microsoft Teams Meeting

Start: Tue 11/16/2021 9:00 AM
End: Tue 11/16/2021 1:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Not yet responded

Organizer: Carissa Shoemaker
Required Attendees Finlay Anderson; Shannon Luoma; Matthew Woodhall; 'Adam Cohen'; 'adam.barnett@usda.gov'; 'Adam.Perez@ladwp.com'; 'allison.rudalevige@psomas.com'; 'alyssa.marquez@wildlife.ca.gov'; 'apcohen@umail.ucsb.edu'; 'ARoesberry@caltrout.org'; 'Audry.Williams@sce.com'; 'bartshe@monolake.org'; 'bbell@co.tuolumne.ca.us'; 'bblood@psomas.com'; 'bburman@usbr.gov'; 'blake.engelhardt@usda.gov'; 'Brandy.Wood@Wildlife.ca.gov'; 'bryan.hatchell@colorado.edu'; 'calweb@tnc.org'; 'cdaly@mackaysposito.com'; 'Chad_Mellison@fws.gov'; 'chair@toiyabe.sierraclub.org'; 'Chase.Hildeburn@Waterboards.ca.gov'; 'cknight@caltrout.org'; 'claire@monolake.org'; 'comdev@mono.ca.gov'; 'conservation@bristleconecnps.org'; 'cshutes@calsport.org'; 'curator@monobasinhistory.org'; 'daniel.sussman@waterboards.ca.gov'; 'daniel.yarborough@usda.gov'; 'dawn.alvarez@usda.gov'; 'dfjohnso@blm.gov'; 'easternsierraartist@gmail.com'; 'ed.hancock@waterboards.ca.gov'; 'eric.tillemans@ladwp.com'; 'eric@friendsoftheriver.org'; 'events@mammothmuseum.org'; 'ferccaseadmin@sce.com'; 'FOMLR@bodiefoundation.org'; 'frontierpacktrain@gmail.com'; 'gardenofegan@suddenlink.net'; 'geoff@monolake.org'; 'ghaverst@blm.gov'; 'gordon.martin@usda.gov'; 'greg@monolake.org'; 'GRoff@caltrout.org'; 'heather@stillwatersci.com'; 'holly@inyo-monowater.org'; 'hydroesq@schat.net'; 'info@friendsoftheinyo.org'; 'info@monolake.org'; 'info@rockcreekpackstation.com'; 'Jacqueline.beidl@usda.gov'; 'James.Erdman@wildlife.ca.gov'; 'jennifer.watts@waterboards.ca.gov'; 'jenny@sierranevadaalliance.org'; 'jkrclr@gmail.com'; 'jmharty@kearnswest.com'; 'johnwentworth@mltpa.org'; 'jonklusmire@yahoo.com'; 'jora@friendsoftheinyo.org'; 'jstrickland@tu.org'; 'justin_barrett@fws.gov'; 'kary.schlick@usda.gov'; 'katie@accessfund.org'; 'kelly.henderson@sce.com'; 'Kelly.Larimer@KleinschmidtGroup.com'; 'kquinlan16@gmail.com'; 'Lawson.reif@usda.gov'; 'lbergeron@pcta.org'; 'lcompas@hrassoc.com'; 'lisa@monolake.org'; 'lprimosc@blm.gov'; 'markbagley02@gmail.com'; 'marshmistress@msn.com'; 'martin.ostendorf@sce.com'; 'maryroper51@gmail.com'; 'matt.driscoll@sierranevada.ca.gov'; 'Matthew.Harper@Kleinschmidtgroup.com'; 'megan.mullowney@usda.gov'; 'monique.sanchez@usda.gov'; 'mparuolo@mammothlakesrecreation.org'; 'Mparuolo@mono.ca.gov'; 'naomi@teambishop.com'; 'nate@esavalanche.org'; 'office@esavalanche.org'; 'nathan.sill@usda.gov'; 'Nick.Buckmaster@wildlife.ca.gov'; 'nicolas.von@sce.com'; 'nora.gamino@usda.gov'; 'nosmog@yahoo.com'; 'Patricia.Moyer@Wildlife.ca.gov'; 'Paul.Pau@ladwp.com'; 'paulR4shopping@verizon.net'; 'pgunsolley@gmail.com'; 'Philipana@aol.com'; 'pmcfarland395@gmail.com'; 'president@esaudubon.org'; 'pstickells@gmail.com'; 'rcollins@caltrout.org'; 'robbie@monolake.org'; 'Rose.Banks@wildlife.ca.gov'; 'saddlebaglake@gmail.com'; 'Saeed.Jorat@ladwp.com'; 'sb@snowhydrology.com'; 'seth.carr@sce.com'; 'shawna_theisen@fws.gov'; 'sheila.irons@usda.gov'; 'ashley.blythehaverstock@usda.gov'; 'shellydk@frontiernet.net'; 'SJacobson@caltrout.org'; 'stephen_bowes@nps.gov'; 'steve.norton@psomas.com'; 'steve.parmenter@wildlife.ca.gov'; 'talpaugh@kearnswest.com'; 'thomas.torres@usda.gov'; 'tiogalodge@gmail.com'; 'tiogapassresortllc@gmail.com'; 'todd.ellsworth@usda.gov'; 'tristan.leong@usda.gov'; 'victor.aguirreorozco@usda.gov'; 'wendy@friendsoftheinyo.org';

A-16.2_Meeting invitation placeholder for Joint Agency Meeting

Required Attendees'wsugimura@mono.ca.gov'; 'Jameisha.Washington@usda.gov'; Lyle Laven; 'Charles.partridge@sce.com'; 'vince.white@sce.com'

Hello Lee Vining Relicensing Participants,

This is a placeholder for our Lee Vining Joint Agency Meeting (JAM). It will be a virtual meeting, please use the Teams link below.

Please let me know if you have questions.
Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

Click here to view the 2021 ERM Sustainability Report and the ERM Foundation Annual Review

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Microsoft Teams meeting

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195471110@teams.bjn.vc
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Alternate VTC dialing instructions

Or call in (audio only)

+1 469-423-0864,,177375467# United States, Dallas

Phone Conference ID: 177 375 467#
Find a local number | Reset PIN

A-16.2_Meeting invitation placeholder for Joint Agency Meeting

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Learn More | Meeting options

Lee Vining Hydroelectric System Relicensing

Joint Agency Meeting (JAM) and Virtual Site Tour

November 16, 2021, 8:00 AM – 1:00 PM PDT via Microsoft Teams

Objectives

- Provide a Project overview
- Discuss FERC relicensing process
  - Traditional Licensing Process (TLP)
- Provide overview of existing information
  - Preliminary Application Document (PAD)
- Discuss potential environmental effects
- Discuss proposed studies to fill information gaps

Time	Agenda Topic/Subtopic	Lead
8:00	**Virtual Site Tour** *(Optional - provided especially for those who missed the in-person site visit)*	
	- Safety moment - Introductions - Review of Site Visit Agenda and Booklet - Watch drone footage	Matthew Woodhall
8:55	**5-minute break**	
9:00	**JAM Welcome & Introductions**	
	- Safety moment - Introductions	Matthew Woodhall
9:20	**SCE and FERC Relicensing Process Overview**	
	- SCE relicensing objectives - FERC relicensing - Study questions and criteria - TLP Schedule	Finlay Anderson
9:45	**Project Overview**	
	- Summary of Project facilities and operations	Seth Carr and Lyle Laven
9:55	**5-minute break**	
10:00	**Overview of Existing Information**	
	- PAD summary of findings, per resource area - Potential effects, per resource area - Resource Management Plans identified - Proposed Study Plans	Finlay Anderson and Resource Leads

- Fish and Aquatics
  - Reservoir Fish Populations
  - Stream Fish Populations
  - Aquatic Habitat Mapping and Sediment Characterization
  - Aquatic Invasive Plants and Algae
  - Operations Model
  - Lower Lee Vining Creek Channel Morphology
  - Stream and Reservoir Water Quality Assessment
- Terrestrial and Botanical
  - General Wildlife and Rare, Threatened, and Endangered Species
  - Botanical (RTE, invasive, and riparian)
- Cultural and Tribal
  - Cultural
  - Tribal
- Recreation and Land Use
  - Recreation Use Assessment
  - Recreation Facilities Condition
  - Project Boundary and Roads
- Visual Quality Assessment

12:20	**Schedule, next steps, action items**	
	- Upcoming important dates and events - Other action items	Finlay Anderson
12:40	**Final Q&A**	
12:55	**Adjourn**	

Materials Available on Relicensing Website

- Preliminary Application Document, filed August 12, 2021
  - Includes Draft Study Plans
- Site Visit materials
  - Project overview maps
  - Site Visit Booklet
  - Agenda
  - Site Visit Photos
- Process Plan and Schedule
- USFWS IPaC Report (April 2020)
- Project Flyover Video
- FERC Environmental Assessment
- Current FERC License (1997)
- Select Orders Amending the 1997 License

- Technical Working Group (TWG) materials
    - Meeting Agenda
    - Meeting Summaries
    - PowerPoint Presentations
    - TWG Charter Document
- October 2020 Public Meeting materials

ATTENDANCE LIST

LEE VINING, FERC PROJECT NO. 1388

IN-PERSON SITE VISIT – SEPTEMBER 28, 2021, 9:00AM - 3:00PM
VIRTUAL SITE VISIT - NOVEMBER 16, 2021, 8:00AM - 9:00AM
JOINT AGENCY MEETING (JAM) - NOVEMBER 16, 2021, 9:00AM - 12:00PM

	In-Person Site Visit	Virtual Site Visit	Joint Agency Meeting
Relicensing and Facilitation Team Members			
Adam Cohen, Stillwater	X		X
Allison Rudalevige, Psomas	X	X	X
Audry Williams, SCE	X		X
Brad Blood, Psomas	X	X	X
Brandon Kulik, Kleinschmidt	X		X
Bret Hoffman, Kleinschmidt		X	X
Carissa Shoemaker, ERM	X	X	X
Edith Read, E. Read and Associates, Inc.	X		X
Finlay Anderson, Kleinschmidt	X	X	X
Heather Bowen Neff, Stillwater Sciences	X	X	X
Joshua Fritz, ERM		X	X
Kelly Larimer, Kleinschmidt	X		
Lindsay Tryba, KW		X	X
Lynn Compas, Historical Research Associates, Inc.			X
Martin Ostendorf, SCE			X
Matthew Harper, Kleinschmidt	X	X	X
Matthew Woodhall, SCE	X	X	X
Seth Carr, SCE	X		X
Shannon Luoma, Kleinschmidt	X	X	X
Shelly Davis-King, Davis-King and Associates	X		
Steve Norton, Psomas	X	X	X
Terra Alpaugh, KW		X	X
Vince White, SCE			X
Technical Working Group Members and Interested Parties			
Phone number (760) 784-4085			X
Adam Barnett, USFS	X		

Alyssa Marquez, CDFW	X		X
Ashley Blythe Haverstock, USFS			X
Bartshe Miller, MLC	X		X
Brandy Wood, CDFW			X
Chad Mellison, USFWS			X
Chris Shutes, CSPA			X
Claire Landowski, MLC	X		
Erin Moore, USFS	X		
Geoff McQuilkin, MLC	X		
Greg Reis, MLC	X		X
Jacqueline Beidl, USFS	X		
Jameisha Washington, USFS			X
James Erdman, CDFW	X	X	X
Jill North, Waterboards		X	X
Kary Schlick, USFS	X		
Lawrence Primosch, BLM			X
Lilian Jonas, NPS contractor	X		
Michael Wiese, USFS	X		X
Monique Sanchez, USFS			X
Naomi Jensen, CDFW			X
Nathan Sill, USFS	X		X
Parker Thaler, Waterboards			X
Patricia Moyer, CDFW			X
Paul Pau, LADWP			X
Paul Rose, Unaffiliated	X		
Raymond Andrews, Bishop Paiute Tribe		X	X
Richard McNeill, USFS	X	X	X
Samuel Rapp, USFS	X		
Sheila Irons, USFS	X		
Stephanie Heller, USFS	X		
Sue Burak, Consulting hydrologist	X		
Thomas Torres, USFS			X

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Energy for What's Ahead℠

Lee Vining Hydroelectric Project

FERC No. 1388

Note that this meeting will be recorded

Welcome!

The meeting will begin at 9:05

Using the chat, please write your name, organization, and your favorite holiday side dish

Joint Agency & Public Meeting

November 16, 2021

Welcome and Land Acknowledgment

SCE would like to take a moment and recognize that the Lee Vining Project is located on the Mono Lake Kutzadikaa Tribes' traditional lands which they have stewarded for generations.

Safety Moment

Welcome and Introductions: Lee Vining Relicensing Team

SCE Team

Matthew Woodhall
Project Manager

Martin Ostendorf
Senior Manager

Audry Williams
Cultural Resources Manager

Seth Carr
Operations Manager

Lyle Laven
Production Manager

Consultant Team

Finlay Anderson
Project Manager

Shannon Luoma
Deputy PM

Kelly Larimer
Project Director

Carissa Shoemaker
TWG Coordinator

Heather Neff
Aquatics Lead

Allison Rudalevige and **Steve Norton**
Terrestrial and Botanical Leads

Shelly Davis-King
Tribal Lead

Lynn Compas
Cultural Lead

Matt Harper
Recreation and Land Use Lead

JAM Agenda

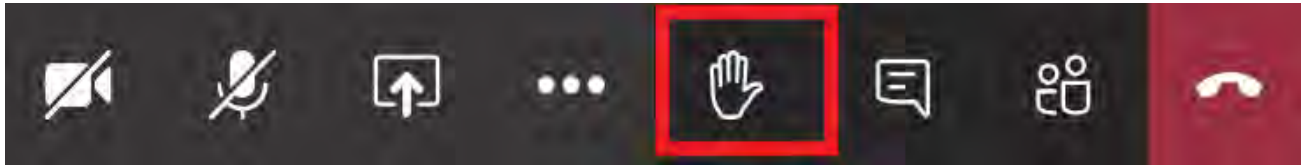
- Safety moment
- Welcome and Introductions
- Meeting objectives
- SCE and FERC relicensing process overviews
- Project overview
- Overview of existing information
  - Preliminary Application Document (PAD) summary of findings
- Proposed study plans
- Schedule, next steps, action items
- Final questions

Meeting Objectives

- Provide a Project overview
- Discuss FERC relicensing process
  - Traditional Licensing Process (TLP)
- Provide overview of existing information
  - Preliminary Application Document (PAD)
- Discuss potential environmental effects
- Discuss proposed studies to fill information gaps

Meeting Tips and Guidelines

- *Note that this meeting is being recorded*
- Please wait to be called on and then unmute your line
  - Introduce yourself (name and affiliation) prior to speaking
- Listen and respect each other
- Stay on topic
- Ask a question by typing it into the chat box during the presentation or by using the raise your hand feature



Relicensing Materials Available on Website

Website: www.sce.com/leevining

- Preliminary Application Document, filed August 12, 2021
  - Including Draft Study Plans
- Site Visit materials
  - Project overview maps
  - Site Visit Booklet
  - Agenda
  - Site Visit Photos
- Process Plan and Schedule
- USFWS IPaC Report (April 2020)
- Project Flyover Video
- FERC Environmental Assessment
- Current FERC License (1997)
- Select Orders Amending the 1997 License
- Technical Working Group (TWG) materials
  - Meeting Agenda
  - Meeting Summaries
  - PowerPoint Presentations
  - TWG Charter Document
- October 2020 Public Meeting materials

SCE RELICENSING PROCESS

SCE Welcome

SCE's Vision

To achieve excellence in Safety, Operations, and Innovation, delivering reliable, valuable and clean generation solutions for our customers and communities

Why is relicensing important? Why are we here?

What role does the Federal Energy Regulatory Commission play?

SCE's Relicensing Objectives

- Obtain project authorization for an additional license term of 30-50 years (18 CFR Part 5)
- Define and describe current operations, no anticipated changes in facilities or operations
- Protect generation assets while providing resource protection/enhancement
- Evaluate effects from ongoing Project operations and maintenance
- Seek collaborative solutions that achieve a sustainable balance for beneficial uses
- Provide safe, reliable, affordable, and clean energy to its customers and community

FERC RELICENSING PROCESS

Federal Energy Regulatory Commission (FERC)

WHAT IS FERC?

A federal, independent agency (formally the Federal Power Commission)

WHAT DOES FERC REGULATE?

Electrical transmission, ***hydroelectric dam licensing*** *and safety, natural gas and oil pipelines*

HOW DOES FERC IMPACT YOU?

FERC manages the participation of the public, agencies, NGOs, and other interested stakeholders.

WHEN DOES RELICENSING START?

The relicensing process officially starts 5 to 5.5 years before license expiration

http://www.ferc.gov/industries/hydropower/gen-info/licensing

What is FERC Relicensing?

- Complex, multiyear
- Involves multiple participant with public involvement opportunities
- Develops an evidentiary record
- Provides FERC with decision-making information
- Determines license term and requirements

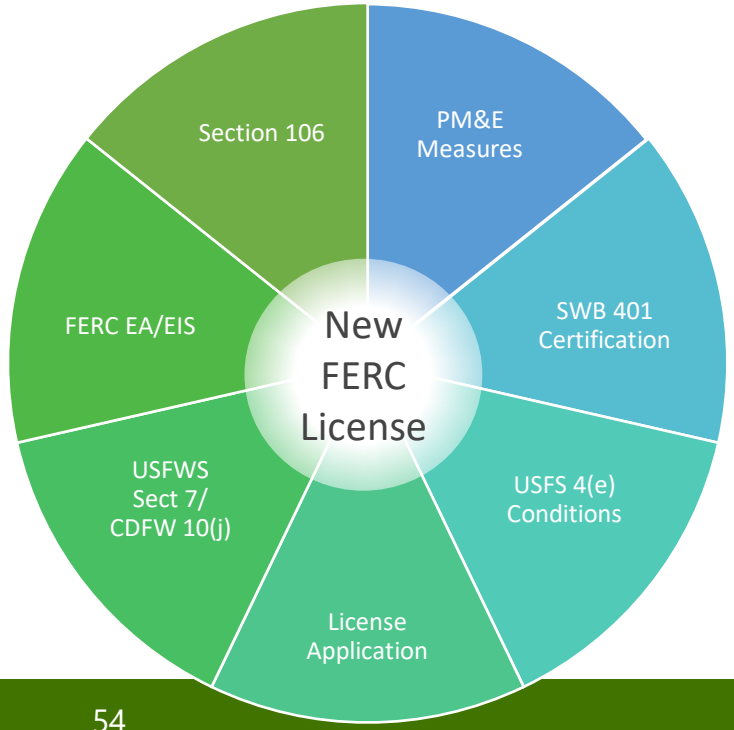
Basic Steps of Relicensing

- **Step 1: Describe Project and file Notice of Intent (NOI)**
- Preliminary Application Document (PAD) summarizes existing Project-related information, potential future operations, and identifies potential resource issues
- Identify Key Questions
  - Stakeholders ask questions and request studies for information that doesn't already exist (Criteria for determining appropriate studies).

Lee Vining Canyon

FERC Relicensing Process Approach

- **Step 2: Answer Questions and Develop License Application**
  - Conduct studies for 1-2 years to fill in data gaps
  - Identify Protection, Mitigation, and Enhancement (PME) measures for the new license in coordination with stakeholders
  - Submit license application to FERC



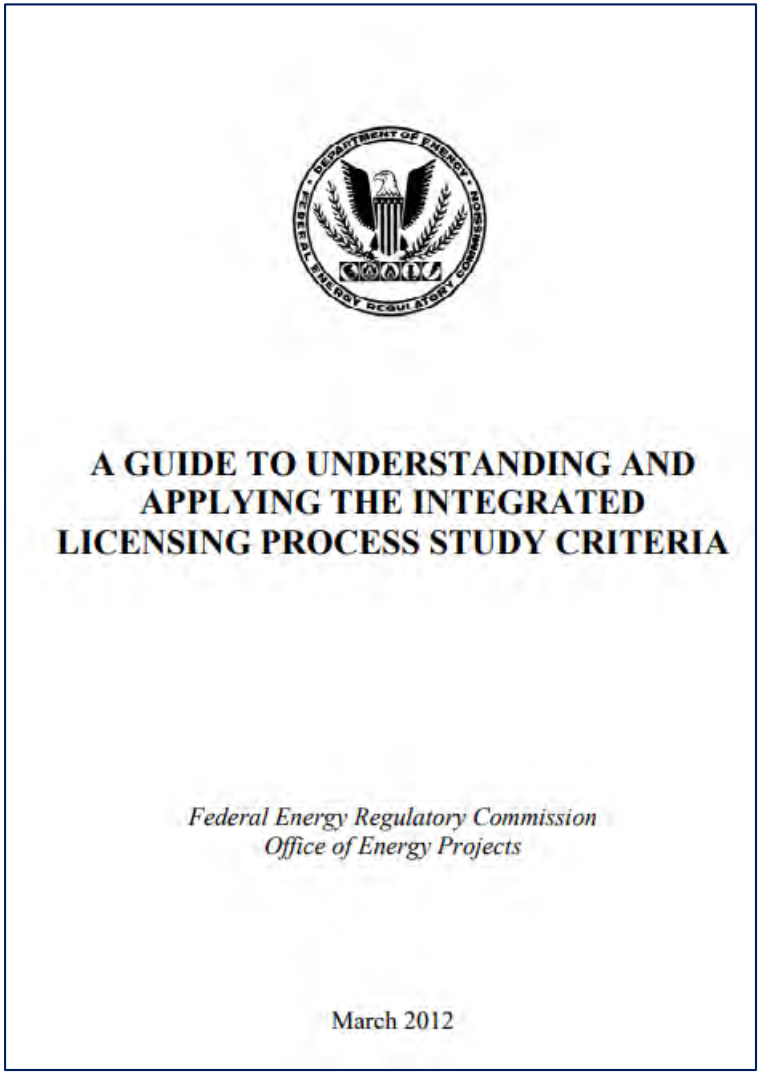
- **Step 3: FERC Conducts a NEPA review and issues license with term and conditions**
  - Solicits comments from stakeholders
  - Receives terms and conditions from agencies
  - Issues License

Study Questions

- Related information necessary to bring Project into compliance with current environmental regulations, standards
- Informed by need to evaluate projects consistent with comprehensive management plans Federal or state comprehensive plans
- Evaluate changes in Project facilities/operations against baseline, where baseline is the current condition

FERC has criteria for study identification

1. Goals and Objectives
2. Relevant Resource Management Goals and Public Interest considerations
3. Existing Information
4. Project Nexus
5. Proposed Methodology
6. Level of effort and Cost



A GUIDE TO UNDERSTANDING AND APPLYING THE INTEGRATED LICENSING PROCESS STUDY CRITERIA

Federal Energy Regulatory Commission
Office of Energy Projects

March 2012

Traditional Licensing Process Stage 1 Schedule

Action	Date	Timeline
Filed Notice of Intent (NOI) and Preliminary Application Document (PAD)	8/12/2021	
FERC Approved Traditional Licensing Process (TLP)	10/8/2021	
Joint Agency Meeting (JAM)	11/16/2021	
Comments due to FERC on PAD and Study Plans	1/17/2022	within 60 days of JAM
SCE provide Study Plans to stakeholders and TWGs	*2/14/2022*	*30 days after comments are due*
Comments due to SCE on Study Plans	*3/16/2022*	*30 days after receiving study plans*
Study Plan Meetings with TWGs	*March/April 2022*	
Final Study Plans to TWGs	*4/15/2022*	

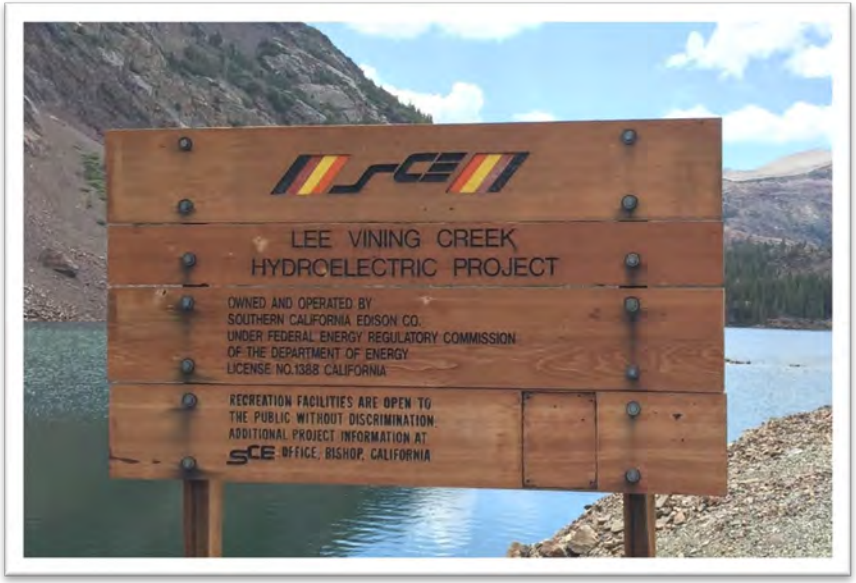
Questions?

LEE VINING HYDROELECTRIC PROJECT OVERVIEW

Saddlebag Lake
Saddlebag Dam
Saddlebag Lake Road
Hoover Wilderness
INYO NATIONAL FOREST
Gardisky Lake
Warren Fork
Spuller Lake
Fantail Lake
Lee Vining Creek
Tioga Pass Road
Poole Powerhouse
Shell Lake
Mine Creek
Ellery Lake
Mono County
Tuolumne County
Tioga Auxillary Dam
Glacier Creek
Rhinedollar Dam
Ansel Adams Wilderness
Tioga Dam
Tioga Lake
Granite Lakes
Upper Gaylor Lake
YOSEMITE NATIONAL PARK

Lee Vining Hydroelectric Project

- Federal Energy Regulatory Commission (FERC) License
  - FERC Project No. 1388
  - Issued February 1997
  - 30 year license term
  - Expires January 31, 2027



- Key Outcomes from Previous Relicensing
  - Established minimum release flows with Project operations (i.e., generation) while protecting aquatic resources
  - Conducted focused studies/evaluation on key resource topics
  - Established resource protection measures

Lee Vining Hydroelectric Project

- Located in the eastern slope of the Sierra Nevada primarily on Inyo National Forest lands about 9 miles upstream of Lee Vining, CA
- Situated on Lee Vining Creek, in Mono County
- The Project maintains 3 reservoirs and 4 dams:
  - Saddlebag Dam and Lake
  - Tioga Dam, Auxiliary Dam, and Lake
  - Rhinedollar Dam and Ellery Lake

Aerial Overview of Lee Vining Project Area

Project Facilities

- Saddlebag Dam and Lake
  - Headwaters of Lee Vining Creek
  - 297-acre reservoir
- Tioga Dams and Lake
  - Headwaters of Glacier Canyon
  - 2 dams: Main and Auxiliary
  - 73-acre reservoir
- Rhinedollar Dam and Ellery Lake
  - Tioga and Saddlebag drain into here
  - 61-acre reservoir
- Poole powerhouse
  - 11.25 megawatts
- Flowline and penstock connect in Ellery Lake and Poole Powerhouse

Water Management

Water Management

- Minimum flows below each reservoir depend on type of hydrologic year (wet, dry, normal)
- Historic contract (sales agreement) dictates annual storage and release – SCE has no control over what happens to the water once it leaves the Project
- Water rights below the Project on Lee Vining Creek belong to LADWP and managed through a settlement agreement to allocate water between the Los Angeles Aqueduct System (beginning at LADWP diversion ~5 mi downstream of Poole Powerhouse)

Project Operations

Operations, Instream Flows

- SCE provides minimum flow releases consistent with current FERC license
- Below Saddlebag Dam
  - Flows for Lee Vining Creek below Saddlebag Dam are determined bi-annually in consultation with the USFS
  - Typical:
  - 14 cubic feet per second (cfs) for wet years
  - 9 cfs for average years
  - 6 cfs for dry years
- Below Tioga Dam
  - From December to April: equal to the natural inflow
  - October and November: 2 cfs or natural inflow
  - May to September: depends on water year and inflow
  - License provides for spring-time cutting of “Ice dams” to prevent downstream property damage
- Below Poole Powerhouse Dam
  - August – May: 27 cfs or the natural flow, whichever is less
  - June and July: 89 cfs or natural flow, whichever is less

Project Operations (continued)

- Poole Powerhouse is used to respond to California Public Utility Commission (CPUC) and CAL ISO demands for power:
  - Demands can be market driven (i.e., energy and renewable load)
  - Can also be response to need for grid and electrical stability to Mono Basin when the source transmission line is de-energized (38 times in 2021 to date)
- When this happens, additional flows are released into Lee Vining Creek to respond to generation requirements

Project Operations (continued)

- Data is not available to easily describe the frequency and magnitude of these
  - They generally last less than 8 hours.
  - Using available data from the downstream LADWP diversion, SCE has estimated that these events are influenced by time of year with higher frequency of events occurring in the winter and spring.
- SCE is proposing to continue Hydro-Resource Optimization in the new license term, and will be characterizing the frequency, magnitude, and duration of these events for the new license along with reviewing potential Project effects.

Questions?

10-minute Break

Overview of Existing Information (PAD findings), Potential Environmental Effects, and Study Plans

Resource Sections (PAD section 5.1-5.13)

Geology and Soils,
Water, &
Fish and Aquatics

Botanical,
Upland Wildlife and Habitat,
Floodplains and Wetlands, &
Rare, Threatened, and Endangered (RTE) Species

Recreation,
Land Use, &
Aesthetics

Cultural & Tribal

PAD Section 6 Overview

Section 6 of the PAD includes:

- A table that describes potential issues and how they may be addressed
- A list of all proposed studies
- A table that describes potential issues that SCE doesn't think warrant a study, rationale as to why, and how some of these questions could be addressed
- References to Appendix that has the draft studies

Geology and Soils Summary

- Saddlebag Lake: within a glacially carved U-shaped valley, 1,200-foot ridges bound the lake on the east and west sides, and talus
- Tioga Lake: in a valley on glacial till with a scattering of rounded rock outcrops.
- Ellery Lake: rocky shoreline with several areas of talus slopes entering the lake from the steep terrain along southern margin.

- Soils: generally thin, limited by harsh environment and recent glaciation; generally coarse-textured, well-drained, and low in organic matter
- Landslides or other mass movements not mapped in Project vicinity; potential for mass wasting, but information limited
- Erosion Control Plan in place for ground-disturbing activities

Water Quality

- Regional water board water quality standards for Project reservoirs and Lee Vining Creek, none for Glacier Creek
- Water quality is generally excellent, but information is limited
- Major nutrient concentrations typically very low
- Ammonium and orthophosphate occasionally elevated in and below dams in spring and fall, in conjunction with reduced DO in reservoirs
- Water quality downstream of Poole PH recorded by SWAMP surveys also good: high DO, low turbidity, low mineral concentrations
- Water temperatures low; DO high in fish surveys
- Fecal coliform bacteria concentrations measured below Poole PH were low, elevated upstream of LADWP diversion
- Dreissenid mussels not expected to invade due to low calcium concentrations and circumneutral pH

Tioga Lake

Fish and Aquatics Summary

Fish Overview

- Project area dominated by non-native populations of brown, brook, and rainbow trout
  - Brown trout introduced in basin in 1919, planted regularly until 1942
  - Brook trout introduced in 1931
  - Unmarked, catchable rainbow trout planted annually beginning in 1942; currently planted annually in all three project reservoirs
- CDFW records available from 2015 - 2016 indicate ~47k lbs of trout stocked in Project waters

Rainbow trout

Fish and Aquatics Summary (continued)

Lee Vining Creek below Saddlebag Dam

Fish Population Monitoring

- Multiple years of surveys conducted between Saddlebag Dam and Ellery Lake:
  - 1984, 1986, 1999, 2000, 2001, 2006, 2011, and 2016
  - No native species documented
  - Biomass highest below Saddlebag Dam (8.3 g/m^2) and upstream of Ellery Lake (7.2 g/m^2)
  - 2016 data indicate typical length-frequency and age-class distributions for brown and brook trout
  - Fish in good condition
- Trout biomass downstream of Poole Powerhouse (6.7 g/m^2) documented in the 1980s
- Surveys not known to have occurred in Lee Vining Creek between Ellery Lake and Poole Powerhouse, Glacier Creek below Tioga Dam, or in Project Reservoirs.

Fish and Aquatics Summary (continued)

Aquatic Habitat Monitoring

Lee Vining Creek Below Poole Powerhouse

- Instream flow study (1992) found trout habitat is maximized:
  - Saddlebag Dam to Slate Ck.: 15-25 cfs
  - Slate Ck. to Ellery Lake: 20-40 cfs
  - Below Poole PH: 30-40 cfs
- Aquatic habitat monitoring conducted between Saddlebag Dam and Slate Creek
  - Surveyed in 1999, 2000, 2001, 2006, 2011, and 2016
  - Recorded abundant spawning gravels, loosely compacted sediments in low gradient areas, occasional LWD
- Habitat mapping between Saddlebag Dam and Ellery Lake, conducted 1984 – 86, to be included in FLA
  - Begins as moderate-gradient riffle, transitions to low-gradient braided channel, then broad riffle/run
- Monitoring not known in Lee Vining Creek downstream of Rhinedollar Dam or in Glacier Creek below Tioga Dam.

Fish and Aquatics Summary (continued)

Benthic Macroinvertebrates

- Data available in Lee Vining Creek
  - —Below Saddlebag and Ellery lakes
  - —Leakage zone below Saddlebag Dam
  - —Downstream of Poole PH
- Data available in Glacier Creek below Tioga Dam
- California Stream Condition Index (CSCI) Data
  - —Below Poole PH in two locations
  - —Downstream of Warren Fork confluence (CSCI = 1.17); Moraine Camp (CSCI = 1.09)
- BMI communities downstream of Project reservoirs similar to nearby natural lakes
- *Didymo* reportedly observed in Lee Vining Creek downstream of Saddlebag Dam

Glacier Creek

Geology, Soils, Water, Fish, and Aquatics – Potential Effects

- Potential to alter water quality in reservoirs and Project streams
- Potential to affect condition of recreational fisheries within Project reservoirs and streams
- Potential to affect quantity and quality of aquatic habitat for fish populations within Project streams
- Colonization of stream reaches by invasive aquatic species including Didymo have the potential to modify aquatic habitat
- Potential to affect fluvial processes and channel morphology downstream of Poole Powerhouse to the LADWP Diversion
- Potential to affect stream hydrology and resource conditions downstream of Poole Powerhouse

Geology, Soils, Water, Fish, and Aquatics - Proposed Studies

Aquatic TWG met four times and the following studies were developed to address the potential Project effects:

- Stream and Reservoir Water Quality
- Reservoir Fish Populations
- Stream Fish Populations
- Aquatic Habitat Mapping and Sediment Characterization
- Aquatic Invasive Plants
- Lower Lee Vining Creek Channel Morphology
- Operations Model

Questions?

Terrestrial and Botanical Resources

Belding's Ground Squirrel at Saddlebag Lake, 2018

Existing Data

- State and Federal Database Reviews
- SCE Biological Surveys and Riparian Monitoring Reports
- License Compliance Documents
- USFS Data and Publications
- Scientific Literature

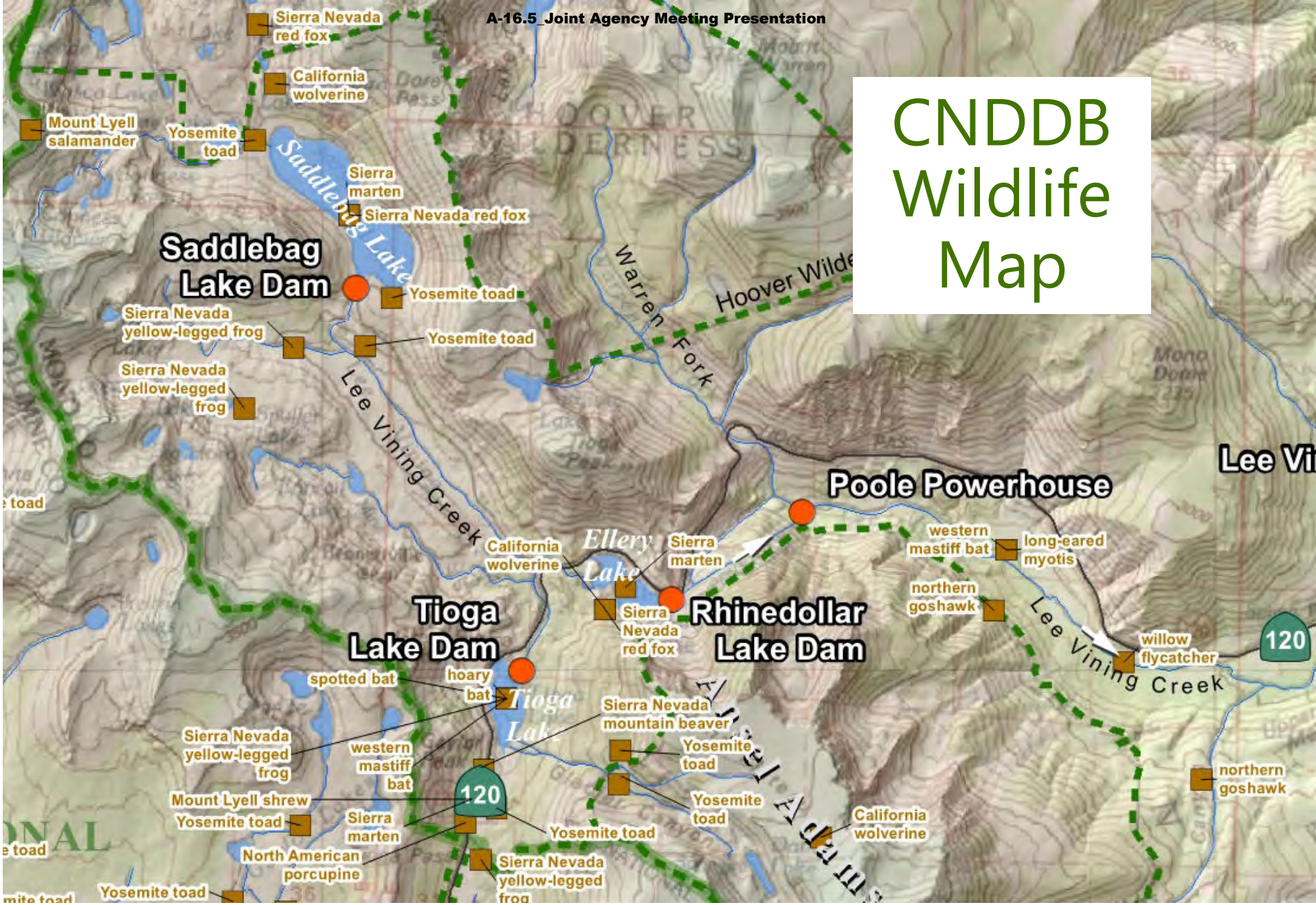
Terrestrial and Botanical Resources

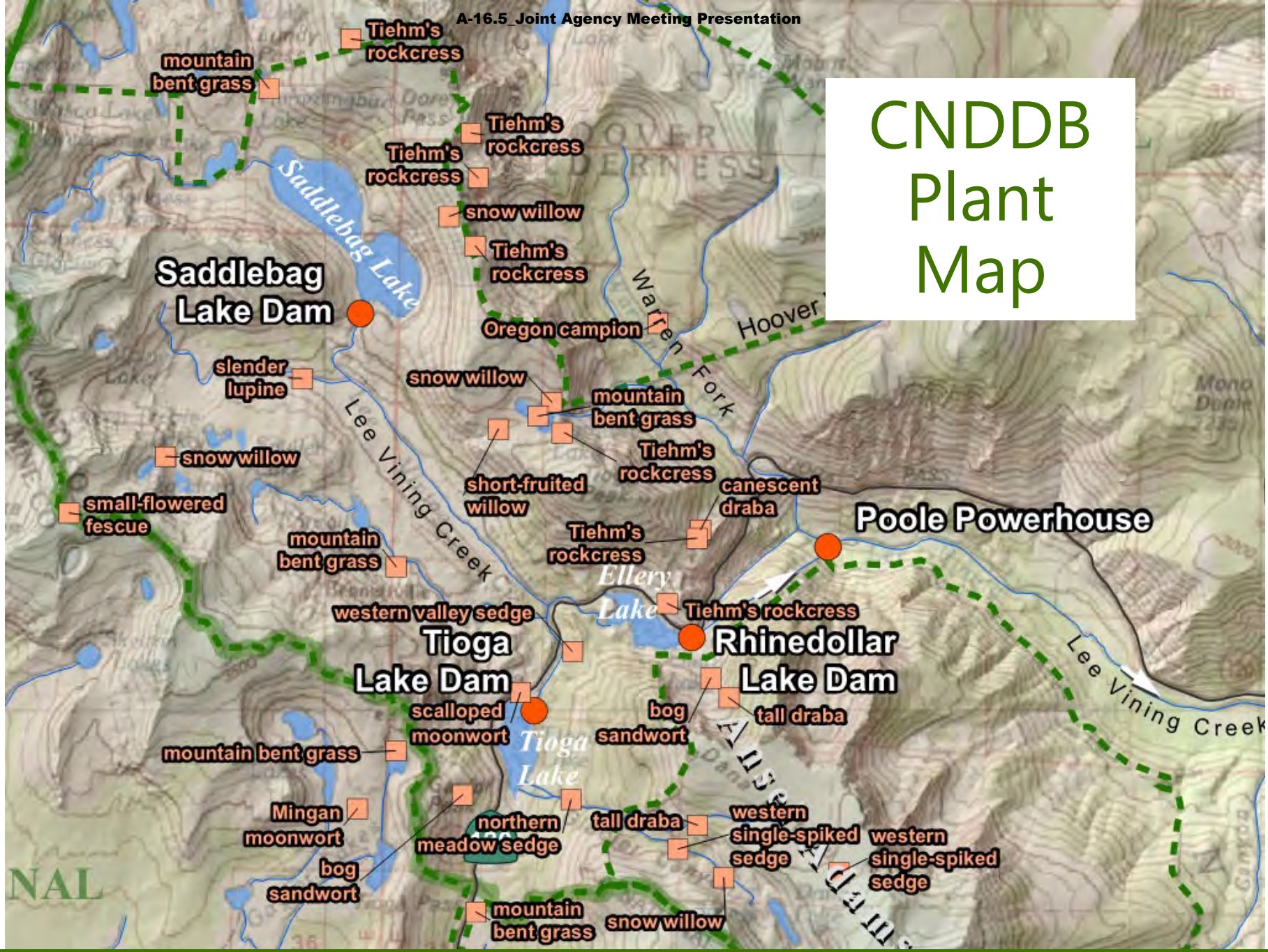
Yosemite Toad at Saddlebag Lake, 2020

Existing Environment

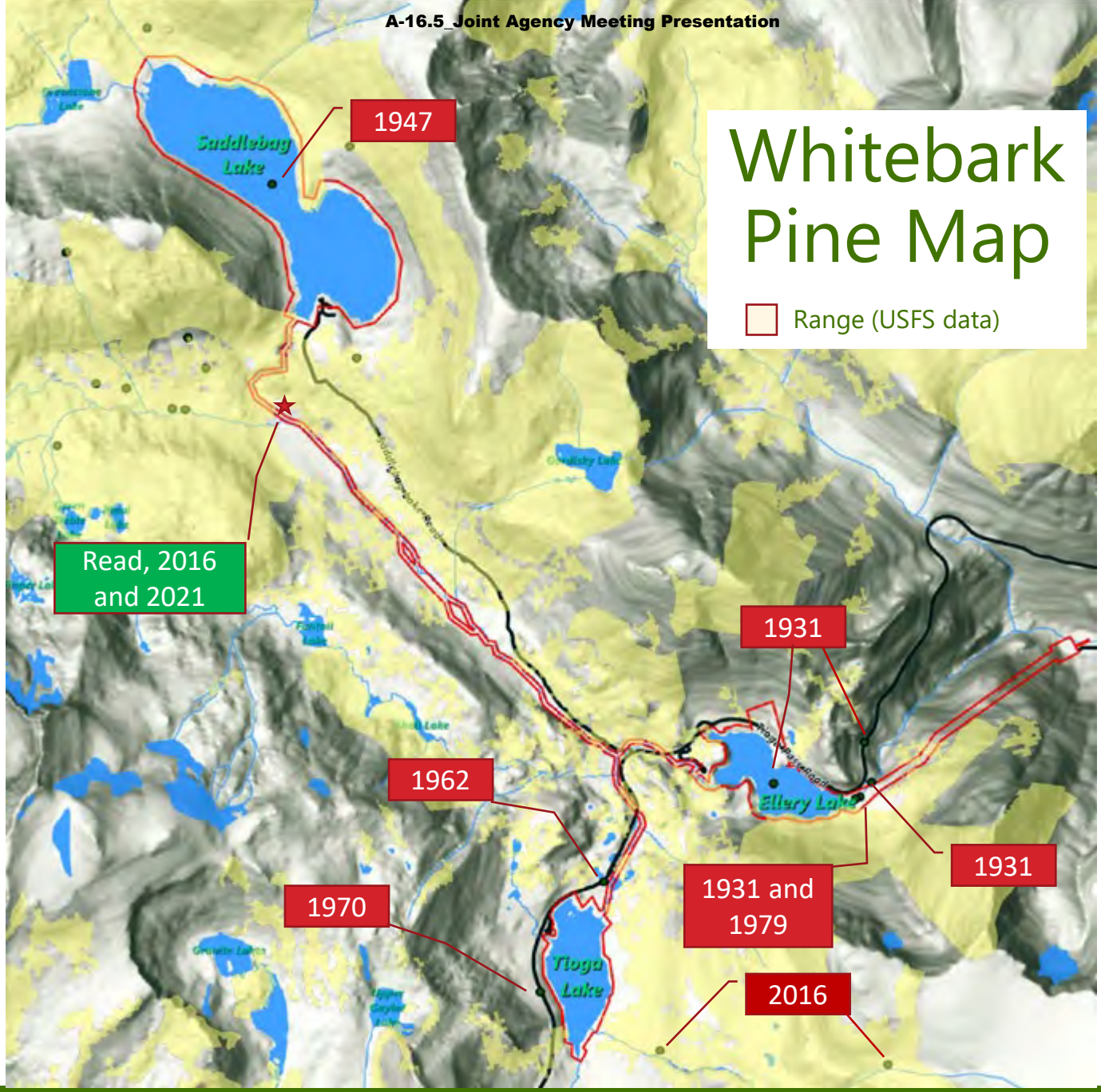
- 14 Vegetation Types Remotely Mapped within Project Area
  - Ranging from wet meadows to scrub to forested areas with riparian and conifer-dominated communities.
  - Provide a wide range of habitats for wildlife.
- Special Status Species Present
  - Yosemite toad
  - Whitebark pine
- Critical Habitat
  - Yosemite toad
  - Sierra Nevada yellow-legged frog
  - Sierra Nevada bighorn sheep

CNDDB Wildlife Map

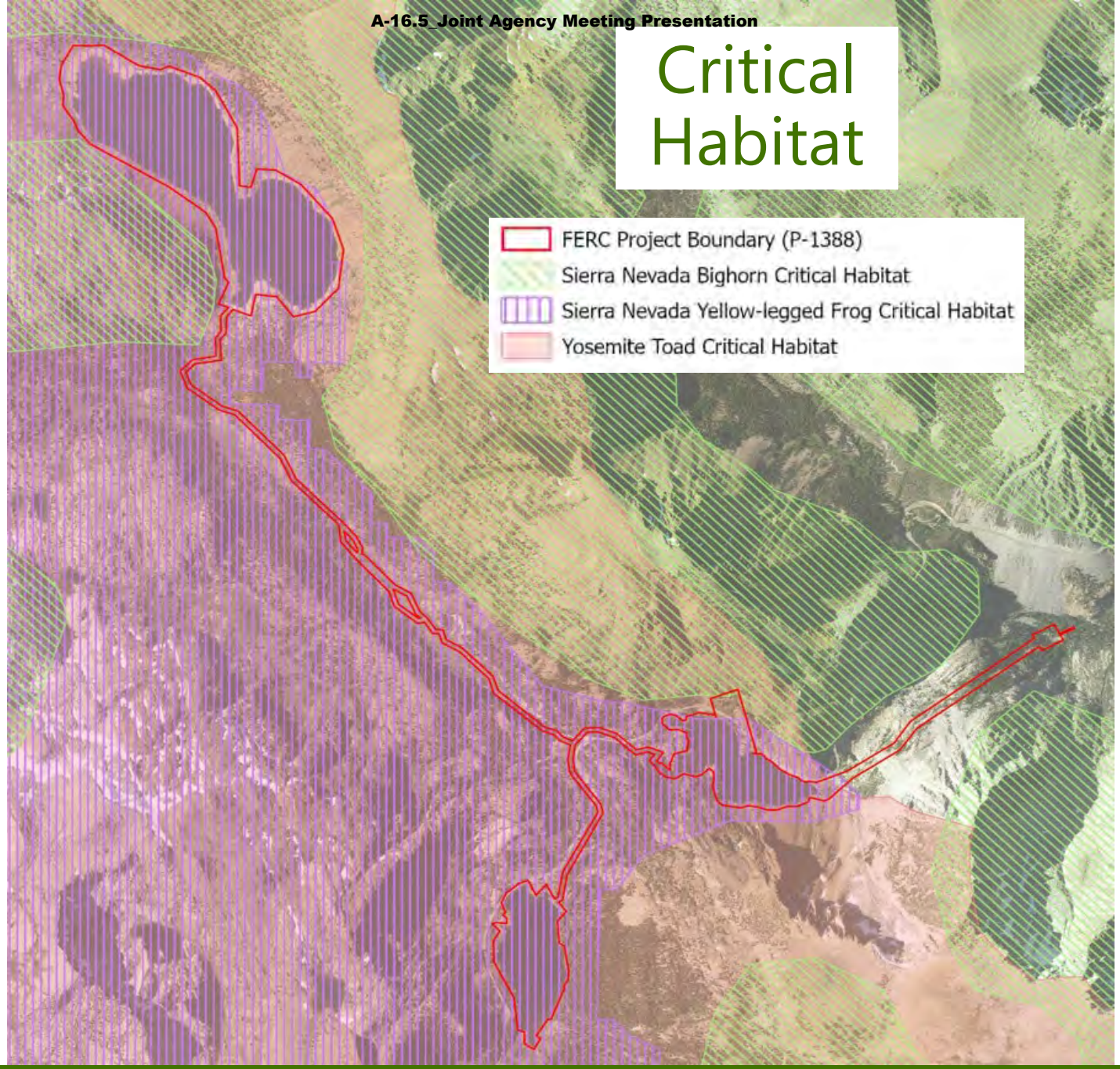




CNDDB Plant Map


Whitebark Pine Map
Range (USFS data)
1947
Saddlebag Lake
Read, 2016 and 2021
1931
1962
Ellery Lake
1931
1931 and 1979
1970
Tioga Lake
2016

Critical Habitat



Terrestrial, Botanical, Wetlands, and RTE Species – Potential Effects

- Project operation and maintenance activities could result in direct and/or indirect effects on sensitive natural communities (including riparian areas), listed plant or wildlife species, or other special status plant or wildlife species.
- Project operation and maintenance activities could result in the spread of introduction of invasive plants.

Terrestrial, Botanical, Wetlands, and RTE Species - Proposed Studies

- Botanical Surveys at Project Facilities
  - RTE species surveys
  - Non-listed special status plant species
  - Invasive species surveys
  - Ground-truth existing USFS vegetation map
- Wildlife
  - General wildlife surveys
  - Yosemite toad surveys
  - Willow flycatcher habitat assessment

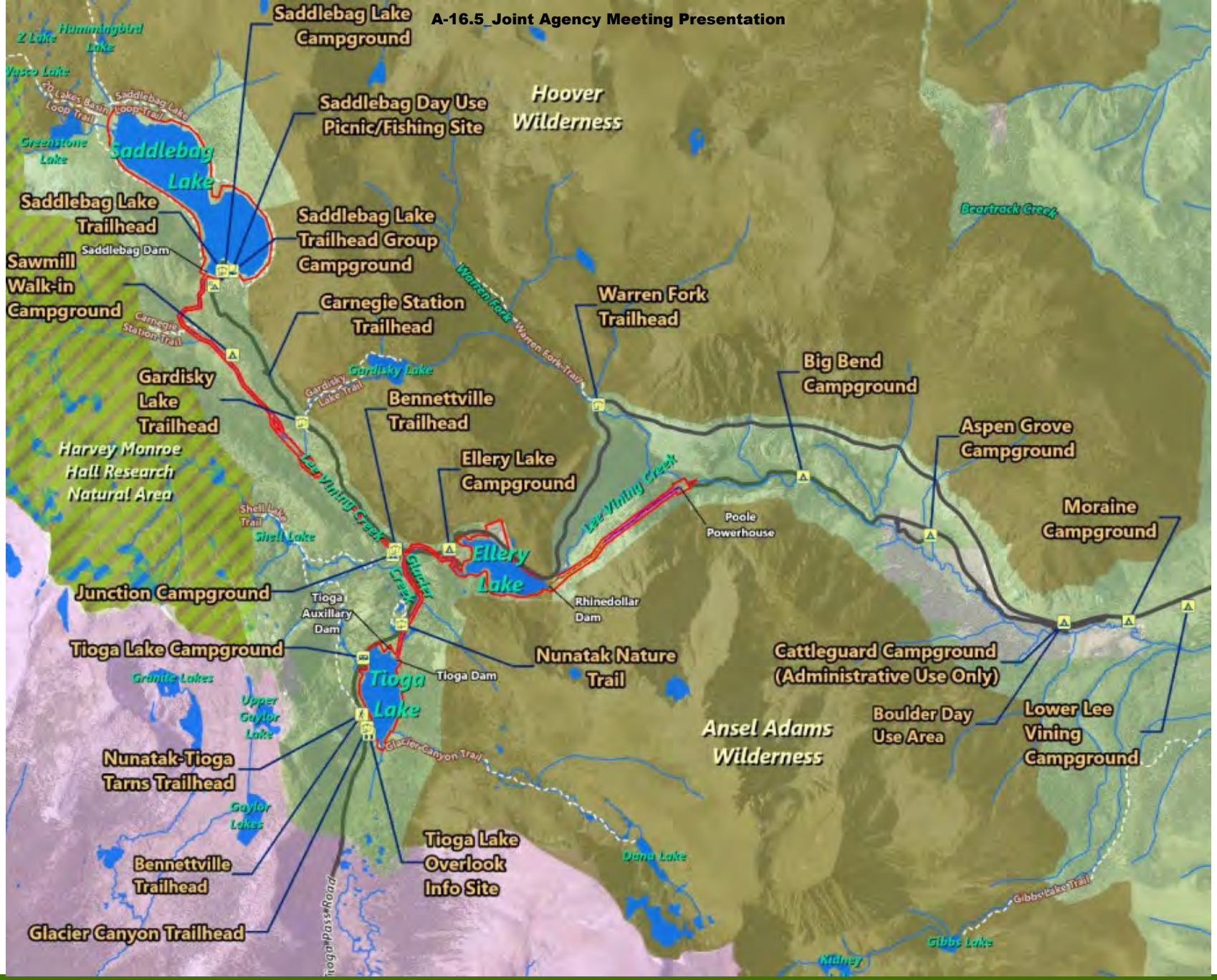
Questions?

Recreational Resources

Existing Environment

- No recreation sites or management plan included in current license.
- Indirect improvements in current license
  - Minimum instream flows (USFS 4e Condition No. 4; Articles 404 and 405)
  - Stable lake levels (USFS 4e Condition No. 6)
  - Annual funding for CDFW's fish stocking program at Ellery (Article 406)

Location	Recreation Site/Use	
Project Reservoirs (Saddlebag, Ellery, Tioga)	• Saddlebag Lake DUA, Campground, Trailhead • Tioga Lake Overlook Info Site, Tioga Lake Campground, Glacier Canyon Trailhead • Ellery Lake Campground • Informal use around reservoirs (camping, pull-outs, user trails)	
Facilities/Use along Lee Vining and Glacier Creeks; Saddlebag Lake and Poole Powerhouse Roads; and Highway 120	• Sawmill Walk-In Campground • Carnegie Station Trailhead • Junction Campground • Bennettville Trailhead • Gardisky Lake Trailhead • Nunatak-Tioga Tarns Trailhead • Nunatak Nature Trail • Warren Fork Trailhead	• Big Bend Campground • Aspen Grove Campground • Boulder Campground • Moraine Campground • Lower Lee Vining Campground • Cattleguard Campground • Informal use around creeks and other USFS facilities


Saddlebag Lake Campground
Hummingbird Lake
Z Lake
Yosco Lake
Saddlebag Lake Loop Trail
Saddlebag Day Use Picnic/Fishing Site
Hoover Wilderness
Greenstone Lake
Saddlebag Lake
Saddlebag Lake Trailhead
Saddlebag Lake Trailhead Group Campground
Saddlebag Dam
Sawmill Walk-in Campground
Carnegie Station Trail
Carnegie Station Trailhead
Warren Fork
Warren Fork Trail
Warren Fork Trailhead
Beartrack Creek
Big Bend Campground
Gardisky Lake
Gardisky Lake Trail
Gardisky Lake Trailhead
Bennettville Trailhead
Aspen Grove Campground
Harvey Monroe Hall Research Natural Area
Ellery Lake Campground
Lee Vining Creek
Poole Powerhouse
Moraine Campground
Shell Lake Trail
Shell Lake
Ellery Lake
Glacier Creek
Junction Campground
Tioga Auxillary Dam
Rhinedollar Dam
Tioga Lake Campground
Nunatak Nature Trail
Cattleguard Campground (Administrative Use Only)
Granite Lakes
Tioga Dam
Tioga Lake
Upper Gaylor Lake
Ansel Adams Wilderness
Boulder Day Use Area
Lower Lee Vining Campground
Nunatak-Tioga Tarns Trailhead
Glacier Canyon Trail
Gaylor Lakes
Tioga Lake Overlook Info Site
Bennettville Trailhead
Dana Lake
Tioga Pass Road
Gibbs Lake Trail
Gibbs Lake
Kidney
Glacier Canyon Trailhead

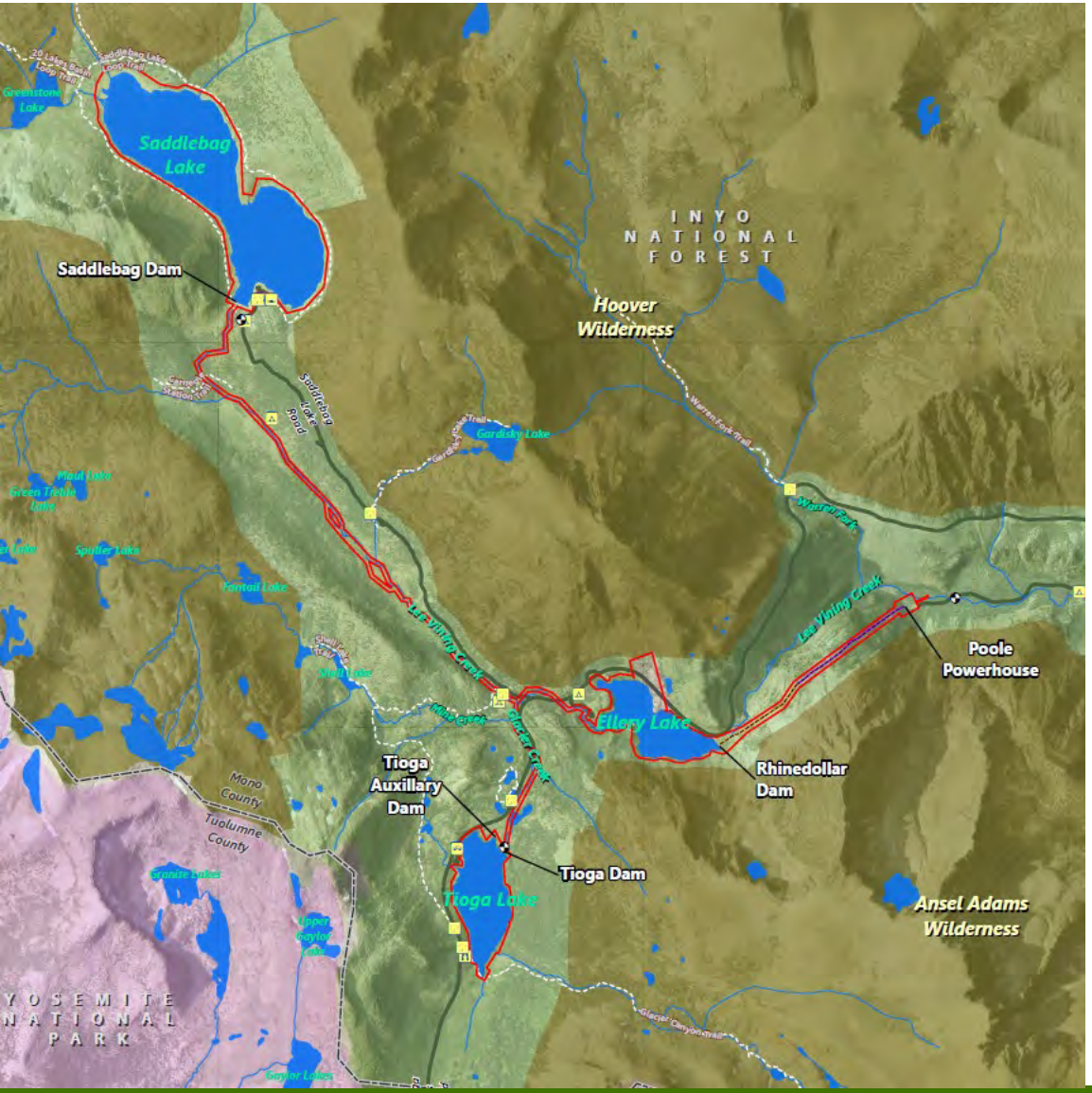
Recreation – Potential Effects

- Existing Project facilities and operations have the potential to promote incremental recreation use.
- Inyo National Forest owns and operates all recreation facilities in the upper Lee Vining Canyon
- Nexus to Project facilities will be assessed as part of proposed studies.

Recreation Proposed Studies

- Recreation Use and Needs Assessment
- Recreation Facilities Condition Assessment

Land Management and Use



Existing Environment

- Project boundary is currently 615.5 acres, tightly encompassing Project features (dams, reservoirs, flowlines, creeks):
  - USFS Lands: 96%
  - SCE Lands: 4%

Land Use & Aesthetics – Potential Effects

- FERC Project Boundary must encompass all lands, roads, and trails necessary for Project purposes, including the O&M of the Project over the term of the FERC license.
- Examples of Project land uses include:
  - Roads/trails providing exclusive access to Project facilities
  - Staging areas

Land Use & Aesthetics Resources: Potential Studies

- Project Boundary, Lands, and Roads
- Visual Quality Assessment

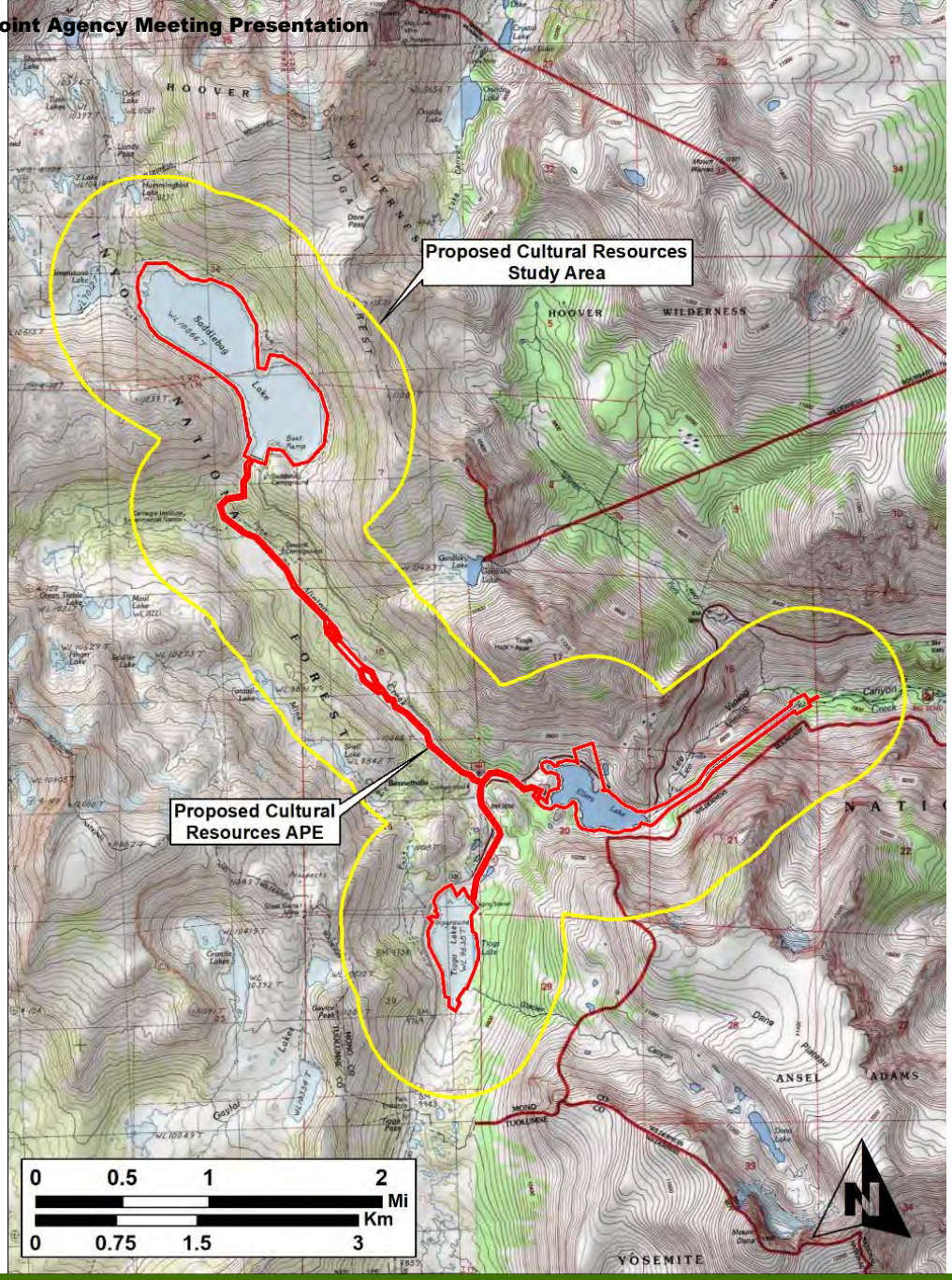
Questions?

Cultural and Tribal Resources

- Cultural Resource
  - A cultural resource can be a building, structure, object, site, or district, usually more than 50 years of age
- Tribal Resource
  - A Tribal resource may include cultural resources, economic interests, water interests, recreation interests, and may also include plants, animals, geological/geographic features, and more

Cultural Resources

- Proposed Area of Potential Effects (APE) is the FERC Boundary
- Study Area is a 0.5-mile buffer around APE



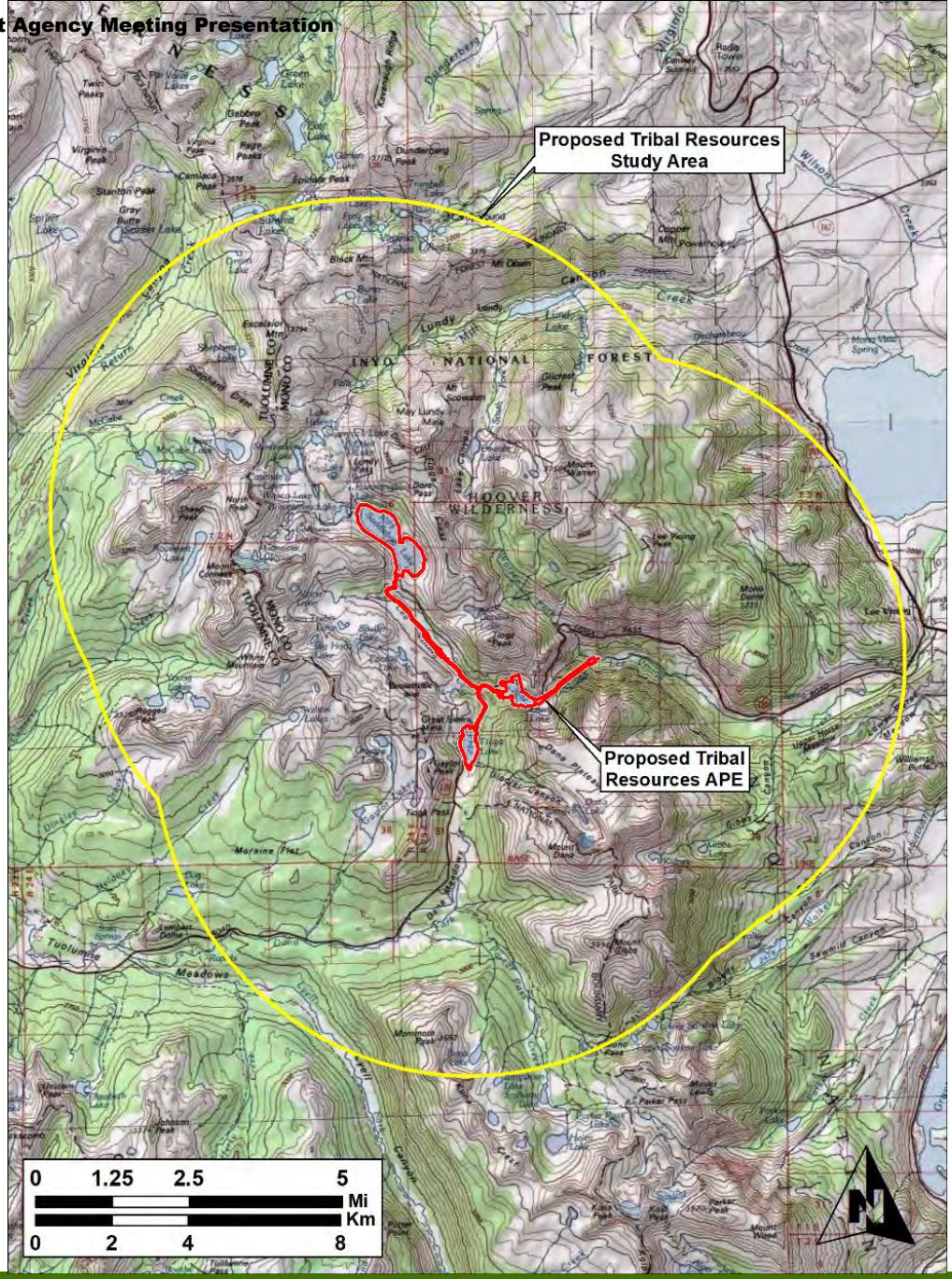
Cultural Resources

Existing Environment

- Data Sources - California Historical Resources Information Center, USFS, Previous Studies, SCE Historical Documents
- 19 previous studies
- 25 previously recorded built environment resources
    - Triple Cottage National Register eligible
- 5 previously recorded archaeological resources

Tribal Resources

- Proposed Area of Potential Effects (APE) is the FERC Boundary
- Study Area is a 5-mi buffer around APE



Tribal Resources

Existing Environment

- Multiple Native American Groups have an interest in the Project Area
  - Northern Paiute, Owens Valley Paiute, Western Shoshone, Southern Miwok, Central Me-Wuk, Hungalelti Washo, Western Mono
- Mono Lake Kutzadikaa Tribe are the principal tribal group
- Data Sources-accessible libraries, online resources, Native American Heritage Commission.
- No federal trust tribal lands in Project

Tribal Resources

Existing Environment

- Important Trans-Sierran Corridor, connecting multiple tribal groups
- Numerous trails identified in proposed Study Area
- Gathering locale especially important from May-October
- Excellent 20th-century information on Native Americans due to interviews in the 1920s, detailed history in the 1960s, and proximity to Yosemite Valley and its 150-year documentation of Native peoples.

Cultural and Tribal Resources

Known Data Gaps

- No recent archaeological survey of most of the Project area.
- No ethnographic study of the Project vicinity.
- No interviews to date with Tribal representatives.
- No study of how Project has affected tribal resources of interest.

Cultural and Tribal – Potential Effects

- Project operation and maintenance activities could result in direct and/or indirect effects on:
  - NRHP eligible built-environment, archaeological resources, and tribal resources
  - Other Tribal resources (not historic properties)
- Recreational activities could result in direct and/or indirect effects on:
  - NRHP eligible resources or other tribal resources

Cultural and Tribal - Proposed Studies

- Cultural Resources Study
  - Background Research
  - Pedestrian Survey
  - Archaeological Site Recordation and Evaluations
  - Built Environment Recordation and Evaluations
- Tribal Resources study
  - Background Research
  - Field Investigation with Tribal representatives
  - Interviews with Tribal representatives
  - Documentation and evaluation of Tribal resources

Questions?

RELICENSING SCHEDULE OVERVIEW

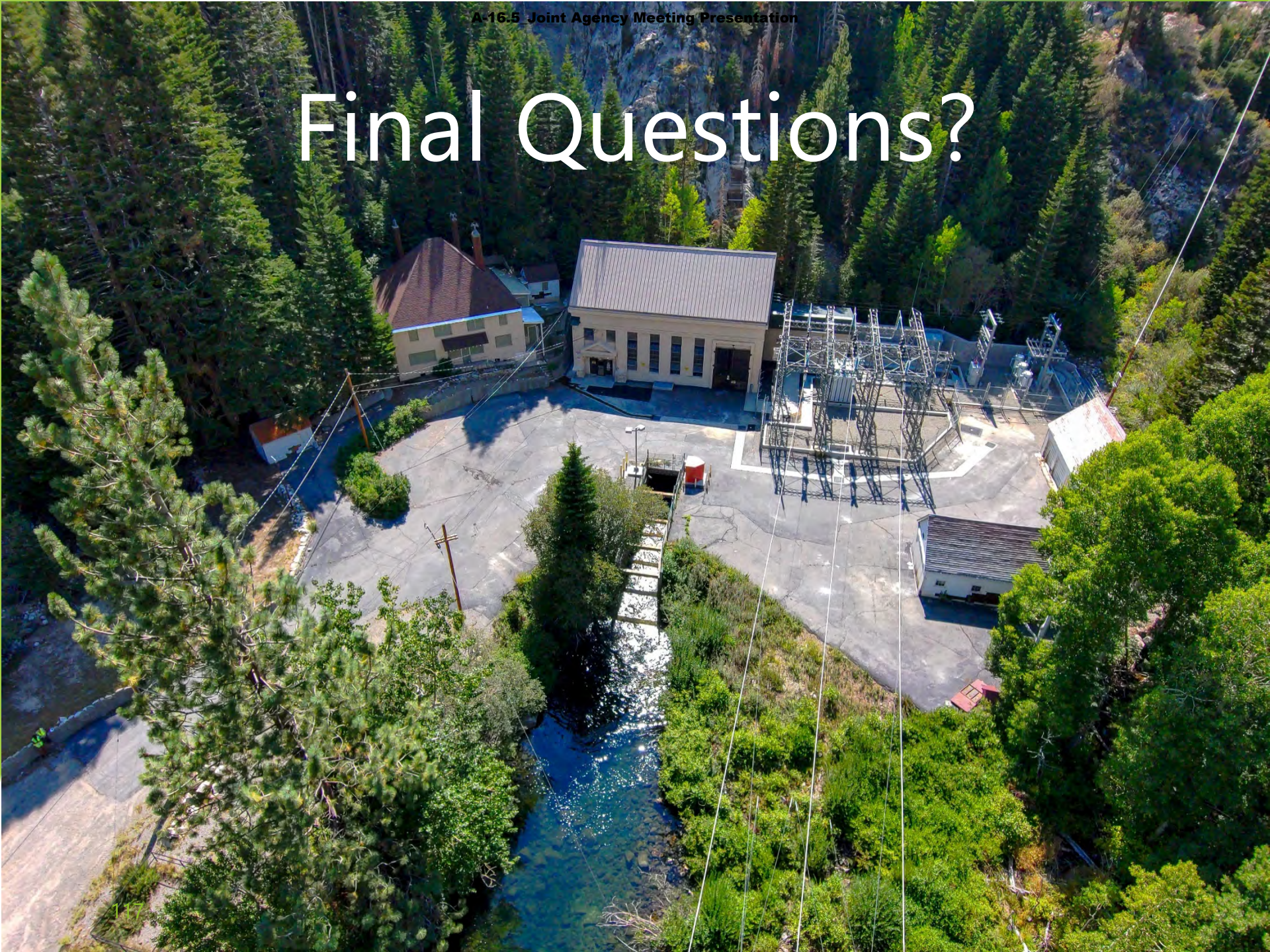
Relicensing Process Schedule

Date	Activity
August 12, 2021	SCE Filed Notice of Intent/Pre-Application Document (NOI/PAD)
September 2021	FERC initiates Tribal consultation
October 8, 2021	FERC approved use of TLP
November 16, 2021	**Joint Agency Meeting to discuss PAD, Study Plans and Process**
January 17, 2022	Comments due to FERC on PAD and Study Plans
February 14, 2022	*SCE provide Updated Study Plans to stakeholders and TWGs*
March 16, 2022	*Comments due to SCE on Study Plans*
March/April 2022	*Study Plan Meetings with TWGs*
April 15, 2022	*Final Study Plans to TWGs*
Spring/Summer 2022-2023	Conduct field studies
January 2023	*Interim Study Report meeting*
September 3, 2024	SCE Files Draft License Application
January 31, 2025	SCE Files Final License Application

How to Stay Involved

- Check the Project website for updates/news at www.sce.com/leevining
- You can view other SCE relicensing Projects at www.sce.com/regulatory/hydro-licensing
- Sign-up to receive Project-related emails through the Contact Registration Form/Project Questionnaire on the Project website
- Sign up for FERC's for e-subscription (docket number "P-1388") at www.ferc.gov
- Email Carissa Shoemaker with questions carissa.shoemaker@erm.com

Final Questions?



Thank you!

A-17.1_Botanical data and reports provided to CDFW, USFS

From: Moyer, Patricia (Trisha)@Wildlife
To: Carissa Shoemaker
Subject: RE: [External Email]Lee Vining Joint Agency Meeting
Date: Monday, November 22, 2021 10:35:34 AM
Attachments: image001.jpg
image002.png
image003.png

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Thank you!
Trisha A. Moyer
CDFW- Desert Inland Region 6
Habitat Conservation Program Supervisor
787 North Main Street Suite 220
Bishop, CA 93514
(760) 835-4304

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Monday, November 22, 2021 9:29 AM
To: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; sheila.irons@usda.gov
Subject: RE: [External Email]Lee Vining Joint Agency Meeting

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Hi Rick and Trisha,
The botanical reports you requested below are saved at this link for sharing around. We are also compiling historic data and GIS shape files, but that will take us a little time to complete.
Lee Vining PAD Resources
Thanks!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Sent: Wednesday, November 17, 2021 7:47 AM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Adam Cohen <acohen@stillwatersci.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; apcohen@umail.ucsb.edu; ARoesberry@caltrout.org; Audry.Williams@sce.com; bartshe@monolake.org; bbell@co.tuolumne.ca.us; bblood@psomas.com; bburman@usbr.gov; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; bryan.hatchell@colorado.edu; calweb@tnc.org; cdaly@mackaysposito.com; Chad_Mellison@fws.gov; chair@toiyabe.sierraclub.org; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; cknight@caltrout.org; claire@monolake.org; comdev@mono.ca.gov; conservation@bristleconecnps.org; cshutes@calsport.org; curator@monobasinhistory.org; Sussman, Daniel@Waterboards <daniel.sussman@waterboards.ca.gov>; Yarborough, Daniel -FS <daniel.yarborough@usda.gov>; Alvarez, Dawn -FS <dawn.alvarez@usda.gov>; dfjohnso@blm.gov; easternsierraartist@gmail.com; Hancock, Ed@Waterboards <Ed.Hancock@waterboards.ca.gov>; eric.tillemans@ladwp.com; eric@friendsoftheriver.org; events@mammothmuseum.org; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; frontierpacktrain@gmail.com; gardenofegan@suddenlink.net; geoff@monolake.org; ghaverst@blm.gov; gordon.martin@usda.gov; greg@monolake.org; GRoff@caltrout.org; heather@stillwatersci.com; holly@inyo-monowater.org; hydroesq@schat.net; info@friendsoftheinyo.org; info@monolake.org; INFO@ROCKCREEKPACKSTATION.COM; Beidl, Jacqueline -FS <jacqueline.beidl@usda.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; jenny@sierranevadaalliance.org; jkrclr@gmail.com; jmharty@kearnswest.com; johnwentworth@mltpa.org; jonklusmire@yahoo.com; jora@friendsoftheinyo.org; jstrickland@tu.org; justin_barrett@fws.gov; Schlick, Kary -FS <kary.schlick@usda.gov>; katie@accessfund.org; kelly.henderson@sce.com; Kelly.Larimer@KleinschmidtGroup.com; kquinlan16@gmail.com; Reif, Lawson -FS <lawson.reif@usda.gov>; Lizbergeron <lbergeron@pcta.org>; lcompas@hrassoc.com; lisa@monolake.org; lprimosc@blm.gov; markbagley02@gmail.com; marshmistress@msn.com; Martin Ostendorf <Martin.Ostendorf@sce.com>; maryroper51@gmail.com; Driscoll, Matt@SNC <Matt.Driscoll@sierranevada.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matt Paruolo <mparuolo@mammothlakesrecreation.org>; Mparuolo@mono.ca.gov; naomi@teambishop.com; nate@esavalanche.org; office@esavalanche.org; Sill, Nathan -FS <nathan.sill@usda.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>;

nicolas.von@sce.com; Gamino, Nora -FS <nora.gamino@usda.gov>; nosmog@yahoo.com; Paul.Pau@ladwp.com; paulR4shopping@verizon.net; pgunsolley@gmail.com; Philipana@aol.com; pmcfarland395@gmail.com; president@esaudubon.org; pstickells@gmail.com; rcollins@caltrout.org; robbie@monolake.org; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; saddlebaglake@gmail.com; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; seth.carr@sce.com; shawna_theisen@fws.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; shellydk@frontiernet.net; SJacobson@caltrout.org; stephen_bowes@nps.gov; steve.norton@psomas.com; Parmenter, Steve@Wildlife <Steve.Parmenter@wildlife.ca.gov>; talpaugh@kearnswest.com; Torres, Thomas - FS <thomas.torres@usda.gov>; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; Ellsworth, Todd - FS <todd.ellsworth@usda.gov>; Leong, Tristan -FS <tristan.leong@usda.gov>; Aguirre orozco, Victor - FS <victor.aguirreorozco@usda.gov>; wendy@friendsoftheinyo.org; wsugimura@mono.ca.gov; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Lyle Laven <Lyle.Laven@sce.com>; Charles.partridge@sce.com; vince.white@sce.com

Cc: Jessica Strickland <Jessica.Strickland@tu.org>; falconkeeper22@gmail.com; Tilford Denver <tilford.denver@bishoppaiute.org>; Barbara Durham <thpo@timbisha.com>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; claymiwumati@gmail.com; brha8857@colorado.edu; Serrell Smokey <Serrell.Smokey@washoetribe.us>; Heller, Stephanie -FS <stephanie.heller@usda.gov>; slrapp@ucsc.edu; lilian_jonas@contractor.nps.gov; Wiese, Michael - FS, Bishop, CA <michael.wiese@usda.gov>; Moore, Erin - FS, BISHOP, CA <Erin.Moore@usda.gov>; Brandon.Kulik@KleinschmidtGroup.com; LTryba@kearnswest.com; Bret Hoffman <Bret.Hoffman@KleinschmidtGroup.com>; blancapaloma@msn.com; Ashley Overhouse <ashley@friendsoftheriver.org>; Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>; North, Jill@Waterboards <Jill.North@waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>; Joshua Fritz <Joshua.Fritz@erm.com>

Subject: RE: [External Email]Lee Vining Joint Agency Meeting

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Carissa, please include CDFW when you distribute these reports.

Thank you,

Trisha

Trisha A. Moyer

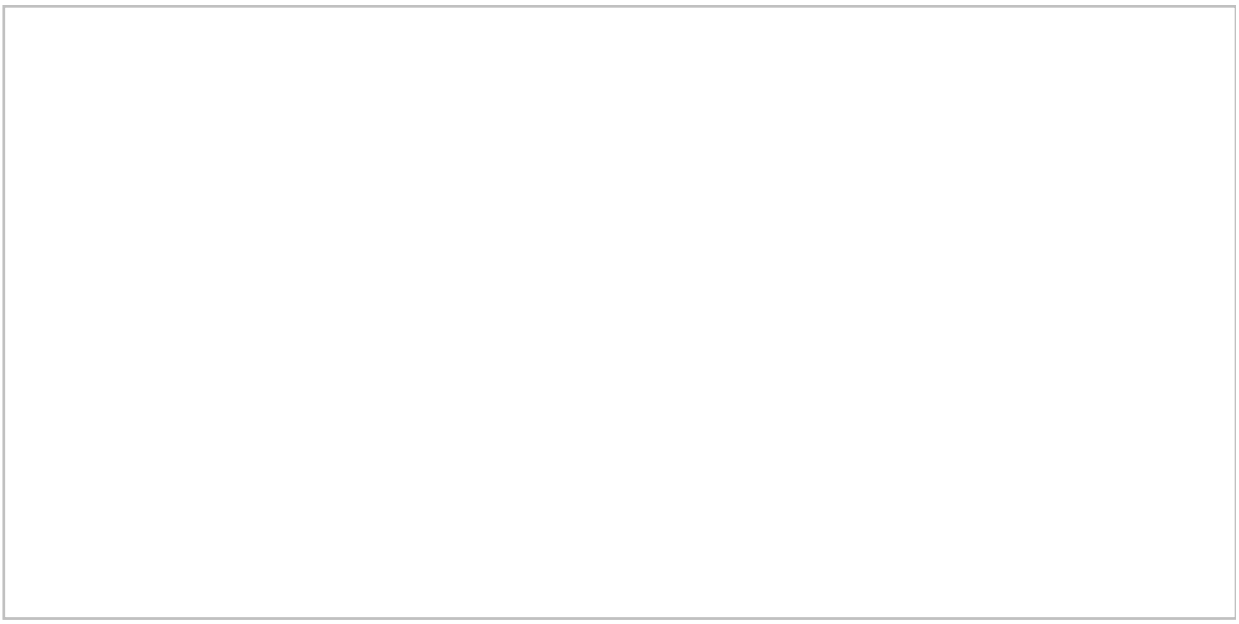
CDFW- Desert Inland Region 6

Habitat Conservation Program Supervisor

787 North Main Street Suite 220

Bishop, CA 93514

(760) 835-4304



From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, November 17, 2021 7:10 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Adam Cohen <acohen@stillwatersci.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; apcohen@umail.ucsb.edu; ARoesberry@caltrout.org; Audry.Williams@sce.com; bartshe@monolake.org; bbell@co.tuolumne.ca.us; bblood@psomas.com; bburman@usbr.gov; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; bryan.hatchell@colorado.edu; calweb@tnc.org; cdaly@mackaysposito.com; Chad_Mellison@fws.gov; chair@toiyabe.sierraclub.org; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; cknight@caltrout.org; claire@monolake.org; comdev@mono.ca.gov; conservation@bristleconecnps.org; cshutes@calsport.org; curator@monobasinhistory.org; Sussman, Daniel@Waterboards <daniel.sussman@waterboards.ca.gov>; Yarborough, Daniel -FS <daniel.yarborough@usda.gov>; Alvarez, Dawn -FS <dawn.alvarez@usda.gov>; dfjohnso@blm.gov; easternsierraartist@gmail.com; Hancock, Ed@Waterboards <Ed.Hancock@waterboards.ca.gov>; eric.tillemans@ladwp.com; eric@friendsoftheriver.org; events@mammothmuseum.org; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; frontierpacktrain@gmail.com; gardenofegan@suddenlink.net; geoff@monolake.org; ghaverst@blm.gov; gordon.martin@usda.gov; greg@monolake.org; GRoff@caltrout.org; heather@stillwatersci.com; holly@inyo-monowater.org; hydroesq@schat.net; info@friendsoftheinyo.org; info@monolake.org; INFO@ROCKCREEKPACKSTATION.COM; Beidl, Jacqueline -FS <jacqueline.beidl@usda.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; jenny@sierranevadaalliance.org; jkrclr@gmail.com; jmharty@kearnswest.com; johnwentworth@mltpa.org; jonklusmire@yahoo.com; jora@friendsoftheinyo.org; jstrickland@tu.org; justin_barrett@fws.gov; Schlick, Kary -FS <kary.schlick@usda.gov>; katie@accessfund.org; kelly.henderson@sce.com; Kelly.Larimer@KleinschmidtGroup.com; kquinlan16@gmail.com; Reif, Lawson -FS

<lawson.reif@usda.gov>; Lizbergeron <lbergeron@pcta.org>; lcompas@hrassoc.com; lisa@monolake.org; lprimosc@blm.gov; markbagley02@gmail.com; marshmistress@msn.com; martin.ostendorf@sce.com; maryroper51@gmail.com; Driscoll, Matt@SNC <Matt.Driscoll@sierranevada.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matt Paruolo <mparuolo@mammothlakesrecreation.org>; Mparuolo@mono.ca.gov; naomi@teambishop.com; nate@esavalanche.org; office@esavalanche.org; Sill, Nathan -FS <nathan.sill@usda.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; nicolas.von@sce.com; Gamino, Nora -FS <nora.gamino@usda.gov>; nosmog@yahoo.com; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; Paul.Pau@ladwp.com; paulR4shopping@verizon.net; pgunsolley@gmail.com; Philipana@aol.com; pmcfarland395@gmail.com; president@esaudubon.org; pstickells@gmail.com; rcollins@caltrout.org; robbie@monolake.org; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; saddlebaglake@gmail.com; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; seth.carr@sce.com; shawna_theisen@fws.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; shellydk@frontiernet.net; SJacobson@caltrout.org; stephen_bowes@nps.gov; steve.norton@psomas.com; Parmenter, Steve@Wildlife <Steve.Parmenter@wildlife.ca.gov>; talpaugh@kearnswest.com; Torres, Thomas - FS <thomas.torres@usda.gov>; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; Ellsworth, Todd - FS <todd.ellsworth@usda.gov>; Leong, Tristan -FS <tristan.leong@usda.gov>; Aguirre orozco, Victor - FS <victor.aguirreorozco@usda.gov>; wendy@friendsoftheinyo.org; wsugimura@mono.ca.gov; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Lyle Laven <Lyle.Laven@sce.com>; Charles.partridge@sce.com; vince.white@sce.com

Cc: Jessica Strickland <Jessica.Strickland@tu.org>; falconkeeper22@gmail.com; Tilford Denver <tilford.denver@bishoppaiute.org>; Barbara Durham <thpo@timbisha.com>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; claymiwumati@gmail.com; brha8857@colorado.edu; Serrell Smokey <Serrell.Smokey@washoetribe.us>; Heller, Stephanie -FS <stephanie.heller@usda.gov>; slrapp@ucsc.edu; lilian_jonas@contractor.nps.gov; Wiese, Michael - FS, Bishop, CA <michael.wiese@usda.gov>; Moore, Erin - FS, BISHOP, CA <Erin.Moore@usda.gov>; Brandon.Kulik@KleinschmidtGroup.com; LTryba@kearnswest.com; Bret Hoffman <Bret.Hoffman@KleinschmidtGroup.com>; blancapaloma@msn.com; Ashley Overhouse <ashley@friendsoftheriver.org>; Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>; North, Jill@Waterboards <Jill.North@waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>; Joshua Fritz <Joshua.Fritz@erm.com>

Subject: Re: [External Email]Lee Vining Joint Agency Meeting

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Hi Carissa
I did a quick read of the botany section of the PAD.
It mentions several reports,
Psomas biological survey reports (two reports prepared for SCE):
– Summary of Biological Resources Determination of No Effect on Listed Species for Southern California Edison Company's Tioga Lake Dams Geomembrane Liner Installation Project, Mono County, California (Psomas, 2013)
– Biological Resources Evaluation Technical Report for the Southern California Edison South Lake Dam, Agnew Lake Dam, Saddlebag Lake Dam, and Tioga Lake Dam, and Auxiliary Dam

Maintenance and Geo-Membrane Lining Projects (Psomas, 2010)
E. Read and Associates riparian monitoring reports:
− Lee Vining Creek (FERC No. 1388) Riparian, Aquatic Habitat, and Fish Population Monitoring: Phase 2 (Year 2) Compared to Baseline and 2006 (Read, 2012)
− Lee Vining Creek (FERC No. 1388) Riparian Monitoring Phase 2 Year 3 (2016) Compared to Previous Years (Read, 2017)
Environmental Assessment of Potential Cumulative Impacts Associated with Hydropower Development in the Mono Lake Basin, California (FERC Nos. 1388, 1389, 1390, 3259, and 3272) (FERC, 1990) A list of special status plant species was compiled
Could I please get copies of these reports, any raw data associated with botanical surveys and monitoring, and the spatial data for the FERC infrastructure and botanical surveys and monitoring.
Thank you
rick

Rick McNeill
Assistant Forest Botanist
Forest Service
Inyo National Forest
cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov
351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker
Sent: Friday, October 1, 2021 11:10
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Adam Cohen <acohen@stillwatersci.com>; adam.barnett@usda.gov <adam.barnett@usda.gov>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; allison.rudalevige@psomas.com <allison.rudalevige@psomas.com>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; apcohen@umail.ucsb.edu <apcohen@umail.ucsb.edu>; ARoesberry@caltrout.org <ARoesberry@caltrout.org>; Audry.Williams@sce.com <Audry.Williams@sce.com>; bartshe@monolake.org <bartshe@monolake.org>; bbell@co.tuolumne.ca.us <bbell@co.tuolumne.ca.us>; bblood@psomas.com <bblood@psomas.com>; bburman@usbr.gov <bburman@usbr.gov>; blake.engelhardt@usda.gov <blake.engelhardt@usda.gov>; Brandy.Wood@Wildlife.ca.gov <Brandy.Wood@Wildlife.ca.gov>; bryan.hatchell@colorado.edu <bryan.hatchell@colorado.edu>; calweb@tnc.org <calweb@tnc.org>; cdaly@mackaysposito.com <cdaly@mackaysposito.com>; Chad_Mellison@fws.gov

<Chad_Mellison@fws.gov>; chair@toiyabe.sierraclub.org <chair@toiyabe.sierraclub.org>; Chase.Hildeburn@Waterboards.ca.gov <Chase.Hildeburn@Waterboards.ca.gov>; cknight@caltrout.org <cknight@caltrout.org>; claire@monolake.org <claire@monolake.org>; comdev@mono.ca.gov <comdev@mono.ca.gov>; conservation@bristleconecnps.org <conservation@bristleconecnps.org>; cshutes@calsport.org <cshutes@calsport.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; daniel.sussman@waterboards.ca.gov <daniel.sussman@waterboards.ca.gov>; daniel.yarborough@usda.gov <daniel.yarborough@usda.gov>; dawn.alvarez@usda.gov <dawn.alvarez@usda.gov>; dfjohnso@blm.gov <dfjohnso@blm.gov>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; eric@friendsoftheriver.org <eric@friendsoftheriver.org>; events@mammothmuseum.org <events@mammothmuseum.org>; ferccaseadmin@sce.com <ferccaseadmin@sce.com>; FOMLR@bodiefoundation.org <FOMLR@bodiefoundation.org>; frontierpacktrain@gmail.com <frontierpacktrain@gmail.com>; gardenofegan@suddenlink.net <gardenofegan@suddenlink.net>; geoff@monolake.org <geoff@monolake.org>; ghaverst@blm.gov <ghaverst@blm.gov>; gordon.martin@usda.gov <gordon.martin@usda.gov>; greg@monolake.org <greg@monolake.org>; GRoff@caltrout.org <GRoff@caltrout.org>; heather@stillwatersci.com <heather@stillwatersci.com>; holly@inyo-monowater.org <holly@inyo-monowater.org>; hydroesq@schat.net <hydroesq@schat.net>; info@friendsoftheinyo.org <info@friendsoftheinyo.org>; info@monolake.org <info@monolake.org>; info@rockcreekpackstation.com <info@rockcreekpackstation.com>; Jacqueline.beidl@usda.gov <Jacqueline.beidl@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jennifer.watts@waterboards.ca.gov <jennifer.watts@waterboards.ca.gov>; jenny@sierranevadaalliance.org <jenny@sierranevadaalliance.org>; jkrclr@gmail.com <jkrclr@gmail.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>; johnwentworth@mltpa.org <johnwentworth@mltpa.org>; jonklusmire@yahoo.com <jonklusmire@yahoo.com>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; jstrickland@tu.org <jstrickland@tu.org>; justin_barrett@fws.gov <justin_barrett@fws.gov>; kary.schlick@usda.gov <kary.schlick@usda.gov>; katie@accessfund.org <katie@accessfund.org>; kelly.henderson@sce.com <kelly.henderson@sce.com>; Kelly.Larimer@KleinschmidtGroup.com <Kelly.Larimer@KleinschmidtGroup.com>; kquinlan16@gmail.com <kquinlan16@gmail.com>; Lawson.reif@usda.gov <Lawson.reif@usda.gov>; lbergeron@pcta.org <lbergeron@pcta.org>; lcompas@hrassoc.com <lcompas@hrassoc.com>; lisa@monolake.org <lisa@monolake.org>; lprimosc@blm.gov <lprimosc@blm.gov>; markbagley02@gmail.com <markbagley02@gmail.com>; marshmistress@msn.com <marshmistress@msn.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; maryroper51@gmail.com <maryroper51@gmail.com>; matt.driscoll@sierranevada.ca.gov <matt.driscoll@sierranevada.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com <Matthew.Harper@Kleinschmidtgroup.com>; megan.mullowney@usda.gov <megan.mullowney@usda.gov>; monique.sanchez@usda.gov <monique.sanchez@usda.gov>; mparuolo@mammothlakesrecreation.org <mparuolo@mammothlakesrecreation.org>; Mparuolo@mono.ca.gov <Mparuolo@mono.ca.gov>; naomi@teambishop.com <naomi@teambishop.com>; nate@esavalanche.org <nate@esavalanche.org>; office@esavalanche.org <office@esavalanche.org>; nathan.sill@usda.gov <nathan.sill@usda.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; nicolas.von@sce.com <nicolas.von@sce.com>; nora.gamino@usda.gov <nora.gamino@usda.gov>; nosmog@yahoo.com

<nosmog@yahoo.com>; Patricia.Moyer@Wildlife.ca.gov <Patricia.Moyer@Wildlife.ca.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; paulR4shopping@verizon.net <paulR4shopping@verizon.net>; pgunsolley@gmail.com <pgunsolley@gmail.com>; Philipana@aol.com <Philipana@aol.com>; pmcfarland395@gmail.com <pmcfarland395@gmail.com>; president@esaudubon.org <president@esaudubon.org>; pstickells@gmail.com <pstickells@gmail.com>; rcollins@caltrout.org <rcollins@caltrout.org>; robbie@monolake.org <robbie@monolake.org>; Rose.Banks@wildlife.ca.gov <Rose.Banks@wildlife.ca.gov>; saddlebaglake@gmail.com <saddlebaglake@gmail.com>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; sb@snowhydrology.com <sb@snowhydrology.com>; seth.carr@sce.com <seth.carr@sce.com>; shawna_theisen@fws.gov <shawna_theisen@fws.gov>; sheila.irons@usda.gov <sheila.irons@usda.gov>; ashley.blythehaverstock@usda.gov <ashley.blythehaverstock@usda.gov>; shellydk@frontiernet.net <shellydk@frontiernet.net>; SJacobson@caltrout.org <SJacobson@caltrout.org>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; steve.norton@psomas.com <steve.norton@psomas.com>; steve.parmenter@wildlife.ca.gov <steve.parmenter@wildlife.ca.gov>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; thomas.torres@usda.gov <thomas.torres@usda.gov>; tiogalodge@gmail.com <tiogalodge@gmail.com>; tiogapassresortllc@gmail.com <tiogapassresortllc@gmail.com>; todd.ellsworth@usda.gov <todd.ellsworth@usda.gov>; tristan.leong@usda.gov <tristan.leong@usda.gov>; victor.aguirreorozco@usda.gov <victor.aguirreorozco@usda.gov>; wendy@friendsoftheinyo.org <wendy@friendsoftheinyo.org>; wsugimura@mono.ca.gov <wsugimura@mono.ca.gov>; Jameisha.Washington@usda.gov <Jameisha.Washington@usda.gov>; Lyle Laven <Lyle.Laven@sce.com>; Charles.partridge@sce.com <Charles.partridge@sce.com>; vince.white@sce.com <vince.white@sce.com>

Cc: Jessica Strickland <Jessica.Strickland@tu.org>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; Tilford Denver <tilford.denver@bishoppaiute.org>; Barbara Durham <thpo@timbisha.com>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; claymiwumati@gmail.com <claymiwumati@gmail.com>; brha8857@colorado.edu <brha8857@colorado.edu>; Serrell Smokey <Serrell.Smokey@washoetribe.us>; stephanie.heller@usda.gov <stephanie.heller@usda.gov>; slrapp@ucsc.edu <slrapp@ucsc.edu>; lilian_jonas@contractor.nps.gov <lilian_jonas@contractor.nps.gov>; michael.wiese@usda.gov <michael.wiese@usda.gov>; Richard.McNeill@usda.gov <Richard.McNeill@usda.gov>; Erin.Moore@usda.gov <Erin.Moore@usda.gov>; Brandon.Kulik@KleinschmidtGroup.com <Brandon.Kulik@KleinschmidtGroup.com>; LTryba@kearnswest.com <LTryba@kearnswest.com>; Bret Hoffman <Bret.Hoffman@KleinschmidtGroup.com>; Chris Shutes <BlancaPaloma@msn.com>; Ashley Overhouse <ashley@friendsoftheriver.org>; Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>; North, Jill@Waterboards <Jill.North@waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>; Joshua Fritz <Joshua.Fritz@erm.com>

Subject: [External Email]Lee Vining Joint Agency Meeting

When: Tuesday, November 16, 2021 9:00 AM-1:00 PM.

Where: Microsoft Teams Meeting

[External Email]
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Hello Lee Vining Relicensing Participants,

This is an invitation to the **real** Lee Vining Joint Agency Meeting (JAM) – no longer a placeholder. It will be a virtual meeting, please use the Teams link below.
Please let me know if you have questions.
Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

Click here to view the 2021 ERM Sustainability Report and the ERM Foundation Annual Review

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A-17.2_Follow up re USFS data request

From:	Carissa Shoemaker
To:	McNeill, Richard - FS, BISHOP, CA; Moyer, Patricia (Trisha)@Wildlife
Cc:	Finlay Anderson; Shannon Luoma; Irons, Sheila -FS
Subject:	RE: [External Email]Lee Vining Joint Agency Meeting
Date:	Friday, December 10, 2021 9:33:00 AM
Attachments:	image001.png image003.png

Hi Rick and Trisha,
The Lee Vining FERC boundary spatial data is compiled here: Lee Vining Shape Files.
We're still working on the monitoring studies' raw data, we should have that prepared by the end of the month.

Let us know if you have questions.
Thanks

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Sunday, December 5, 2021 9:22 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: Re: [External Email]Lee Vining Joint Agency Meeting

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Hi Carissa

Thank you for the update.

The raw data as spreadsheets is actually best, but I will need the spatial data for where the raw data was collected.

rick

Rick McNeill
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Friday, December 3, 2021 14:00
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: RE: [External Email]Lee Vining Joint Agency Meeting

Hi Rick,

Thanks for checking in.
We are still pulling your requested information together. We expect to have the FERC boundary spatial data ready next week and the monitoring studies raw data at the end of December. Similar to what was prepared for Bishop, my understanding is that this raw data will not be spatial files, it will be in Excel. Also please note that the Psomas reports do not have spatial data – the only shape files that were created were to develop the reports' figures.

Thanks Rick

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>

Sent: Friday, December 3, 2021 6:58 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: Re: [External Email]Lee Vining Joint Agency Meeting

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Hi Carissa

On Nov 17th, I requested the spatial data for the LV FERC project.

Could I please get an update on the status of my request.

rick

Rick McNeill
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Monday, November 22, 2021 10:19
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: Re: [External Email]Lee Vining Joint Agency Meeting

Thank you Carissa

Rick McNeill
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Monday, November 22, 2021 09:28
To: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: RE: [External Email]Lee Vining Joint Agency Meeting

Hi Rick and Trisha,

The botanical reports you requested below are saved at this link for sharing around. We are also compiling historic data and GIS shape files, but that will take us a little time to complete.

Lee Vining PAD Resources

Thanks!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Sent: Wednesday, November 17, 2021 7:47 AM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Adam Cohen <acohen@stillwatersci.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; apcohen@umail.ucsb.edu; ARoesberry@caltrout.org; Audry.Williams@sce.com; bartshe@monolake.org; bbell@co.tuolumne.ca.us; bblood@psomas.com; bburman@usbr.gov; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; bryan.hatchell@colorado.edu; calweb@tnc.org; cdaly@mackaysposito.com; Chad_Mellison@fws.gov; chair@toiyabe.sierraclub.org; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; cknight@caltrout.org; claire@monolake.org; comdev@mono.ca.gov; conservation@bristleconecnps.org; cshutes@calsport.org; curator@monobasinhistory.org; Sussman, Daniel@Waterboards <daniel.sussman@waterboards.ca.gov>; Yarborough, Daniel -FS <daniel.yarborough@usda.gov>; Alvarez, Dawn -FS <dawn.alvarez@usda.gov>; dfjohnso@blm.gov; easternsierraartist@gmail.com; Hancock, Ed@Waterboards <Ed.Hancock@waterboards.ca.gov>; eric.tillemans@ladwp.com; eric@friendsoftheriver.org; events@mammothmuseum.org; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; frontierpacktrain@gmail.com; gardenofegan@suddenlink.net; geoff@monolake.org; ghaverst@blm.gov; gordon.martin@usda.gov; greg@monolake.org; GRoff@caltrout.org; heather@stillwatersci.com; holly@inyo-monowater.org; hydroesq@schat.net; info@friendsoftheinyo.org; info@monolake.org; INFO@ROCKCREEKPACKSTATION.COM; Beidl, Jacqueline -FS <jacqueline.beidl@usda.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; jenny@sierranevadaalliance.org; jkrclr@gmail.com; jmharty@kearnswest.com; johnwentworth@mltpa.org; jonklusmire@yahoo.com; jora@friendsoftheinyo.org; jstrickland@tu.org; justin_barrett@fws.gov; Schlick, Kary -FS <kary.schlick@usda.gov>; katie@accessfund.org; kelly.henderson@sce.com; Kelly.Larimer@KleinschmidtGroup.com; kquinlan16@gmail.com; Reif, Lawson -FS <lawson.reif@usda.gov>; Lizbergeron <lbergeron@pcta.org>; lcompas@hrassoc.com; lisa@monolake.org; lprimosc@blm.gov; markbagley02@gmail.com; marshmistress@msn.com; Martin Ostendorf <Martin.Ostendorf@sce.com>; maryroper51@gmail.com; Driscoll, Matt@SNC <Matt.Driscoll@sierranevada.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matt Paruolo <mparuolo@mammothlakesrecreation.org>; Mparuolo@mono.ca.gov; naomi@teambishop.com; nate@esavalanche.org; office@esavalanche.org; Sill, Nathan -FS <nathan.sill@usda.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; nicolas.von@sce.com; Gamino, Nora -FS <nora.gamino@usda.gov>; nosmog@yahoo.com; Paul.Pau@ladwp.com; paulR4shopping@verizon.net; pgunsolley@gmail.com; Philipana@aol.com; pmcfarland395@gmail.com; president@esaudubon.org; pstickells@gmail.com; rcollins@caltrout.org; robbie@monolake.org; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; saddlebaglake@gmail.com; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; seth.carr@sce.com; shawna_theisen@fws.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Blythe Haverstock, Ashley - FS

<ashley.blythehaverstock@usda.gov>; shellydk@frontiernet.net; SJacobson@caltrout.org; stephen_bowes@nps.gov; steve.norton@psomas.com; Parmenter, Steve@Wildlife <Steve.Parmenter@wildlife.ca.gov>; talpaugh@kearnswest.com; Torres, Thomas - FS <thomas.torres@usda.gov>; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; Ellsworth, Todd - FS <todd.ellsworth@usda.gov>; Leong, Tristan -FS <tristan.leong@usda.gov>; Aguirre orozco, Victor - FS <victor.aguirreorozco@usda.gov>; wendy@friendsoftheinyo.org; wsugimura@mono.ca.gov; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Lyle Laven <Lyle.Laven@sce.com>; Charles.partridge@sce.com; vince.white@sce.com
Cc: Jessica Strickland <Jessica.Strickland@tu.org>; falconkeeper22@gmail.com; Tilford Denver <tilford.denver@bishoppaiute.org>; Barbara Durham <thpo@timbisha.com>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; claymiwumati@gmail.com; brha8857@colorado.edu; Serrell Smokey <Serrell.Smokey@washoetribe.us>; Heller, Stephanie -FS <stephanie.heller@usda.gov>; slrapp@ucsc.edu; lilian_jonas@contractor.nps.gov; Wiese, Michael - FS, Bishop, CA <michael.wiese@usda.gov>; Moore, Erin - FS, BISHOP, CA <Erin.Moore@usda.gov>; Brandon.Kulik@KleinschmidtGroup.com; LTryba@kearnswest.com; Bret Hoffman <Bret.Hoffman@KleinschmidtGroup.com>; blancapaloma@msn.com; Ashley Overhouse <ashley@friendsoftheriver.org>; Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>; North, Jill@Waterboards <Jill.North@waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>; Joshua Fritz <Joshua.Fritz@erm.com>
Subject: RE: [External Email]Lee Vining Joint Agency Meeting

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Carissa, please include CDFW when you distribute these reports.
Thank you,
Trisha

Trisha A. Moyer

CDFW- Desert Inland Region 6
Habitat Conservation Program Supervisor
787 North Main Street Suite 220
Bishop, CA 93514

(760) 835-4304

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, November 17, 2021 7:10 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Adam Cohen <acohen@stillwatersci.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; Adam.Perez@ladwp.com; allison.rudalevige@psomas.com; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; apcohen@umail.ucsb.edu; ARoesberry@caltrout.org; Audry.Williams@sce.com; bartshe@monolake.org; bbell@co.tuolumne.ca.us; bblood@psomas.com; bburman@usbr.gov; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; bryan.hatchell@colorado.edu; calweb@tnc.org; cdaly@mackaysposito.com; Chad_Mellison@fws.gov; chair@toiyabe.sierraclub.org; Hildeburn, Chase@Waterboards <Chase.Hildeburn@Waterboards.ca.gov>; cknight@caltrout.org; claire@monolake.org; comdev@mono.ca.gov; conservation@bristleconecnps.org; cshutes@calsport.org; curator@monobasinhistory.org; Sussman, Daniel@Waterboards <daniel.sussman@waterboards.ca.gov>; Yarborough, Daniel -FS <daniel.yarborough@usda.gov>; Alvarez, Dawn -FS <dawn.alvarez@usda.gov>; dfjohnso@blm.gov; easternsierraartist@gmail.com; Hancock, Ed@Waterboards <Ed.Hancock@waterboards.ca.gov>; eric.tillemans@ladwp.com; eric@friendsoftheriver.org; events@mammothmuseum.org; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; frontierpacktrain@gmail.com; gardenofegan@suddenlink.net; geoff@monolake.org; ghaverst@blm.gov; gordon.martin@usda.gov; greg@monolake.org; GRoff@caltrout.org; heather@stillwatersci.com; holly@inyo-monowater.org; hydroesq@schat.net; info@friendsoftheinyo.org; info@monolake.org; INFO@ROCKCREEKPACKSTATION.COM; Beidl, Jacqueline -FS <jacqueline.beidl@usda.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Watts, Jennifer@Waterboards <Jennifer.Watts@Waterboards.ca.gov>; jenny@sierranevadaalliance.org; jkrclr@gmail.com; jmharty@kearnswest.com; johnwentworth@mltpa.org; jonklusmire@yahoo.com; jora@friendsoftheinyo.org; jstrickland@tu.org; justin_barrett@fws.gov; Schlick, Kary -FS <kary.schlick@usda.gov>; katie@accessfund.org; kelly.henderson@sce.com;

Kelly.Larimer@KleinschmidtGroup.com; kquinlan16@gmail.com; Reif, Lawson -FS <lawson.reif@usda.gov>; Lizbergeron <lbergeron@pcta.org>; lcompas@hrassoc.com; lisa@monolake.org; lprimosc@blm.gov; markbagley02@gmail.com; marshmistress@msn.com; martin.ostendorf@sce.com; maryroper51@gmail.com; Driscoll, Matt@SNC <Matt.Driscoll@sierranevada.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matt Paruolo <mparuolo@mammothlakesrecreation.org>; Mparuolo@mono.ca.gov; naomi@teambishop.com; nate@esavalanche.org; office@esavalanche.org; Sill, Nathan -FS <nathan.sill@usda.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; nicolas.von@sce.com; Gamino, Nora -FS <nora.gamino@usda.gov>; nosmog@yahoo.com; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; Paul.Pau@ladwp.com; paulR4shopping@verizon.net; pgunsolley@gmail.com; Philipana@aol.com; pmcfarland395@gmail.com; president@esaudubon.org; pstickells@gmail.com; rcollins@caltrout.org; robbie@monolake.org; Banks, Rose@Wildlife <Rose.Banks@wildlife.ca.gov>; saddlebaglake@gmail.com; Saeed.Jorat@ladwp.com; sb@snowhydrology.com; seth.carr@sce.com; shawna_theisen@fws.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; shellydk@frontiernet.net; SJacobson@caltrout.org; stephen_bowes@nps.gov; steve.norton@psomas.com; Parmenter, Steve@Wildlife <Steve.Parmenter@wildlife.ca.gov>; talpaugh@kearnswest.com; Torres, Thomas - FS <thomas.torres@usda.gov>; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; Ellsworth, Todd - FS <todd.ellsworth@usda.gov>; Leong, Tristan -FS <tristan.leong@usda.gov>; Aguirre orozco, Victor - FS <victor.aguirreorozco@usda.gov>; wendy@friendsoftheinyo.org; wsugimura@mono.ca.gov; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Lyle Laven <Lyle.Laven@sce.com>; Charles.partridge@sce.com; vince.white@sce.com

Cc: Jessica Strickland <Jessica.Strickland@tu.org>; falconkeeper22@gmail.com; Tilford Denver <tilford.denver@bishoppaiute.org>; Barbara Durham <thpo@timbisha.com>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; claymiwumati@gmail.com; brha8857@colorado.edu; Serrell Smokey <Serrell.Smokey@washoetribe.us>; Heller, Stephanie -FS <stephanie.heller@usda.gov>; slrapp@ucsc.edu; lilian_jonas@contractor.nps.gov; Wiese, Michael - FS, Bishop, CA <michael.wiese@usda.gov>; Moore, Erin - FS, BISHOP, CA <Erin.Moore@usda.gov>; Brandon.Kulik@KleinschmidtGroup.com; LTryba@kearnswest.com; Bret Hoffman <Bret.Hoffman@KleinschmidtGroup.com>; blancapaloma@msn.com; Ashley Overhouse <ashley@friendsoftheriver.org>; Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>; North, Jill@Waterboards <Jill.North@waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>; Joshua Fritz <Joshua.Fritz@erm.com>

Subject: Re: [External Email]Lee Vining Joint Agency Meeting

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Hi Carissa

I did a quick read of the botany section of the PAD.

It mentions several reports,

Psomas biological survey reports (two reports prepared for SCE):
- Summary of Biological Resources Determination of No Effect on Listed Species for Southern California Edison Company's Tioga Lake Dams Geomembrane Liner Installation Project, Mono County, California (Psomas, 2013)
- Biological Resources Evaluation Technical Report for the Southern California Edison South Lake Dam, Agnew Lake Dam, Saddlebag Lake Dam, and Tioga Lake Dam, and Auxiliary Dam Maintenance and Geo-Membrane Lining Projects (Psomas, 2010)

E. Read and Associates riparian monitoring reports:
- Lee Vining Creek (FERC No. 1388) Riparian, Aquatic Habitat, and Fish Population Monitoring: Phase 2 (Year 2) Compared to Baseline and 2006 (Read, 2012)
- Lee Vining Creek (FERC No. 1388) Riparian Monitoring Phase 2 Year 3 (2016) Compared to Previous Years (Read, 2017)

Environmental Assessment of Potential Cumulative Impacts Associated with Hydropower Development in the Mono Lake Basin, California (FERC Nos. 1388, 1389, 1390, 3259, and 3272) (FERC, 1990) A list of special status plant species was compiled

Could I please get copies of these reports, any raw data associated with botanical surveys and monitoring, and the spatial data for the FERC infrastructure and botanical surveys and monitoring.

Thank you

rick

Rick McNeill
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker
Sent: Friday, October 1, 2021 11:10
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson

<finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Adam Cohen <acohen@stillwatersci.com>; adam.barnett@usda.gov <adam.barnett@usda.gov>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; allison.rudalevige@psomas.com <allison.rudalevige@psomas.com>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; apcohen@umail.ucsb.edu <apcohen@umail.ucsb.edu>; ARoesberry@caltrout.org <ARoesberry@caltrout.org>; Audry.Williams@sce.com <Audry.Williams@sce.com>; bartshe@monolake.org <bartshe@monolake.org>; bbell@co.tuolumne.ca.us <bbell@co.tuolumne.ca.us>; bblood@psomas.com <bblood@psomas.com>; bburman@usbr.gov <bburman@usbr.gov>; blake.engelhardt@usda.gov <blake.engelhardt@usda.gov>; Brandy.Wood@Wildlife.ca.gov <Brandy.Wood@Wildlife.ca.gov>; bryan.hatchell@colorado.edu <bryan.hatchell@colorado.edu>; calweb@tnc.org <calweb@tnc.org>; cdaly@mackaysposito.com <cdaly@mackaysposito.com>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; chair@toiyabe.sierraclub.org <chair@toiyabe.sierraclub.org>; Chase.Hildeburn@Waterboards.ca.gov <Chase.Hildeburn@Waterboards.ca.gov>; cknight@caltrout.org <cknight@caltrout.org>; claire@monolake.org <claire@monolake.org>; comdev@mono.ca.gov <comdev@mono.ca.gov>; conservation@bristleconecnps.org <conservation@bristleconecnps.org>; cshutes@calsport.org <cshutes@calsport.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; daniel.sussman@waterboards.ca.gov <daniel.sussman@waterboards.ca.gov>; daniel.yarborough@usda.gov <daniel.yarborough@usda.gov>; dawn.alvarez@usda.gov <dawn.alvarez@usda.gov>; dfjohnso@blm.gov <dfjohnso@blm.gov>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; eric@friendsoftheriver.org <eric@friendsoftheriver.org>; events@mammothmuseum.org <events@mammothmuseum.org>; ferccaseadmin@sce.com <ferccaseadmin@sce.com>; FOMLR@bodiefoundation.org <FOMLR@bodiefoundation.org>; frontierpacktrain@gmail.com <frontierpacktrain@gmail.com>; gardenofegan@suddenlink.net <gardenofegan@suddenlink.net>; geoff@monolake.org <geoff@monolake.org>; ghaverst@blm.gov <ghaverst@blm.gov>; gordon.martin@usda.gov <gordon.martin@usda.gov>; greg@monolake.org <greg@monolake.org>; GRoff@caltrout.org <GRoff@caltrout.org>; heather@stillwatersci.com <heather@stillwatersci.com>; holly@inyo-monowater.org <holly@inyo-monowater.org>; hydroesq@schat.net <hydroesq@schat.net>; info@friendsoftheinyo.org <info@friendsoftheinyo.org>; info@monolake.org <info@monolake.org>; info@rockcreekpackstation.com <info@rockcreekpackstation.com>; Jacqueline.beidl@usda.gov <Jacqueline.beidl@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jennifer.watts@waterboards.ca.gov <jennifer.watts@waterboards.ca.gov>; jenny@sierranevadaalliance.org <jenny@sierranevadaalliance.org>; jkrclr@gmail.com <jkrclr@gmail.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>; johnwentworth@mltpa.org <johnwentworth@mltpa.org>; jonklusmire@yahoo.com <jonklusmire@yahoo.com>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; jstrickland@tu.org <jstrickland@tu.org>; justin_barrett@fws.gov <justin_barrett@fws.gov>; kary.schlick@usda.gov <kary.schlick@usda.gov>; katie@accessfund.org <katie@accessfund.org>; kelly.henderson@sce.com <kelly.henderson@sce.com>; Kelly.Larimer@KleinschmidtGroup.com <Kelly.Larimer@KleinschmidtGroup.com>; kquinlan16@gmail.com <kquinlan16@gmail.com>; Lawson.reif@usda.gov <Lawson.reif@usda.gov>; lbergeron@pcta.org <lbergeron@pcta.org>; lcompas@hrassoc.com <lcompas@hrassoc.com>;

lisa@monolake.org <lisa@monolake.org>; lprimosc@blm.gov <lprimosc@blm.gov>; markbagley02@gmail.com <markbagley02@gmail.com>; marshmistress@msn.com <marshmistress@msn.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; maryroper51@gmail.com <maryroper51@gmail.com>; matt.driscoll@sierranevada.ca.gov <matt.driscoll@sierranevada.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com <Matthew.Harper@Kleinschmidtgroup.com>; megan.mullowney@usda.gov <megan.mullowney@usda.gov>; monique.sanchez@usda.gov <monique.sanchez@usda.gov>; mparuolo@mammothlakesrecreation.org <mparuolo@mammothlakesrecreation.org>; Mparuolo@mono.ca.gov <Mparuolo@mono.ca.gov>; naomi@teambishop.com <naomi@teambishop.com>; nate@esavalanche.org <nate@esavalanche.org>; office@esavalanche.org <office@esavalanche.org>; nathan.sill@usda.gov <nathan.sill@usda.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; nicolas.von@sce.com <nicolas.von@sce.com>; nora.gamino@usda.gov <nora.gamino@usda.gov>; nosmog@yahoo.com <nosmog@yahoo.com>; Patricia.Moyer@Wildlife.ca.gov <Patricia.Moyer@Wildlife.ca.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; paulR4shopping@verizon.net <paulR4shopping@verizon.net>; pgunsolley@gmail.com <pgunsolley@gmail.com>; Philipana@aol.com <Philipana@aol.com>; pmcfarland395@gmail.com <pmcfarland395@gmail.com>; president@esaudubon.org <president@esaudubon.org>; pstickells@gmail.com <pstickells@gmail.com>; rcollins@caltrout.org <rcollins@caltrout.org>; robbie@monolake.org <robbie@monolake.org>; Rose.Banks@wildlife.ca.gov <Rose.Banks@wildlife.ca.gov>; saddlebaglake@gmail.com <saddlebaglake@gmail.com>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; sb@snowhydrology.com <sb@snowhydrology.com>; seth.carr@sce.com <seth.carr@sce.com>; shawna_theisen@fws.gov <shawna_theisen@fws.gov>; sheila.irons@usda.gov <sheila.irons@usda.gov>; ashley.blythehaverstock@usda.gov <ashley.blythehaverstock@usda.gov>; shellydk@frontiernet.net <shellydk@frontiernet.net>; SJacobson@caltrout.org <SJacobson@caltrout.org>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; steve.norton@psomas.com <steve.norton@psomas.com>; steve.parmenter@wildlife.ca.gov <steve.parmenter@wildlife.ca.gov>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; thomas.torres@usda.gov <thomas.torres@usda.gov>; tiogalodge@gmail.com <tiogalodge@gmail.com>; tiogapassresortllc@gmail.com <tiogapassresortllc@gmail.com>; todd.ellsworth@usda.gov <todd.ellsworth@usda.gov>; tristan.leong@usda.gov <tristan.leong@usda.gov>; victor.aguirreorozco@usda.gov <victor.aguirreorozco@usda.gov>; wendy@friendsoftheinyo.org <wendy@friendsoftheinyo.org>; wsugimura@mono.ca.gov <wsugimura@mono.ca.gov>; Jameisha.Washington@usda.gov <Jameisha.Washington@usda.gov>; Lyle Laven <Lyle.Laven@sce.com>; Charles.partridge@sce.com <Charles.partridge@sce.com>; vince.white@sce.com <vince.white@sce.com>

Cc: Jessica Strickland <Jessica.Strickland@tu.org>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; Tilford Denver <tilford.denver@bishoppaiute.org>; Barbara Durham <thpo@timbisha.com>; Monty Bengochia <Monty.Bengochia@bishoppaiute.org>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; claymiwumati@gmail.com <claymiwumati@gmail.com>; brha8857@colorado.edu <brha8857@colorado.edu>; Serrell Smokey <Serrell.Smokey@washoetribe.us>; stephanie.heller@usda.gov <stephanie.heller@usda.gov>; slrapp@ucsc.edu <slrapp@ucsc.edu>; lilian_jonas@contractor.nps.gov <lilian_jonas@contractor.nps.gov>; michael.wiese@usda.gov <michael.wiese@usda.gov>; Richard.McNeill@usda.gov <Richard.McNeill@usda.gov>; Erin.Moore@usda.gov <Erin.Moore@usda.gov>; Brandon.Kulik@KleinschmidtGroup.com

<Brandon.Kulik@KleinschmidtGroup.com>; LTryba@kearnswest.com <LTryba@kearnswest.com>; Bret Hoffman <Bret.Hoffman@KleinschmidtGroup.com>; Chris Shutes <BlancaPaloma@msn.com>; Ashley Overhouse <ashley@friendsoftheriver.org>; Thaler, Parker@Waterboards <parker.thaler@waterboards.ca.gov>; North, Jill@Waterboards <Jill.North@waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>; Joshua Fritz <Joshua.Fritz@erm.com>
Subject: [External Email]Lee Vining Joint Agency Meeting
When: Tuesday, November 16, 2021 9:00 AM-1:00 PM.
Where: Microsoft Teams Meeting

[External Email]
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Hello Lee Vining Relicensing Participants,

This is an invitation to the **real** Lee Vining Joint Agency Meeting (JAM) – no longer a placeholder. It will be a virtual meeting, please use the Teams link below.

Please let me know if you have questions.
Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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Microsoft Teams meeting

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A-17.3_Follow up discussion re USFS data request

From:	McNeill, Richard - FS, BISHOP, CA
To:	Finlay Anderson
Cc:	Carissa Shoemaker; Shannon Luoma; Irons, Sheila -FS; Sanchez, Monique - FS; Matthew Woodhall; Engelhardt, Blake -FS; Sill, Nathan -FS; Edith Read
Subject:	Re: [External Email]Lee Vining data
Date:	Wednesday, January 12, 2022 9:49:25 AM
Attachments:	image001.png image002.jpg Outlook-Forest Ser.png

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Thank you Finlay

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Wednesday, January 12, 2022 09:43
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Sill, Nathan -FS <nathan.sill@usda.gov>; Edith Read <marshmistress@msn.com>
Subject: RE: [External Email]Lee Vining data
Hi Richard – see the attached; perhaps there was an issue with how I shared it. If you look at this and are still not seeing what you are looing for, lets hop in a call with Edith.
FMA

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, January 12, 2022 8:47 AM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Sill, Nathan -FS <nathan.sill@usda.gov>; Edith Read <marshmistress@msn.com>
Subject: Re: [External Email]Lee Vining data

Hi Finlay and Edith
Thank you for the data.
The riparian shrub data that Edith sent was from 1999-2021, but the riparian herbaceous data only covers from 1999-2006.
I understand that the data from 2021 may not be ready for distribution, but can I please get the data that used for the 2012 and 2017 riparian monitoring reports.
I looked through the reports that I have and they do not include the raw data.
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Tuesday, January 11, 2022 15:49
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matthew Woodhall <matthew.woodhall@sce.com>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; Sill, Nathan -FS <nathan.sill@usda.gov>; Edith Read <marshmistress@msn.com>
Subject: RE: [External Email]Lee Vining data

Richard –
As requested, SCE is providing you with the background data for the published monitoring reports you've asked for. No further data for the most recently completed monitoring studies will be provided until Edith is ready with the report, but when it is ready and when SCE initiates the required consultation, you will provided the complete data-set with the report for review.

I want to acknowledge that this has taken longer getting together than desired. Edith has explained that providing historic data takes some time: It needed to be properly compiled and organized; for herbs especially, there has been movement of species into different genera and families over the years, so she went back through all the data since 1999 and updating all the plant names to current taxonomy, and update wetland status ranks according to the most recent regional list, to make sure any analysis that's done comparing results from different years is apples to apples. This is a lot of data. It is unfortunate that we understood that you were focused on Riparian data, as we could have saved some time; I could have clarified that when you first made the request.
As stated previously, we believe this could have been provided or discussed in the course of developing study plans, but, hopefully this fills in some gaps for you. If you need some additional time for a specific study request, I am sure we can work it out on a case by case basis or we can leave a placeholder in the study plans for future discussion.
Thanks

Finlay Anderson
Sr. Regulatory Advisor

O: 971.345.0517 C: 503.329.3586
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From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, January 5, 2022 12:21 PM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Edith Read <marshmistress@msn.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matthew Woodhall <matthew.woodhall@sce.com>
Subject: Re: [External Email]Lee Vining data

Hi Finlay
What we are looking from stakeholders, by January 18 are study requests. For the request you would identify the question you have or the theory you are developing around a project effect on the resource. Sheila and Monique can help you with the criteria that would be used to frame a study request, but I am also available to support you. You might find this document helpful.
I have to get an understanding for the system and what has been done so far, to know what is needed for study requests or comments.
From there, SCE response with a study plan, or a reason why they don't think this study is necessary. OR perhaps the response is "good question, we have existing information that we can analyze to address this". In any event, that starts the dialogue. There is a response, a meeting to discuss the response and resolve differences, and then a revised study plan.
Understood, but I fail to see what that has to do with my requests for information.
Right now, it seems you have information you need to pose the question and I don't see a need for time extensions – especially since we would like to be in the field in 2022. If we can help by giving you more information we will – but Edith's priority right now is has to be the Bishop Creek Draft License Application due in a couple of weeks so I am trying to keep the team focused on that.
I have other projects that I need to be working on as well and considering that I requested this data over a month ago, I feel like the delay is not my responsibility.
I also am struggling to understand why emailing a spreadsheet is such a large commitment of Edith's time.

Happy to jump on a call and discuss if I am mis-understanding what you are looking for and how you are intending to use it.
Not sure what there is to discuss. I requested data over a month ago, what I received has either been incorrect or incomplete.
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Wednesday, January 5, 2022 11:54
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Edith Read <marshmistress@msn.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matthew Woodhall <matthew.woodhall@sce.com>
Subject: RE: [External Email]Lee Vining data

Hi Richard --

We will work to get this information to you in a timely manner, however I am concerned that you may be a couple of steps ahead in the process.

What we are looking from stakeholders, by January 18 are study requests. For the request you would identify the question you have or the theory you are developing around a project effect on the resource. Sheila and Monique can help you with the criteria that would be used to frame a study request, but I am also available to support you. You might find this document helpful.

From there, SCE response with a study plan, or a reason why they don't think this study is necessary. OR perhaps the response is "good question, we have existing information that we can analyze to address this". In any event, that starts the dialogue. There is a response, a meeting to discuss the response and resolve differences, and then a revised study plan.

Right now, it seems you have information you need to pose the question and I don't see a need for time extensions – especially since we would like to be in the field in 2022. If we can help by giving you more information we will – but Edith's priority right now is has to be the Bishop Creek Draft License Application due in a couple of weeks so I am trying to keep the team focused on that.

Happy to jump on a call and discuss if I am mis-understanding what you are looking for and how you are intending to use it.

Thoughts?

FMA

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, January 5, 2022 9:13 AM
To: Edith Read <marshmistress@msn.com>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>
Subject: Re: [External Email]Lee Vining data

Hi Edith
Thank you for sending the riparian data for the LV FERC project.
In the report titled **Lee Vining Creek (FERC No. 1388) Riparian Monitoring Phase 2 Year 3**, there are charts for both riparian shrub and riparian herbaceous monitoring, specifically pages 27-28, 35-36, and 43-44.
The data you sent to me only has data for woody species, not herbaceous.
Can you please send me the herbaceous data as well.
Once again, can you please send it ASAP, I would hate to have to ask for an extension of the deadline because I did not receive the data in time to review it fully.
Thank you
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, January 4, 2022 12:42
To: Edith Read <marshmistress@msn.com>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>
Subject: Re: [External Email]Lee Vining data

Thank you Edith

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Edith Read <marshmistress@msn.com>
Sent: Tuesday, January 4, 2022 11:15
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>
Subject: Re: [External Email]Lee Vining data

Hi Rick -- I've attached a zip file with the corrected site locations. We've had a lot of trouble with GPS up there, which I thought got fixed during our season last year but obviously not. So I manually created the shapefile in GIS using a georeferenced topo and aerial photo. Let me know if you have any more questions. edith

---

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, January 4, 2022 7:30 AM
To: Edith Read <marshmistress@msn.com>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>
Subject: Re: [External Email]Lee Vining data

Hi Edith
The spatial data doesn't seem to be correct.
The points appear near Sugar Pine Reservoir on the the Tahoe NF.
Can you please send the correct spatial data ASAP, I need to get my comments submitted to Monique by Friday.
Also could you please check to see that the raw data you sent is also for the correct locations.
I would hate to have to ask for an extension on the deadline for these comments.
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, January 4, 2022 06:29
To: Edith Read <marshmistress@msn.com>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: Re: [External Email]Lee Vining data

Thank you Edith

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Edith Read <marshmistress@msn.com>
Sent: Thursday, December 30, 2021 17:33
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: [External Email]Lee Vining data

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Hi Rick -- I have attached an Excel file with the tree and shrub monitoring data for Lee Vining, as well as a zip file containing the shape and associated files for the monitoring site locations. Hope you have a nice holiday weekend. edith

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Telephone Memo

To: Public Files
From: Frank Winchell - OEP
Date: November 23, 2021
Dockets: P-1388-081
Project: Lee Vining Hydroelectric Project

Subject: Consultation with the Washoe Tribe of Nevada and California.

On November 22, 2021, I contacted Darrel Cruz, Director of Cultural Resources for the Washoe Tribe of Nevada and California (Tribe). Darrel said that the Lee Vining Hydroelectric Project was outside their territory and would defer to other tribes located nearer to the project that may have an interest.

Document Accession #: 20211123-3019 Filed Date: 11/23/2021

Document Content(s)

P-1388-081 telephone memo.pdf.....1

Telephone Memo

To: Public Files
From: Frank Winchell - OEP
Date: December 3, 2021
Dockets: P-1388-081
Project: Lee Vining Hydroelectric Project

Subject: Consultation with the Tuolumne Band of Me-Wuk Indians

On November 22, 2021, I called the receptionist at the headquarters of the Tuolumne Band of Me-Wuk Indians (Band) and she transferred me to Andrea Reich (Chairperson of the Band) where I left a message on her answering machine to call me back on whether the Band would like to consult with us involving the relicensing of the Lee Vining Hydroelectric Project. On November 29, 2021 I called the receptionist again and she transferred me to Katherine Cantrell, Administrative Assistant to the Tribal Chairperson, where I left a message on her answering machine to call me back to see if the Band would like to consult further with us. On December 2, 2021, I was able to reach Katherine, and she said that they would defer on consulting with us at this time.

Document Accession #: 20211203-3033 Filed Date: 12/03/2021

Document Content(s)

P-1388-081 memo Tuolumne Band of Me-Wuk Indians.pdf 1

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Energy for What's Ahead℠

Wayne P. Allen
Principal Manager
Regulatory Support Services

Filed Electronically

December 8, 2021

Kimberly D. Bose, Secretary
Nathaniel J. Davis, Sr., Deputy Secretary
Federal Energy Regulatory Commission
825 First Street, NE
Washington, DC 20426

Subject: **Lee Vining Hydroelectric Project, FERC Project No. 1388 Joint Agency and Public Meeting Summary**

Dear Secretary Bose,

Pursuant to 18 CFR 16.8(b)(3)(i)(A) and 18 CFR 16.8(b)(3)(ii) of the rules and regulations of the Federal Energy Regulatory Commission (FERC or Commission), Southern California Edison Company (SCE), licensee of the Lee Vining Hydroelectric Project, FERC Project No. 1388 (Project), held a Joint Agency and Public Meeting (JAM) virtually on November 16, 2021.

As noted in the Pre-Application Document (PAD) filed with FERC on August 12, 2021, due to the possibility of weather-related concerns, SCE opted to hold an in-person site visit on September 28, 2021 and hold the JAM virtually on November 16, 2021. Public notice of the JAM was published on November 4 and 11, 2021 in the *Mammoth Times,* a local Mono County publication. Proof of publication is included in this filing as Attachment A. A virtual site visit was also held immediately prior to the JAM, for any stakeholders interested in attending.

Pursuant to 18 CFR 16.8(b)(4), a recording and transcript of the JAM are available upon Request. Included with this filing is a final meeting agenda, attendance list, copies of comments provided following the site visit, and a copy of the PowerPoint presentation (Attachment B). Materials are also available at www.sce.com/leevining.

SCE looks forward to working with FERC and other interested parties on the Project relicensing. Should there be any questions or concerns regarding this filing please contact Matthew Woodhall, Senior Regulatory Advisor, by phone at (626) 302-9596 or via email at matthew.woodhall@sce.com.

Sincerely,

DocuSigned by:
Wayne Allen
106CF18A73D445F...

Wayne P. Allen
Principal Manager

Enclosures: Attachment A: Proof of publication
Attachment B: JAM and Site Visit Material

1515 Walnut Grove Avenue
Rosemead, CA 91770
626.302.9741
wayne.allen@sce.com

Document Accession #: 20211216-5098 Filed Date: 12/16/2021

NORTH FORK RANCHERIA
OF MONO INDIANS OF CALIFORNIA

TRIBAL GOVERNMENT OFFICE
P.O. Box 929
North Fork, CA 93643-0929
(559) 877-2461
FAX (559) 877-2467

December 9, 2021

Federal Energy Regulatory Commission
Kimberly D. Bose, Secretary
888 First Street NE, Room 1A
Washington, DC 20426

RE: Docket No. P-1388-081-California; Lee Vining Hydroelectric Project, Southern California Edison

Secretary Bose:

The North Fork Rancheria of Mono Indians of California, a federally recognized tribal government, has reviewed the letter regarding project consultation with our tribe regarding the Lee Vining Hydroelectric Project re-licensing.

The tribe is seeking consultation for this re-license project in order to ensure that our concerns are addressed in the Traditional Licensing Process. We would like to meet with commission staff to initiate consultation and this can be coordinated with our Tribal Council. The meeting can be in person or virtual whichever is preferred.

We look forward to the consultation process.

Respectfully,

Fred L. Beihn
Tribal Chairman
fbeihn@nfr-nsn.gov

Document Accession #: 20211216-5098 Filed Date: 12/16/2021

Document Content(s)

Document_2021-12-13_162706.pdf 1

DocuSign Envelope ID: 69EC7944-F947-45D4-B2FB-C61031E49FCE

SOUTHERN CALIFORNIA EDISON
Energy for What's Ahead℠

Wayne P. Allen
Principal Manager
Regulatory Support Services

Electronically Filed

January 11, 2022

Julianne Polanco
State Historic Preservation Officer
California Office of Historic Preservation
1725 23rd Street
Sacramento, CA 95816

Subject: Section 106 Consultation: Proposed Area of Potential Affect for Southern California Edison Lee Vining Creek Hydroelectric Project Relicensing FERC Project No. 1388, Inyo County, California

Dear Ms. Polanco,

Southern California Edison Company (SCE), as delegated under 36 Code of Federal Regulation (CFR) Part 800.2 (c)(4) by the Federal Energy Regulatory Commission (FERC) on October 8, 2021 Notice of Commencement (enclosed) is initiating Section 106 of the National Historic Preservation Act (NHPA) consultation with your office in support of the relicensing process for the Lee Vining Creek Project (Project). The Project is licensed under FERC Project Number 1388.

The Project is located on the eastern slope of the Sierra Nevada along the eastern boundary of Yosemite National Park, and approximately 9 miles upstream from Mono Lake and the town of Lee Vining in Mono County, California. The Project is situated on Lee Vining Creek, largely within the Inyo National Forest managed by the U.S. Forest Service; the remaining Project lands are privately owned.

SCE currently operates the Project under a 30-year license issued by FERC on February 4, 1997. The license will expire January 31, 2027. SCE is seeking a license renewal to continue operation and maintenance (O&M) of the Project.

Lee Vining Creek Facilities

The Project consists of three dams and reservoirs, an auxiliary dam, a flowline consisting of a pipeline and penstock, and a powerhouse with a generating capacity of 11.25 megawatt (mw). the key Project facilities include Saddlebag Dam and Lake, Tioga Dam and Lake, the Rhinedollar Dam, Ellery Lake, a flowline consisting of pipeline and penstock, and the Poole Powerhouse. Releases and spill from both Saddlebag Lake and Tioga Lake flow into Ellery Lake, which is the intake and regulating reservoir for Poole Powerhouse. The two lakes have historically been drawn down in the winter to provide storage capacity for spring runoff. Ellery Lake is the forebay for the powerhouse, and its storage level is not as varied as the two upper reservoirs. Water is conveyed from Ellery Lake to the powerhouse via the flowline and penstock. Minimum flows are provided into Lee Vining Creek below Poole Powerhouse.

Relicensing Efforts

On October 6, 2020 SCE held a public meeting to introduce the Project to stakeholders and the public, as well as invite participation in Technical Working Groups (TWG). The TWG process is

1515 Walnut Grove Avenue
Rosemead, CA 91770
626.302.9741
wayne.allen@sce.com

DocuSign Envelope ID: 69EC7944-F947-45D4-B2FB-C61031E49FCE

open to all interested parties including public agencies, Native American tribes, and not-for-profit organizations, as well as individuals. The intent of the TWG meetings it to gather information on resources to help inform the Notice of Intent (NOI) and Preliminary Application Document (PAD). Based on this known information, SCE worked with stakeholders to identify gaps in our knowledge and key questions that should be addressed as part of the process. SCE developed study plans to address resources in the Project Area, including cultural resources under the CUL-1 Study Plan, which addresses prehistoric and historic period archaeological resources and historic period built environment resources, and CUL-2 ethnographic/tribal resources. SCE held Cultural and Tribal TWG meetings on January 27, February 24, March 31 and May 26, 2021.

The purpose of this letter is to consult with your office regarding the adequacy of the Proposed Area of Potential Effects (APE) for cultural and tribal resources under the CUL-1 and 2 Study Plans. This consultation is intended to build upon the consultation efforts undertaken to date, including the TWGs meetings which included discussion with your Office, Tribes and federal agencies regarding the study implementation and APE development.

Proposed APE Description

The Proposed APE for the Project CUL-1 and Cul-2 Studies includes all FERC Project facilities where Project Operations and Maintenance (O&M) have the potential to cause direct or indirect adverse effects to historic properties. Specifically, the Proposed APE includes all Project facilities and O&M areas located within the existing FERC Project Boundary and any other facilities outside of the FERC Boundary where Project O&M activities are conducted including areas where SCE proposes to expand the FERC Boundary (see Figures 1 and 2). Under the study, all lands in the APE will be subject to intensive inventory for precontact and historic period archaeological resources, historic period built environment resources, and tribal resources in order to identify any historic properties under Section 106 that may be affected by FERC Project operations. The Proposed APE is buffered by a 1-mile study radius for the CUL-1 and 5-mile study radius for the CUL-2 that is intended to aid in study development and contextual research. While this study area will be used for contextual development, it will not be subject to cultural resources inventory.

SCE requests your comments on the appropriateness of this Proposed APE for the CUL-1 and CUL-2 Studies pursuant to 36 CFR Part 800.4 [a][1]. SCE respectfully requests a 30-day review. Please direct any questions regarding this report to Audry Williams at (626) 302-5104 or by e-mail at audry.williams@SCE.com.

Sincerely,

DocuSigned by:
Wayne Allen
106CF18A73D445F...

Wayne Allen
Principal Manger

Enclosures:

FERC Notice of Commencement
Figures 1 and 2: APE Maps

1515 Walnut Grove Avenue
Rosemead, CA 91770
626.302.9741
wayne.allen@sce.com

State of California • Natural Resources Agency Gavin Newsom, *Governor*

DEPARTMENT OF PARKS AND RECREATION Armando Quintero, *Director*
OFFICE OF HISTORIC PRESERVATION

Julianne Polanco, State Historic Preservation Officer
1725 23rd Street, Suite 100, Sacramento, CA 95816-7100
Telephone: (916) 445-7000 FAX: (916) 445-7053
calshpo.ohp@parks.ca.gov www.ohp.parks.ca.gov

March 23, 2022

In reply refer to: FERC831003C

Mr. Wayne Allen
Principal Manager
Regulatory Support Services
Southern California Edison
1515 Walnut Grove Avenue
Rosemead, CA 91770

VIA EMAIL/FERC E-File

RE: Section 106 Consultation for the Relicensing of the Southern California Edison Lee Vining Hydroelectric Project (FERC No. 1388-081) Inyo County, California

Dear Mr. Allen,

The State Historic Preservation Officer (SHPO) received your consultation letter dated January 11, 2022, pursuant to Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 300101), as amended, and its implementing regulation found at 36 CFR 800. In the Notice of Intent to File License Application dated October 8, 2021, the Southern California Edison Company (SCE) was designated as the non-federal representative for Section 106 consultation for the Federal Energy Regulatory Commission (FERC) and consults on their behalf pursuant to 36 CFR § 800.2(c)(4).

SCE, on behalf of the FERC is requesting SHPO comments on the Area of Potential Effects (APE) it proposed for the above referenced undertaking. SCE is seeking a license renewal to continue operation and maintenance for FERC Project No. 1388; the current license expires January 31, 2027. The Project consists of three dams and reservoirs, an auxiliary dam, a flowline consisting of a pipeline and penstock, and a powerhouse with a generating capacity of 11.25 megawatts. Key Project facilities include Saddlebag Dam and Lake, Tioga Dam and Lake, the Rhinedollar Dam, Ellery Lake, and the Poole Powerhouse. SCE has been consulting with Project stakeholders in public meetings and Technical Working Groups since October 6, 2020.

SCE propose the APE to include all FERC Project facilities where Project Operations and Maintenance (O&M) have the potential to cause direct or indirect effects to historic properties. The proposed APE was depicted on maps submitted with the letter and includes all Project facilities and O&M areas located within the existing FERC Project Boundary and any other facilities outside of the FERC Boundary where Project O&M activities are conducted including areas where SCE proposed to expand the FERC boundary.

Following review of the proposed APE, I offer the following comments:

- Pursuant to 36 CFR § 800.4(a)(1), I find the APE as defined to be sufficient for the undertaking.

If you have any questions or concerns, please contact Brendon Greenaway at (916) 445-7036 or Brendon.Greenaway@parks.ca.gov.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

A-23_Request for additional info Botanical TWG

From: Wufoo
To: Carissa Shoemaker
Subject: Lee Vining Hydroelectric Project [#25]
Date: Thursday, January 20, 2022 10:58:49 AM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Name	Greg Reis
Title (if applicable)	Info&Resto specialist
Agency / Organization (if applicable)	MLC
Email	greg@monolake.org
I am interested in the following resource areas	• Botanical and Wildlife Resources • Riparian and Wetland Habitats
Please indicate if you would like to be involved in any Technical Working Groups (TWGs) that will be informed to address the following resources areas.	Yes
	Please add me to botanical TWG in addition to the ones I already signed up for. thanks! Greg
Based on information presented on this website or the Public Outreach meeting of October 6, are you aware of additional studies, or resource management plans that may be relevant to the project area and/or resource (describe)?	No
Based on information presented on this website or the Public Outreach meeting of October 6, are you aware of additional studies, or resource management plans that may be relevant to the project area and/or resource (describe)	No
Is there a representative other than yourself you would like to designate as an additional contact for potential follow-up by SCE or SCE's representative for the resource area(s) checked above? Please indicate their contact information below:	No

From:	Carissa Shoemaker
To:	Carissa Shoemaker
Subject:	FW: Consistency Determination
Date:	Friday, February 10, 2023 4:06:26 PM

From: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>
Sent: Wednesday, May 11, 2022 9:02 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: FW: Consistency Determination

FYI

Emily Waters
Licensing & Regulatory Coordinator
Kleinschmidt
971-236-5853
www.KleinschmidtGroup.com
Follow us on LinkedIn

From: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Sent: Wednesday, May 11, 2022 8:58 AM
To: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>
Subject: RE: Consistency Determination

Hi Emily -
The Commission staff agrees that the Southern California Edison (SCE) relicensing of the Lee Vining Hydroelectric Project (FERC Project No. P-1388) is not located within the California coastal zone and that its operation does not affect coastal resources. By this email the Commission staff determines that SCE has met its federal Coastal Zone Management Act responsibilities.
Regards,
Cassidy

Cassidy Teufel
Manager
Energy, Ocean Resources
and Federal Consistency
California Coastal Commission
455 Market Street, Suite 228
San Francisco, CA 94105-2219
(805) 585-1825
http://www.coastal.ca.gov/

From: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>

Sent: Wednesday, May 11, 2022 7:45 AM
To: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Subject: FW: Consistency Determination

Hi Cassidy,

Following up to see if you were able to look into a consistency determination for our Lee Vining project, described in my email below. Thanks!

Sincerely,

Emily Waters
Licensing & Regulatory Coordinator
Kleinschmidt
971-236-5853
www.KleinschmidtGroup.com
Follow us on LinkedIn

From: Emily Waters
Sent: Tuesday, April 26, 2022 7:10 AM
To: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Subject: RE: Consistency Determination

Thank you, Cassidy!

While I'm at it, would it be possible for you to give me a similar determination for another project we are working on right now for SCE? This one is the Lee Vining Hydroelectric Project (FERC Project No. P-1388) – information about the project can be found here: https://www.sce.com/regulatory/hydro-licensing/leevining. This Project is located on the eastern boundary of Yosemite National Park, ~9 miles upstream from Mono Lake and the town of Lee Vining, California.

Sincerely,

Emily Waters
Licensing & Regulatory Coordinator
Kleinschmidt
971-236-5853
www.KleinschmidtGroup.com
Follow us on LinkedIn

From: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Sent: Monday, April 25, 2022 3:25 PM
To: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>
Subject: RE: Consistency Determination

Hi Emily -
The Commission staff agrees that the Southern California Edison (SCE) relicensing of the Bishop Hydroelectric Project (FERC Project No. P-1394) is not located within the California coastal zone and that its operation does not affect coastal resources. By this email the Commission staff determines that SCE has met its federal Coastal Zone Management Act responsibilities. Please contact me should you have any questions regarding this matter.
Regards,
Cassidy

Cassidy Teufel
Manager
Energy, Ocean Resources
and Federal Consistency
California Coastal Commission
455 Market Street, Suite 228
San Francisco, CA 94105-2219
(805) 585-1825
http://www.coastal.ca.gov/

From: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>
Sent: Monday, April 25, 2022 9:44 AM
To: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Subject: RE: Consistency Determination

Hi Cassidy,

Thanks for the response! We wondered if offices were still closed or not. The project being relicensed is the Bishop Hydroelectric Project (FERC Project No. P-1394). It is located in Bishop, California on Bishop Creek and its smaller tributaries, including the South Fork and Middle Fork of Bishop Creek, Green Creek, Birch Creek, and McGee Creek. Bishop Creek is a tributary to the Owens River. Southern California Edison (SCE) is the Project owner and operator. SCE has a relicensing website with links to project filings and information which you an access here: https://www.sce.com/regulatory/hydro-licensing/bishop-creek-project-relicensing. Please let me know if you have any other questions.

Sincerely,

Emily Waters
Licensing & Regulatory Coordinator
Kleinschmidt
971-236-5853
www.KleinschmidtGroup.com
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From: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Sent: Monday, April 25, 2022 9:33 AM

To: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>
Subject: RE: Consistency Determination

Hi Emily –
Thanks for reaching out on this. Can you provide more information about the hydropower facility being relicensed (name, location, watercourse)? Please also note that our offices are still closed so the best way to reach me is via email.
Thanks,
Cassidy

Cassidy Teufel
Manager
Energy, Ocean Resources
and Federal Consistency
California Coastal Commission
455 Market Street, Suite 228
San Francisco, CA 94105-2219
(805) 585-1825
http://www.coastal.ca.gov/

From: Emily Waters <Emily.Waters@Kleinschmidtgroup.com>
Sent: Monday, April 25, 2022 9:24 AM
To: Teufel, Cassidy@Coastal <Cassidy.Teufel@coastal.ca.gov>
Subject: Consistency Determination

Hello,

I'm following up about a voicemail I left last week at a phone number listed for Cassidy Teufel, who is listed as the federal consistency coordinator on the Coastal Commission website. I'm working on a hydropower project relicensing located in Bishop, California. Due to the project's location, we do not believe that the project affects the coastal zone, but it is a federally regulated project (FERC) so we are inquiring about getting a negative determination or consistency determination from the California Coastal Commission. I am hoping that you or someone else at the Commission can provide us a written statement regarding our need (or lack thereof) for a consistency determination that we can include in our final license application to FERC. If I should contact someone else at the Commission for this request, kindly pass along their contact information.

Sincerely,

Emily Waters
Licensing & Regulatory Coordinator
Kleinschmidt
971-236-5853
www.KleinschmidtGroup.com
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A-25_Discussion re motorboats in reservoirs

From:	Barnett, Adam -FS
To:	Shannon Luoma
Subject:	motorboats in LV reservoirs
Date:	Monday, May 23, 2022 4:19:26 PM
Attachments:	image001.png image002.png image003.png image004.png

---

Hi Shannon,

The INF does not have restrictions on motorboat use on the LV project reservoirs, so SCE does not need Forest Service approval to conduct the fish study. The boating restrictions may be from CDFW.

Adam

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

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From:	Carissa Shoemaker
To:	Beidl, Jacqueline - FS, CA
Cc:	Audry Williams; Shannon Luoma; Lauren Rosenkranz
Subject:	RE: Lee Vining FERC Meetings
Date:	Wednesday, February 1, 2023 11:31:12 AM
Attachments:	image001.png image002.png image003.png image004.png image005.png Lee Vining 2022 Progress Report .msg

Thanks Jacquie,

I will add you back to the Lee Vining contact list and the Cultural/Tribal Technical Working Group list too.
We did just have a Progress Report meeting today (2/1) to discuss the 2022 studies and next steps for studies occurring this year. The attached email has information about the Progress Report and a link included to download it.

Let me know if you have any questions or trouble accessing.
Thanks!

Carissa Shoemaker

My part-time work schedule is generally as follows: Tuesday morning, Thursday morning, and all day Friday.
I can be available outside of these times if given advanced notice.

ERM
M 907 575 0294

From: Beidl, Jacqueline - FS, CA <jacqueline.beidl@usda.gov>
Sent: Wednesday, February 1, 2023 9:55 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Audry Williams <Audry.Williams@sce.com>
Subject: Lee Vining FERC Meetings

EXTERNAL MESSAGE

Hi Carissa! I think I dropped off the FERC meeting invites while I on detail to the regional office this past year. I'm back on the Inyo and would like to see these invites again. Thanks!

Jacqueline Beidl, Archaeologist
Heritage Program Manager and Tribal Liaison
Forest Service
Inyo National Forest
p: 509-949-9869
jacqueline.beidl@usda.gov
351 Pacu Lane
Bishop, CA 93514
www.fs.usda.gov

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TJ Wiggs

From: Carissa Shoemaker
Sent: Tuesday, March 5, 2024 12:56 PM
To: Lake, Mono@Parks
Subject: RE: Venue for a public meeting

Thank you! We did end up booking the Lee Vining Community Center.

Carissa Shoemaker
Licensing Coordinator
www.kleinschmidtgroup.com
907-575-0294

From: Lake, Mono@Parks <Mono.Lake@parks.ca.gov>
Sent: Tuesday, March 5, 2024 11:47 AM
To: Carissa Shoemaker <Carissa.Shoemaker@KleinschmidtGroup.com>
Subject: RE: Venue for a public meeting

You don't often get email from mono.lake@parks.ca.gov. Learn why this is important

I apologize for my delay in response. We do have a small conference room and a theater for larger groups. You should reach out to Nina.Derksen@usda.gov for access to the Mono basin Visitor Center, which is administered by the Inyo National Forest.

Your best bet might be the Lee Vining Community Center. You can reserve that space through Mono County permits. It is big enough for public gatherings as well and open/heated all winter.

Let me know if you have additional questions,

Catherine Jones
State Park Interpreter I
Mono Lake Tufa State Natural Reserve
Office: (760) 647-6331
Cell: (530) 523-3714
Catherine.Jones@parks.ca.gov

From: Carissa Shoemaker <Carissa.Shoemaker@KleinschmidtGroup.com>
Sent: Friday, December 8, 2023 10:22 AM
To: Lake, Mono@Parks <Mono.Lake@parks.ca.gov>
Subject: Venue for a public meeting

A-27_Discussion re reservation of meeting space

> You don't often get email from carissa.shoemaker@kleinschmidtgroup.com. Learn why this is important

Hi there,
I'm looking for a potential venue to host a public meeting for the SCE Lee Vining Hydroelectric Project.
Does the visitor center at Mono Lake have a meeting space available to rent?

Thank you

Carissa Shoemaker
Licensing Coordinator
Kleinschmidt
C: 907-575-0294
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A-28_Discussion re USFS contact included in meeting requests and correspondence

From:	Matthew Woodhall
To:	Shannon Luoma; Finlay Anderson; Carissa Shoemaker; Angela Whelpley
Cc:	Irons, Sheila - FS, CA
Subject:	FW: (External):Favor to ask
Date:	Thursday, March 28, 2024 1:39:51 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png

---

To All,

Please ensure that Sheila Irons (FS) is on ***ALL*** correspondences and meeting invites related to Lee Vining and Lundy relicensing. I will be sending the same note to the Rush Creek team so hopefully we can get the holes filled where she is not being included.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From: Irons, Sheila - FS, CA <sheila.irons@usda.gov>
Sent: Thursday, March 28, 2024 11:48 AM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: (External):Favor to ask

Hi Matt. Today I was on a Forest planning meeting. One of the items discussed was the FERC projects and where they stand. Turns out that many of our specialist have received the Rush Creek study reports, but since I didn't receive, I was totally unaware.

For the other projects, I think I got a notification of the Lundy PAD from FERC. And I have in my notes from our January meeting that the study reports for Lee Vining Canyon should be out in the next couple of months.

Can you please ensure I receive all information on the FERC projects, including meeting requests? Thanks.

Sheila Irons
Forest Lands Officer
Forest Service
Inyo National Forest
p: 760-873-2477
c: 760-965-9609
sheila.irons@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.usda.gov

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TJ Wiggs

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, April 19, 2024 2:56 PM
To: Matthew Woodhall
Cc: Seth Carr; Shannon Luoma; Steve Norton; Kelly Larimer; Jay King; Martin Ostendorf; Heather Bowen Neff; Finlay Anderson; Allison Rudalevige; Audry Williams; Brad Blood; Carissa Shoemaker; Matthew Woodhall; Angela Whelpley; Lynn Johnson; Ian Pryor; Christina Buck; Noah Hume; Matthew C Paruolo; Matt McKechnie
Subject: Save the Dates: Lee Vining and Lundy Stakeholder Meetings

Hello Lee Vining and Lundy relicensing interested parties,

This is a reminder of SCE and FERC's upcoming stakeholder meetings for the Projects coming up in mid-May. These are in-person meetings with no virtual or call-in options available. If you have not received an invitation for the Lee Vining Tech Report Review meeting (May 14), Lundy Site Visit (May 15), or Lundy Scoping Meetings (May 14 and 15) please let me know. The relicensing team is hoping to get a better idea of attendance at these meetings, so please 'accept' the invitation(s) if you do plan to attend.

I would also like to inform you of some beneficial changes to the tentative schedule provided on January 26 (below). The meetings and site visit have been condensed into two days, rather than three.

Lee Vining Hydro Project (P-1388)
Tuesday May 14, 9am-4pm: Technical Study Report and Initial Project Effects stakeholder meeting, hosted by SCE. This will be a daytime in-person meeting held at the Lee Vining Community Center. The purpose is to review draft Technical Reports, begin discussions on potential Project effects, and address stakeholder questions. This will be open to the general public. An all-day placeholder invite was sent out, an agenda and other materials will be sent out closer to the meeting date.

Lundy Hydro Project (P-1390)

- Wednesday May 15 8:30am-12pm; Site visit / Project tour: Participants will meet at the Guss Hess Community Park (129 Mattly Ave, Lee Vining) and then drive, caravan-style, to the Lundy Project area to view and discuss Project infrastructure, operations, and resources. Extent of the tour will be determined by road conditions and accessibility. NOTE that FERC recently sent out a Notice of this site visit with an incorrect time of 9:00am and the community center as a starting point. They have since issued an errata to clarify the details herein. We will send out a calendar invite for the site visit shortly.

- Tuesday May 14 (6pm-8pm) and Wednesday May 15 (2pm-5pm); The two public meetings, hosted by FERC will be in-person meeting held at the Lee Vining Community Center. These will be open to the general public. The same information will be presented at both meetings. The purpose of the public meetings and site visit are to:
    - Initiate scoping pursuant to the National Environmental Policy Act (NEPA);
    - Review and discuss existing conditions and resource management objectives;
    - Review and discuss existing information and make preliminary identification of information and study needs;
    - Review, discuss, and finalize the process plan and schedule for pre-filing activity that incorporates the time periods provided for in this part and, to the extent reasonably possible, maximizes coordination of Federal, state, and tribal permitting and certification processes, including consultation under section 7 of the Endangered Species Act and water quality certification or waiver thereof under section 401 of the Clean Water Act; and

- Discuss the appropriateness of any Federal or state agency or Indian tribe acting as a cooperating agency for development of an environmental document pursuant to the NEPA.

Thank you, and please let me know if you have any questions.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

A-30_Information re upcoming May 2024 stakeholder meetings

From:	Beeler, Heather
To:	Matthew Woodhall
Cc:	Seth Carr; Shannon Luoma; Steve Norton; Kelly Larimer; Jay King; Martin Ostendorf; Heather Bowen Neff; Finlay Anderson; Allison Rudalevige; Audry Williams; Brad Blood; Carissa Shoemaker; Angela Whelpley; Lynn Johnson; Ian Pryor; Christina Buck; Noah Hume; Matthew C Paruolo; Matt McKechnie
Subject:	RE: [EXTERNAL] Save the Dates: Lee Vining and Lundy Stakeholder Meetings
Date:	Wednesday, May 8, 2024 12:30:15 PM
Attachments:	image001.png

You don't often get email from heather_beeler@fws.gov. Learn why this is important

Hi Matthew,

I have a pre-scheduled conflict during this week and I won't be able to make or participate in this meeting. On behalf of the Service's Migratory Bird Program. I will be the contact for this Service consultation regarding Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (Eagle Act) coordination and compliance topics. Unfortunately I am not available during the dates/times of your planned scoping meetings. I expect you will coordinate with agencies beyond those scoping meetings. Here's some info to help get you started.

MBTA:

- When you get a chance, please outline how your project will avoid and minimize impacts to birds, perhaps by developing a Bird and Bat Conservation Strategy to include a bird nesting plan with appropriate nest protection buffers. Examples exist for other energy projects specifically designed for Southern Nevada and California and developed by SCE.

Eagle Act:

- Please develop an Eagle Conservation Plan describing the project, what's known and/or planned surveys to detect bald and golden eagle territories and nest sits proximate to the project.
- Describe how the project will avoid an minimize take of bald and golden eagles and their nests.
- Permits are available should take not be practicably avoidable.

Here's some helpful information:

- To avoid disturbance to nests that could cause take, here's our eagle nest buffer recommendations. The Bald Eagle buffer recommendation be reduced formally shortly so please check back in if needed at a later time. https://www.fws.gov/library/collections/eagle-nest-buffers-california-and-nevada
- Should you determine the project would necessitate removal of eagle nests (including trees supporting eagle nests) under the Bald and Golden Eagle Protection Act would be required prior to removing a nest. That can only be done if the nest is not in use (no eggs or young). Please see this webpage, our newly revised Eagle Rule now allows for some do it yourself online permits for bald eagles should it be determined that is the species you're dealing with. https://www.fws.gov/program/eagle-management/eagle-incidental-disturbance-and-nest-take-permits
- For an overview of our revised eagle permit program, here's our main webpage for eagle management. We now have General Permits (do it yourself online) for bald eagle incidental

take, bald eagle nest removal, electric utility (collision and electrocution) and lower risk wind projects (see map). Golden Eagles due to their population status and concerns will still always require more coordination for Specific (that's what we now call them, similar to HCP process) permits for incidental take, including disturbance, or nest removals.
https://www.fws.gov/program/eagle-management

Please feel free to reach out to me or include me in any consultation meetings you might have with the Field Office. If eagle take is not expected and can be avoided, perhaps we can determine that with minimal coordination and appropriate documentation.
Thanks,
Heather

Heather Beeler (she/her)
Eagle Permit Coordinator
Migratory Bird Program, R8
U.S. Fish and Wildlife Service
Cell: 775-508-9754

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Friday, April 19, 2024 1:56 PM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>
Cc: Seth Carr <Seth.Carr@sce.com>; Shannon.Luoma@KleinschmidtGroup.com; steve.norton@psomas.com; Kelly.Larimer@KleinschmidtGroup.com; jay@farwestern.com; Martin Ostendorf <Martin.Ostendorf@sce.com>; Heather Neff <heather@stillwatersci.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; allison.rudalevige@psomas.com; Audry Williams <Audry.Williams@sce.com>; bblood@psomas.com; carissa.shoemaker@kleinschmidtgroup.com; Matthew Woodhall <Matthew.Woodhall@sce.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; lynn@teamenvironmental.com; Ian@stillwatersci.com; cbuck@stillwatersci.com; noah@stillwatersci.com; Matthew C Paruolo <MATTHEW.PARUOLO@SCE.COM>; mmckechnie@stillwatersci.com
Subject: [EXTERNAL] Save the Dates: Lee Vining and Lundy Stakeholder Meetings

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hello Lee Vining and Lundy relicensing interested parties,

This is a reminder of SCE and FERC's upcoming stakeholder meetings for the Projects coming up in

mid-May. These are in-person meetings with no virtual or call-in options available. If you have not received an invitation for the Lee Vining Tech Report Review meeting (May 14), Lundy Site Visit (May 15), or Lundy Scoping Meetings (May 14 and 15) please let me know. The relicensing team is hoping to get a better idea of attendance at these meetings, so please 'accept' the invitation(s) if you do plan to attend.

I would also like to inform you of some beneficial changes to the tentative schedule provided on January 26 (below). The meetings and site visit have been condensed into two days, rather than three.

Lee Vining Hydro Project (P-1388)

Tuesday May 14, 9am-4pm: Technical Study Report and Initial Project Effects stakeholder meeting, hosted by SCE. This will be a daytime in-person meeting held at the Lee Vining Community Center. The purpose is to review draft Technical Reports, begin discussions on potential Project effects, and address stakeholder questions. This will be open to the general public. An all-day placeholder invite was sent out, an agenda and other materials will be sent out closer to the meeting date.

Lundy Hydro Project (P-1390)

- Wednesday May 15 8:30am-12pm; Site visit / Project tour: Participants will meet at the Guss Hess Community Park (129 Mattly Ave, Lee Vining) and then drive, caravan-style, to the Lundy Project area to view and discuss Project infrastructure, operations, and resources. Extent of the tour will be determined by road conditions and accessibility. NOTE that FERC recently sent out a Notice of this site visit with an incorrect time of 9:00am and the community center as a starting point. They have since issued an errata to clarify the details herein. We will send out a calendar invite for the site visit shortly.

- Tuesday May 14 (6pm-8pm) and Wednesday May 15 (2pm-5pm); The two public meetings, hosted by FERC will be in-person meeting held at the Lee Vining Community Center. These will be open to the general public. The same information will be presented at both meetings. The purpose of the public meetings and site visit are to:
    - Initiate scoping pursuant to the National Environmental Policy Act (NEPA);
    - Review and discuss existing conditions and resource management objectives;
    - Review and discuss existing information and make preliminary identification of information and study needs;
    - Review, discuss, and finalize the process plan and schedule for pre-filing activity that incorporates the time periods provided for in this part and, to the extent reasonably possible, maximizes coordination of Federal, state, and tribal permitting and certification processes, including consultation under section 7 of the Endangered Species Act and water quality certification or waiver thereof under section 401 of the Clean Water Act; and
    - Discuss the appropriateness of any Federal or state agency or Indian tribe acting as a cooperating agency for development of an environmental document pursuant to the

NEPA.

Thank you, and please let me know if you have any questions.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

A-31_Survey response re LV relicensing information

From:	Carissa Shoemaker
To:	Carissa Shoemaker
Subject:	FW: Lee Vining Hydroelectric Project [#29]
Date:	Friday, July 5, 2024 3:28:48 PM
Attachments:	~WRD0000.jpg

From: Wufoo <no-reply@wufoo.com>
Sent: Tuesday, June 25, 2024 8:30 PM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: Lee Vining Hydroelectric Project [#29]

> You don't often get email from no-reply@wufoo.com. Learn why this is important

Name	Teri Tracy
Title (if applicable)	Eastern Sierra Policy Coordinator
Agency / Organization (if applicable)	Mono Lake Committee
Email	ttracy@monolake.org
Address	PO Box 29 Corner of Hwy 395 & 3rd Street Lee Vining, California 93541 United States
Phone Number (Office)	(760) 647-6595
Please indicate if you would like to be involved in any Technical Working Groups (TWGs) that will be informed to address the following resources areas.	No
Based on information presented on this website or the Public Outreach meeting of October 6, are you aware of additional studies, or resource management plans that may be relevant to the project area and/or resource (describe)?	No
Based on information presented on this website or the Public Outreach meeting of October 6, are you aware of additional studies, or resource management plans that may be relevant to the project area and/or resource (describe)	No
Is there a representative other than yourself you would like to designate as an additional contact for potential follow-up by SCE or SCE's representative for the resource area(s)	Yes

checked above? Please indicate their contact information below:	
Thank you for your time. Please provide any additional comments and/or questions regarding the Lee Vining Hydroelectric Project, Pre-Application Document, or relicensing.	My primary request is to be kept informed of comment deadlines and document filings. Thank you!

This email notification is powered by **Wufoo**, the free online form builder.
Make your own HTML forms for free at wufoo.com

GET STARTED!

Study Plan Consultation

Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-01	1/14/2021	CA State Water Board	Comments on PAD and Study Plan Requests	Email (with Letter)
B-02	2/22/2021	Mono Lake Committee	Discussion re TWG draft meeting notes and Mono Lake Committee study requests (attached)	Email (with PPT)
B-03	4/22/2021	USFWS	Wildlife discussions with USFWS	Email
B-04.1	6/15/2021	TWG Members	Update re study plans	Email
B-04.2	6/15/2021	USFS	Discussion re study plans update to TWG	Email
B-05	11/17/2021	CDFW	Discussion re Chytrid (bd) testing policies	Email
B-06	1/14/2022	CDFW	Comments on PAD and Study Plan Requests	Letter
B-07	1/14/2022	USFS	Comments on PAD and Study Plan Requests	Letter
B-08.1	1/19/2022	All Stakeholders	Notice re study plan meeting invitation	Email
B-08.2	1/20/2022	USFS	New USFS contact to add to Recreation and Land Use TWG	Email
B-09.1	2/2/2022	USFS	Botanical study plan coordination with USFS	Email
B-09.2	2/14/2022	USFS	Update permit from USFS re collection of Species of Conservation Concern	Email
B-10.1	2/22/2022	TWG Members	Notice re revised study plan availability notification and request for comments	Email
B-10.2	3/1/2022	North Fork Mono Tribe, USFS, TWG Members	Discussion re revised technical study plan	Email
B-10.3	3/3/2022	USFS	Discussion re revised technical study plan	Email
B-10.4	3/11/2022	USFS	Coordination re revised Botanical study plan meeting	Email
B-11	2/28/2022	CA State Water Board	Question re hydro-optimization study plan (AQ-5)	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-12	3/17/2022	All Stakeholders	Notice re revised study plan meeting agenda (attached)	Email
B-13	3/17/2022	CA State Water Board	Comments on Revised Technical Study Plan	Letter
B-14.1	3/18/2022	CDFW	Comments on TERR-2 Study Proposal (Yosemite Toad)	Email
B-14.2	3/18/2022	CDFW	Discussion re comments on TERR-2 Study Proposal (Yosemite Toad)	Email
B-15	3/24/2022	CDFW	Meeting invitation re wildlife study plan discussions	Email
B-16	3/25/2022	CDFW	Comments on Revised Technical Study Plan	Document
B-17	3/25/2022	SCE	Notes re wildlife study plan meeting with CDFW	Document
B-18	3/28/2022	All Stakeholders	Revised Study Plan meeting invitation	Email
B-19.1	3/28/2022	SCE	Agenda for Revised Technical Study Plan meeting	Document
B-19.2	3/28/2022	SCE	Revised Technical Study Plan Stakeholder Meeting notes	Document
B-19.3	3/28/2022	SCE	Revised Technical Study Plan Stakeholder Meeting PPT Presentation	Document
B-20	3/29/2022	CDFW	Coordination re times to discuss Yosemite toad study plan	Email
B-21	3/30/2022	CDFW	Sharing project shapefiles	Email (zip)
B-22	3/30/2022	CDFW	Meeting invitation re wildlife study plan discussion with CDFW	Email
B-23.1	3/30/2022	CDFW	Email to CDFW re wildlife study plan meeting	Email
B-23.2	3/30/2022	SCE	Wildlife study plan meeting agenda and minutes	Document
B-23.3	3/30/2022	SCE	Wildlife study plan meeting minutes	Document
B-24	3/31/2022	USFS	Comments on Revised Technical Study Plan	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-25	4/12/2022	CDFW	Discussion re coordinating study plan meeting availability with CDFW	Email
B-26	4/15/2022	CDFW	Discussion re Highway 120 weather	Email
B-27	4/15/2022	CA State Water Board	Discussion re fish tissue study and mercury question	Email
B-28	4/25/2022	CDFW	Discussion re comments on study plans	Email
B-29	5/6/2022	TWG Members	Notice re final Technical Study Plans availability	Email
B-30.1	5/10/2022	USFS	Discussion re draft Recreation Nexus Survey (attached)	Email
B-30.2	5/12/2022	USFS	Discussion re draft Recreation Nexus Survey (attached)	Email
B-30.3	5/13/2022	USFS	Follow up to discussion re draft Recreation Nexus Survey	Email
B-30.4	5/24/2022	USFS	USFS edits to Recreation Nexus Survey questions	Email
B-30.5	5/25/2022	USFS	Discussion re Recreation Nexus Survey site identification	Email
B-31.1	5/10/2022	CDFW, USFS	Photos of snow and ice at Tioga Lake	Email
B-31.2	5/18/2022	CDFW, USFWS	Discussion re snow pack at Tioga Lake for Yosemite toad survey	Email
B-32	5/23/2022	CDFW, USFWS	Coordination re first herp survey date	Email
B-33.1	6/7/2022	CDFW, USFWS	Discussion re second herp survey dates	Email
B-33.2	6/14/2022	CDFW, USFWS	First herp survey summary results and dates for second survey coordination with CDFW	Email
B-33.3	6/29/2022	CDFW, USFWS	Summary of second herp survey results	Email
B-34	6/8/2022	CDFW	Discussion re CDFW Regional Biologist approval for LV Fish Monitoring methods	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-35	6/14/2022	USFS	Discussion re vegetation map updates, spatial data re Inyo National Forest Terrestrial Ecological Unit Inventory	Email (zip)
B-36	6/16/2022	USFS	Discussion re Big Bend Campground re channel morphology survey	Email
B-37	6/17/2022	CDFW	Discussion re electrofishing permit	Email
B-38	7/25/2022	USFS	Coordination of electrofishing methods with USFS	Email
B-39	7/26/2022	Mono County	County confirms no restrictions for motorized boats on Ellery and Tioga Lakes	Email
B-40	7/27/2022	CDFW	Discussion re boats in project reservoirs	Email
B-41.1	8/9/2022	USFS	Discussion re pressure transducer installation	Email
B-41.2	9/6/2022	USFS	USFS approves pressure transducer installation	Email
B-42.1	8/9/2022	CDFW	Discussion re Yosemite Toad with attached mitochondrial DNA evolution paper	Email
B-42.2	8/9/2022	CDFW	Discussion re Yosemite Toad with attached Buca climate disease and YOTO declines papers	Email
B-43	8/29/2022	CDFW	Photos of toadlets at Saddlebag Lake	Email
B-44	8/30/2022	CDFW	Discussion re populations at Buca site	Email
B-45.1	11/11/2022	CDFW	Memos summarizing phone conversations with CDFW re toad survey findings	Email
B-45.2	11/16/2022	CDFW	Discussion re telephone memos re toad survey findings	Email
B-46	12/12/2022	CDFW	Meeting agenda for 2023 Yosemite Toad field survey with attached paper on Buca	Email
B-47	12/14/2022	USFWS	Discussion re coordination meeting re 2023 toad survey efforts	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-48.1	12/12/2022	CDFW	Conference call between Project Team (SCE, Kleinschmidt, and Psomas), and California Department of Fish and Wildlife (CDFW)	Telephone
B-48.2	12/17/2022	CDFW	Discussion re 12-12-22 conference call and meeting minutes review (minutes attached)	Email
B-49	1/10/2023	CDFW, USFWS	Agenda for Yosemite Toad call with CDFW and USFWS	Email
B-50.1	1/30/2023	USFS	Discussion re 2022 progress report meeting and list of project infrastructure	Email
B-50.2	2/28/2023	USFS	Further discussion re report comments and spatial data 2022 botanical surveys	Email
B-51	1/31/2023	CDFW	Contact updates for Progress Report meeting and Recreation and Land Use TWG	Email
B-52	2/2/2023	USFS	Meeting minutes re 2023 Yosemite Toad Field Season Update to Inyo National Forest	Email
B-53.1	2/7/2023	USFS	Discussion re Yosemite Toad	Email
B-53.2	2/23/2023	USFS	Discussion re Yosemite Toad and permit	Email
B-53.3	2/27/2023	USFS	Discussion re meeting re Yosemite Toad	Email
B-54	2/10/2023	USFS	Discussion re meeting with Thomas Torres (Inyo National Forest Wildlife Biologist)	Email
B-55	2/13/2023	USFS	Discussion re coordination of YOTO sampling	Email
B-56	2/21/2023	CDFW	Discussion re coordination of 2023 study planning TWG	Email
B-57	2/23/2023	CDFW	Email with CDFW Progress report comments attached	Email
B-58	2/27/2023	USFS	Notice re Jacqueline Beidl (USFS) involved in Cultural and Tribal TWG	Email
B-59.1	3/1/2023	SCE	Recreation and Land Use Meeting Agenda	Document

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-59.2	3/1/2023	SCE	Recreation and Land Use Draft Meeting Notes	Document
B-60.1	3/6/2023	USFS	Discussion re draft CUL-1 Cultural Resources review	Email
B-60.2	3/7/2023	USFS	Discussion re draft CUL-1 Cultural Resources review and spatial data	Email
B-61	3/7/2023	CDFW	CDFW attendance re 3-15-23 TWG meeting	Email
B-62	3/7/2023	CDFW	Discussion re fisheries stocking	Email
B-63	3/15/2023	SCE	Draft meeting notes 3-15-23 Recreation and Land Use TWG meeting	Document
B-64	3/16/2023	CDFW	CDFW Comments on Lee Vining Creel survey methods	Email
B-65	3/21/2023	USFS	Discussion re Yosemite toad DNA studies	Email
B-66	3/24/2023	CDFW	Discussion re Lee Vining Fire Suppression Plan	Email
B-67	3/29/2023	Mono Lake Committee	Description of Warren Creek data (not attached)	Email
B-68	3/31/2023	SCE	2022 Progress Report Technical Memos	Letter
B-69	4/14/2023	USFS	Discussion re 2023 RTE special status plant surveys and permits (attached 2022 permit)	Email
B-70	4/19/2023	Bridgeport Indian Colony	Notice from Bridgeport Indian Colony deferring negotiations and decision making to Mono Lake Kootzaduka'a Tribe	Email
B-71.1	4/19/2023	SCE	Meeting Notes from 4-19-23 Cultural and Tribal TWG	Document
B-71.2	4/19/2023	SCE	PPT from 4-19-23 Cultural and Tribal TWG	Email (PPT attached)
B-72	4/19/2023	SCE	Meeting Notes from 4-19-23 Recreation and Land Use TWG	Document
B-73	4/19/2023	American Indian Council of Mariposa County (Southern Sierra Miwok Nation)	Notice of unavailability for Cultural and Tribal TWG (Southern Sierra Miwok Nation)	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-74	4/19/2023	Walker River Paiute Tribe	Notice of unavailability for Cultural and Tribal TWG (Walker)	Email
B-75	5/18/2023	SCE	Meeting summary 5-18-23 Aquatics and Hydrology TWG	Document
B-76	5/18/2023	SCE	PPT from 5-18-23 Aquatics and Hydrology TWG	Document
B-77	5/19/2023	Mono Lake Committee, TWG Members	Discussion re Ops Model remote sensing and snow data	Email
B-78	5/25/2023	CDFW	Discussion re pool habitat field checklist	Email
B-79	5/30/2023	NPS, USFS	Discussion re toad survey efforts	Email
B-80	6/20/2023	NPS	Discussion re project description with reasoning for collecting Anaxyrus DNA in the Inyo National Forest	Email
B-81	6/28/2023	Mono Lake Kootzaduka'a Tribe of CA and NV	Email with attached 6-19-23 Tribal Consultation Request from Mono Lake Kootzaduka'a Tribe	Email
B-82.1	7/17/2023	TWG Members, CDFW	Discussion re weather delays affecting recreation studies, postponing surveys to 2024	Email
B-82.2	7/17/2023	Friends of the Inyo	Discussion re weather delays affecting recreation studies, postponing surveys to 2024	Email
B-82.3	7/17/2023	USFS	Discussion re weather delays affecting recreation studies, postponing surveys to 2024	Email
B-82.4	7/17/2023	Mono Lake Committee	Discussion re weather delays affecting recreation studies, postponing surveys to 2024	Email
B-82.5	7/18/2023	North Fork Mono Tribe	Discussion re weather delays affecting recreation studies, postponing surveys to 2024	Email
B-83.1	8/1/2023	NPS, USFS, USFWS	Discussion re toad DNA sampling	Email
B-83.2	8/7/2023	NPS, USFS, USFWS	Discussion re toad DNA sampling	Email
B-83.3	8/10/2023	NPS, CDFW, USFWS	Discussion re toad DNA sampling	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-84	8/9/2023	North Fork Rancheria of Mono Indians of CA	Discussion re proposal to delay REC-1 study	Email
B-85	8/14/2023	USFS	Discussion re 2023 Recreation studies and campground access	Email
B-86	8/15/2023	CDFW	Discussion re samples from Saddlebag Lake and Tioga Pass being sent to lab	Email
B-87	9/13/2023	TWG Members (Aquatics and Hydrology), CDFW	Reminder that comments on the Draft Technical Report of the Year 1 (2022) AQ-1, AQ-2, WQ-1 are due Monday November 13	Email
B-88	9/20/2023	NPS	Discussion re Toad DNA sampling third location	Email
B-89	10/30/2023	CDFW	Discussion re adding Trisha (CDFW) to Aquatics and Terrestrial TWG	Email
B-90.1	10/30/2023	TWG Members (Aquatics and Hydrology)	Reminder that comments on the Draft Technical Report of the Year 1 (2022) AQ-1, AQ-2, WQ-1 are due Monday November 13	Email
B-90.2	10/30/2023	TWG Members (Terrestrial and Botanical)	Reminder that comments on the Draft Technical Report of the Year 1 (2022) TERR-1 are due Monday November 13	Email
B-90.3	11/6/2023	USFS	Discussion re how to submit comments on Year 1 Technical Reports	Email
B-91	10/30/2023	USFS	Request to remove Blake Engelhardt and add Rick McNeill for botanical input in relation to FERC projects on the Inyo National Forest	Email
B-92	11/13/2023	CA State Water Board	CA State Water Board comments on Draft Study Reports	Letter
B-93.1	11/14/2023	USFS	Email to USFS requesting comments on draft study reports	Email
B-93.2	12/14/2023	USFS	Discussion re USFS Draft Technical Report Comments	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-93.3	12/27/2023	USFS	Email with USFS comments on technical studies	Email
B-94	11/22/2023	CDFW	Email with CDFW comments on Draft Technical Reports attached	Email
B-95	11/29/2023	CDFW	Discussion re potential wolverine scat sample testing	Email
B-96	1/5/2024	USFS	Doodle poll to USFS Recreation and Land Use relicensing team	Email
B-97.1	1/15/2024	NPS, USFS, USFWS	Discussion re Saddlebag Lake Toad DNA samples	Email
B-97.2	2/6/2024	NPS, USFS, USFWS	Discussion re Saddlebag Lake Toad DNA samples	Email
B-97.3	1/13/2025	NPS, USFS, USFWS	Discussion re Saddlebag Lake Toad DNA samples	Email
B-98	1/18/2024	USFS	Follow up to USFS re Recreation and Land Use TWG	Email
B-99	1/24/2024	USFS	Discussion re 2-28-24 meeting	Email
B-100	2/22/2024	TWG Members (Rec Land Use)	Notice re Recreation and Land Use TWG meeting and package of meeting materials	Email
B-101.1	2/28/2024	CDFW	Discussion re Creel Survey and confirmation with fisheries staff request for photo optional	Email
B-101.2	2/29/2024	CDFW	Discussion re Creel Survey and participation in TWG	Email
B-102	2/28/2024	USFS	Discussion re TWG group participation	Email
B-103	2/29/2024	TWG Members (Recreation and Land Use)	Email re Recreation and Land Use TWG meeting agenda	Email
B-104	4/1/2024	USFS	Follow up discussion re proposed trail counter locations	Email
B-105	4/1/2024	USFS	Discussion re meeting notices and invitations	Email
B-106	4/23/2024	USFS	Discussion re Yosemite Toad meeting coordination	Email
B-107	5/6/2024	CDFW	Discussion re Yosemite Toad meeting coordination tech issues	Email
B-108.1	5/9/2024	NPS, USFS	Discussion re ANCA-ANBO hybridization study 1	Email

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Item #	Date Sent	Stakeholder Group	Type of Correspondence/Consultation Event	Document Type
B-108.2	5/9/2024	NPS, USFS	Discussion re ANCA-ANBO hybridization study 2	Email

CA = California; CDFW = California Department of Fish and Wildlife; LV = Lee Vining; NPS = National Park Service; NV = Nevada; PAD = Pre-Application Document; PPT = PowerPoint; SCE = Southern California Edison; TWG = Technical Working Group; USFS = U.S. Forest Service; USFWS = U.S. Fish and Wildlife Service; YOTO = Yosemite Toad

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From:	Finlay Anderson
To:	Carissa Shoemaker
Cc:	Shannon Luoma
Subject:	FW: SWRCB Lee Vining Comment Letter
Date:	Monday, January 17, 2022 8:44:15 AM
Attachments:	1_14_22_Lee_Vining_PAD_Comments_SWRCB.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

From: North, Jill@Waterboards <Jill.North@waterboards.ca.gov>
Sent: Friday, January 14, 2022 2:54 PM
To: Wayne Allen <Wayne.Allen@sce.com>
Cc: matthew.woodhall@sce.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>; Tristan.leong@usda.gov; todd.ellsworth@usda.gov; chad_mellison@FWS.gov; bartshe@monolake.org; wsigumora@mono.ca.gov; aroesberry@caltrout.org
Subject: SWRCB Lee Vining Comment Letter

Please see the attached comment letter filed with FERC today.
Feel free to email me with any questions.

Happy weekend!

Jill North
Environmental Scientist
Water Quality Certification Unit
Division of Water Rights, State Water Board

CALIFORNIA Water Boards

GAVIN NEWSOM
GOVERNOR

JARED BLUMENFELD
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

January 14, 2021

Mr. Wayne Allen
Southern California Edison
1515 Walnut Grove Avenue
Rosemead, CA 91770
Wayne.Allen@sce.com

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426
Via e-filing

Pre-Application Document Comments and Study Requests
Lee Vining Hydroelectric Project
Federal Energy Regulatory Commission Project No. 1388
Mono County
Lee Vining Creek, Glacier Creek, Saddlebag Lake, Tioga Lake and Ellery Lake

Dear Mr. Allen and Secretary Bose:

Southern California Edison (SCE) owns and operates the Lee Vining Hydroelectric Project (Project), also referred to as Federal Energy Regulatory Commission (FERC) Project No. 1388. On August 12, 2021, SCE filed its Pre-Application Document (PAD) with FERC for relicensing of the Project. On November 16, 2021, State Water Board staff attended a virtual public meeting hosted by SCE to discuss the Project relicensing and information contained in the PAD. The public meeting began a 60-day comment period in which interested parties could submit comments on the Project's PAD and request additional studies.

State Water Board staff hereby submits the enclosed comments and study request pertaining to the Project. The comments and study request are provided in two attachments: *Attachment A: Comments on Pre-Application Document for Lee Vining Hydroelectric Project* and *Attachment B: Study Plan Request for Lee Vining Hydroelectric Project.*

The State Water Board's study plan request discusses the six criteria specified by FERC in the Code of Federal Regulations, title 18, section 4.38(b)(5).

If you have questions regarding this letter please contact Jill North, Project Manager, by email at Jill.North@waterboards.ca.gov. Written correspondence should be directed to:

Wayne Allen
Secretary Bose

January XX, 2022

State Water Resources Control Board
Division of Water Rights – Water Quality Certification Program
Attn: Jill North
P.O. Box 2000
Sacramento, CA 95812-2000

Sincerely,

Jill North

Jill North – Environmental Scientist
Water Quality Certification Program
Division of Water Rights

Attachments: Attachment A: Comments on Pre-Application Document for Lee Vining Hydroelectric Project

Attachment B: Study Plan Requests for Lee Vining Hydroelectric Project

ec:
Matthew Woodhall
Project Lead
Southern California Edison
Matthew.woodhall@sce.com

Alan Roesberry
Chief Administrative Officer
CalTrout
ARoesberry@caltrout.org

Chad Mellison
Fisheries Biologist
United States Fish and Wildlife Service
Chad_Mellison@FWS.gov

Tristan Leong
Hydroelectric Coordinator
United States Forest Service
Tristan.leong@usda.gov

Todd Ellsworth
Hydrologist
US Forest Service
Todd.ellsworth@usda.gov

Alyssa Marquez
Environmental Scientist
California Department of Fish & Wildlife
Alyssa.marquez@wildlife.ca.gov

Beth Lawson
Senior Hydraulic Engineer
California Department of Fish & Wildlife
Beth.Lawson@wildlife.ca.gov

Bartshe Miller
Mono Lake Committee
Bartshe@monolake.org

Wendy Sugimora
Mono County
Planning Commission
WSugimora@mono.ca.gov

Finlay Anderson
Senior Regulatory Advisor
Kleinschmidt
Finlay.anderson@kleinschmidtgroup.com

ATTACHMENT A

COMMENTS ON PRE-APPLICATION DOCUMENT FOR LEE VINING HYDROELECTRIC PROJECT

State Water Resources Control Board (State Water Board) staff are providing the following comments on Southern California Edison's (SCE) Pre-Application Document (PAD) for relicensing the Lee Vining Hydroelectric Project (Project):

1. Section 401 of the Clean Water Act (33 U.S.C. § 1341) requires any applicant for a federal license or permit for an activity that may result in any discharge to navigable waters, to obtain certification from the State that the discharge will comply with the applicable water quality requirements, including the requirements of section 303 of the Clean Water Act (33 U.S.C. § 1313) for water quality standards and implementation plans. Clean Water Act section 401 directs that certifications shall prescribe effluent limitations and other conditions necessary to ensure compliance with the Clean Water Act and with any other appropriate requirements of state law, such as the Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.). Conditions of certification shall become a condition of any federal license or permit subject to certification. The Project will result in a discharge to navigable waters and must obtain certification from the State Water Board as part of relicensing for continued operations.

   A certification issued by the State Water Board for the Project must ensure compliance with the water quality standards in the Lahontan Regional Water Quality Control Board's Water Quality Control Plan for the Lahontan Region (Lahontan Basin Plan) and applicable state water quality control plans. Water quality control plans designate the beneficial uses of water that are to be protected, water quality objectives for the reasonable protection of the beneficial uses and the prevention of nuisance, and a program of implementation to achieve the water quality objectives. (Cal. Wat. Code, §§ 13241, 13050, subds. (h), (j).) The beneficial uses, together with the water quality objectives contained in the water quality control plans, and applicable antidegradation requirements, constitute California's water quality standards for purposes of the Clean Water Act. In issuing water quality certification for a project, the State Water Board must ensure consistency with the designated beneficial uses of waters affected by the project, the water quality objectives developed to protect those uses, and antidegradation requirements. (*PUD No. 1 of Jefferson County v. Washington Dept. of Ecology* (1994) 511 U.S. 700, 714-719.)

   The Project facilities are located on Lee Vining and Glacier Creeks, above Poole Powerhouse. Lee Vining Creek is tributary to Mono Lake, which is designated as an Outstanding Natural Resource Water. The Lahontan Basin Plan sets forth water quality standards for waterbodies in the region including Project-related waters of Lee Vining Creek as well as Ellery Lake, Saddlebag Lake, and Tioga Lake (LRWQCB, 2019). Beneficial uses established by the Lahontan Basin Plan for Project waters relevant to water quality include municipal and domestic

supply; water contact recreation; hydropower generation; navigation; water non-contact recreation; cold freshwater habitat; commercial sportfishing; wildlife habitat; and spawning, reproduction and/or early development.

In addition to beneficial uses, the Lahontan Basin Plan includes narrative and numeric surface water quality objectives that aim to preserve and protect the beneficial uses listed above. High alpine granitic watersheds, such as the Lee Vining Creek watershed, are usually low in organic matter and typically exhibit high water quality conditions. The State of California's Antidegradation Policy (State Water Board Resolution 68-16; see also 40 C.F.R. § 131.12), was developed to protect such areas. Under the Antidegradation Policy, whenever the existing water quality is better than the water quality established in applicable water quality control plans and policies (both narrative and numerical), such existing quality must be maintained unless appropriate findings are made under the policy.

Information collected through the implementation of study plans in the Federal Energy Regulatory Commission (FERC) relicensing process will be used by FERC to develop license conditions and fulfill its obligations under the National Environmental Policy Act (NEPA) and by other agencies that must take permitting actions during relicensing proceedings. Study plan information will assist the State Water Board in developing CEQA and water quality certification conditions to ensure compliance with the Clean Water Act and appropriate requirements of state law.

2. Please note, the City of Los Angeles, Department of Water and Power (LADWP) maintains water rights for diversions from Rush, Lee Vining, Parker, and Walker Creeks. LADWP's water rights licenses require minimum baseflow and flushing flow requirements, including relatively complex "Stream Ecosystem Flows" for Lee Vining Creek downstream of the Project. LADWP's licenses also explicitly require coordination with SCE regarding the Project and related water spills, releases, and flows. As the Project proceeds through relicensing, State Water Board staff will be evaluating the Project's potential impacts on water quality, including public trust resources. For more information on relevant environmental studies and requirements regarding Lee Vining Creek and the Mono Lake watershed, please visit the State Water Board's Mono Lake webpage at:

   https://www.waterboards.ca.gov/waterrights/water_issues/programs/mono_lake/.

3. Section 6.2 Technical Study Plans states, "The Study Plans, included in Appendix C, are preliminary and intended to be high level as this time, but with the intent to start providing Stakeholders with additional information about each

proposed study. SCE's intent is to refine these Study Plans in collaboration with Stakeholders as part of the Study Plan development process." State Water Board staff supports SCE's intended process to work collaboratively with State Water Board staff and other relicensing participants to refine studies. When possible, working collaboratively with all relicensing participants often allows for expedited resolution of issues.

4. Code of Federal Regulations, title 18, section 5.6(c)(1)) states "the pre-application document must describe the existing and proposed (if any) project facilities and operations, provide information on the existing environment, and existing data or studies relevant to the existing environment, and any known and potential impacts of the proposed project on the specified resources." (18 C.F.R. § 5.6(c)(1).) The PAD is unclear on whether SCE proposes any changes to the Project as part of relicensing.

   On November 1, 2021, an SCE consultant, Kleinschmidt, communicated with State Water Board staff that there are no changes to existing operations. State Water Board staff appreciates Kleinschmidt's response and recommends SCE clarify project changes or lack of change in future hydroelectric project PADs.

5. PAD Section 4.6.1, states:

   "SCE's delivery of intra-day load to meet demands is referred to as 'Hydro-Resource Optimization' and has increased since 2016. These operations are in response to grid demand and pricing. The Plant is usually called into operations during the evening hours. These events have resulted in periodic releases of flow into Lee Vining Creek below Poole Powerhouse. Data is not available to easily describe the frequency and magnitude of these, but they generally last less than 8 hours. Using available data from the downstream [Los Angeles Department of Water and Power] diversion, SCE has estimated that these events are influenced by time of year with higher frequency of events occurring in the winter and spring. SCE is proposing to continue Hydro-Resource Optimization in the new license term, and will be characterizing the frequency, magnitude, and duration of these events for the new license along with reviewing potential Project effects."

   State Water Board staff request that SCE provide data collected during past Hydro-Resource Optimization efforts as it relates to flow (including ramping rates) and water quality. State Water Board staff also requests SCE clarify why data is not easily available to quantify the frequency and magnitude of these past events and what changes to flow monitoring would be necessary to accurately

characterize future events. Additionally, State Water Board staff request that the proposed *WQ-1 Stream and Reservoir Water Quality Technical Study Plan* include monitoring of water quality parameters and flow (specifying ramping rates) during Hydro-Resource Optimization events in order to better inform potential impacts to beneficial uses of water.

6. Compliance with the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) is required as part of the water quality certification process. CEQA requires the lead agency to evaluate a project's potential impacts to environmental resources as well as identify mitigation measures and alternatives to reduce project impacts. CEQA also requires public input on identified impacts and mitigation measures. CEQA documentation must analyze and evaluate the Project's impacts to all relevant resources, including aquatic biological resources, special status species, water quality standards, and water quality control plans. Information from studies and data gathering during FERC relicensing informs CEQA document development.

   CEQA Guidelines define the lead agency as "the public agency which has the principal responsibility for carrying out or approving a project." (Cal. Code Regs., tit. 14, § 15367.) It is State Water Board staff's understanding that the State Water Board will act as the CEQA lead agency for the Project relicensing. State Water Board staff request SCE confirm in writing its understanding on whether the State Water Board will be the CEQA lead agency.

   Please note, the State Water Board's preference is to begin the CEQA process following issuance of a Draft License Application in order to provide adequate time to complete the CEQA process prior to taking a final action on SCE's future water quality certification request.

7. Below, State Water Board staff are providing comments on SCE's proposed WQ-1 Stream and Reservoir Water Quality Technical Study Plan:

   - State Water Board staff request the inclusion of fecal coliform testing in Project reservoirs and have samples tested at an Environmental Laboratory Accreditation (ELAP) certified lab. Fecal coliform data will inform potential Project effects to recreational beneficial uses.

   - State Water Board staff request the Stream and Reservoir Water Quality Technical Study Plan include data collection sites at reservoir inflow locations. Inflow water quality will provide background water quality data to assess potential impacts to beneficial uses from reservoir operations and facilities.

ATTACHMENT A

COMMENTS ON PRE-APPLICATION DOCUMENT FOR LEE VINING HYDROELECTRIC PROJECT

- State Water Board staff request water column mercury and methylmercury sampling of all project reservoirs be included in the Stream and Reservoir Water Quality Technical Study Plans.

  According to the PAD section 5.2, there is reduced DO found in the bottom of project reservoirs due to seasonality and prolonged reservoir stratification. Oxygen depletion may lead to increased methylation of mercury due to anoxic conditions. Additionally, there is history of gold, silver, and tungsten mining in the Lee Vining Creek watershed with limited metals and other mining related water quality data available.

  Given the history of the watershed and minimal existing data on mercury concentrations, additional information is needed to address water quality data gaps for the project, establish baseline conditions, inform fish tissue data (requested below in Attachment B), and inform State Water Board staff's assessment of Project impacts to water quality.

- The *Stream and Reservoir Water Quality Technical Study Plan* is proposed for one year, with some comparison to older limited water quality data. State Water Board staff believe one year of data collection is not adequate to evaluate the Project's potential impacts as its operations could span a 50-year term. One year of data collection may not provide sufficient water quality information for various water years. State Water Board staff request the above study continues data collection for a minimum of two years.

ATTACHMENT B

STUDY PLAN REQUEST FOR LEE VINING HYDROELECTRIC PROJECT

State Water Resources Control Board (State Water Board) staff requests a Methylmercury Fish Tissue Sampling Study be conducted as part of relicensing Southern California Edison's (SCE) Lee Vining Hydroelectric Project (Project).

1. *Identifying [the State Water Board's] determination of necessary studies to be performed or the information to be provided by the potential applicant;* (18 C.F.R. § 4.38(b)(5)(i)).

   Available information is insufficient to determine whether the Project may adversely affect beneficial uses in the Lee Vining Creek watershed by providing conditions that increase the methylenation of mercury.

   SCE's Pre-Application Document (PAD) Section 5.3 states, "Information regarding concentrations of mercury within Project waters is minimal. Fish tissue data available from CEDEN collected in 2008 includes concentrations of total mercury in two composite samples of five rainbow trout from each Ellery, Tioga, and Saddlebag Lakes (CEDEN, 2020)." Given that this data was collected over thirteen years ago, additional methylmercury fish tissues collections are warranted and when coupled with additional mercury water quality monitoring (requested in State Water Board's Attachment A, Comment 6) would inform changes in methylmercury concentrations associated with Project reservoir operations, and may inform conditions of a water quality certification.

2. *Identifying the basis for [the State Water Board's] determination;* (18 C.F.R. § 4.38(b)(5)(ii)).

   The State Water Board's determination for this study request is based on information provided by SCE in its PAD. After reviewing this information, State Water Board staff determined this information is insufficient to adequately address potential impacts associated with the Project to beneficial uses within the Lee Vining Creek watershed.

   Information from PAD Section 5.3 references fish tissue mercury levels from a small sampling effort conducted in 2008 to indicate that mercury likely does not adversely impact water quality within the project area. Federal standards for fish consumption are referenced in this section. Future studies should be robust, represent the range of fish that could be caught and consumed by anglers and the general public and compare fish tissue mercury levels to State of California standards.

3. *Discussing [the State Water Board's] understanding of the resource issues and its goals and objectives for these resources;* (18 C.F.R. § 4.38(b)(5)(iii)).

   The State Water Board is responsible for the protection of water quality standards. In relation to the Project, the State Water Board is the state agency with federal Clean Water Act section 401 water quality certification authority and through issuance of a certification must verify that Project operations do not violate a water quality standard or other applicable state water quality requirements. Additional fish tissue mercury information may inform future conditions of a water quality certification.

4. *Explaining why each study methodology recommended by [the State Water Board] is more appropriate than any other available methodology alternatives, including those identified by the potential applicant pursuant to paragraph (b)(2)(vii) of this section;* (18 C.F.R. § 4.38(b)(5)(iv)).

   PAD section 5.3 references limited thirteen-year-old data collected in 2008 from a small sample size to indicate that Project effects to the methylenation of mercury is likely not adversely impacting water resources. State Water Board staff feel a more recent and robust study that that follows standard fish tissue mercury protocols and represents the range of fish that could be caught and/or consumed by the public, coupled with concurrent water quality data related to mercury will better ensure the Project is protective of human health and is compliant with water quality standards.

5. *Documenting that the use of each study methodology recommended by [the State Water Board] is a generally accepted practice;* (18 C.F.R. § 4.38(b)(5)(v)).

   Mercury Fish Tissue sampling is frequently conducted in reservoirs with resident fish and/or sport fishing activities to help inform regulatory decisions regarding potential impacts to beneficial uses associated with the fishery and recreational uses, including fish consumption. As SCE is pursuing a new license to operate the Project for a termed period of up to 50 years, requiring current fish tissue sample is an appropriate data collection event to inform Project relicensing.

6. *Explaining how the studies and information requested will be useful to the [State Water Board] in furthering its resource goals and objectives that are affected by the proposed project*. (18 C.F.R. § 4.38(b)(5)(vi)).

   The State Water Board has broad authority under the Clean Water Act (33 U.S.C. §§ 1251-1387), the California Constitution, and state statutes and regulations to restore and maintain the chemical, physical and biological integrity

of the state's waters, and to regulate the diversion and use of water through the water right priority system in accordance with the State Water Board's reasonable use and public trust responsibilities. The Porter-Cologne Water Quality Control Act (Cal. Wat. Code, § 13000 et seq.) establishes a comprehensive program to protect water quality and the beneficial uses of water and charges the State Water Board and nine regional water quality control boards with protecting water quality in California.

Throughout the Federal Energy Regulatory Commission relicensing process, the State Water Board maintains independent regulatory authority to condition Project operations to protect water quality and beneficial uses consistent with the Clean Water Act, applicable water quality control plans, State Water Board regulations, and any other applicable state laws. Associated with mercury concentrations, the Project has the potential to impact beneficial uses related to the fisheries and recreational uses in the Lee Vining Creek watershed. Requiring mercury fish tissue sampling as part of the relicensing effort for the Project is appropriate as it will ensure up to date fish tissue levels and enable State Water Board staff to more accurately assess potential impacts to the recreational fishery and associated beneficial uses of the waters of the state within the Project area.

B-02_Discussion re TWG draft meeting notes and Mono Lake Committee study requests (attached)

From:	Greg Reis
To:	Carissa Shoemaker; Chris Shutes; Nick.Buckmaster@wildlife.ca.gov; Chase.Hildeburn@Waterboards.ca.gov; Paul.Pau@ladwp.com; Saeed.Jorat@ladwp.com; Geoffrey McQuilkin; alyssa.marquez@wildlife.ca.gov; eric.tillemans@ladwp.com; Adam.Perez@ladwp.com; ed.hancock@waterboards.ca.gov; easternsierraartist@gmail.com; Claire Landowski; Adam Cohen; Christina McDonald; Charles.partridge@sce.com; Rwgoode911@hotmail.com; Torres, Thomas - FS; cshutes@calsport.org; todd.ellsworth@usda.gov; nathan.sill@usda.gov; tristan.leong@usda.gov; Chad_Mellison@fws.gov; sb@snowhydrology.com; sheila.irons@usda.gov; Sanchez, Monique - FS; adam.barnett@usda.gov; justin_barrett@fws.gov; s.manning@bigpinepaiute.org; d.gutierrez@bigpinepaiute.org; c.levine@bigpinepaiute.org
Cc:	Matthew Woodhall; Martin Ostendorf; Finlay Anderson; Shannon Luoma; Kelly Larimer; Heather Bowen Neff; Lyle.Laven@sce.com; seth.carr@sce.com; vince.white@sce.com; talpaugh@kearnswest.com; Mark Sebarrotin; Michael Harty
Subject:	RE: Lee Vining Aquatics TWG February Agenda & January Notes
Date:	Monday, February 22, 2021 9:32:42 AM
Attachments:	image001.png Lee Vining Relicensing Study Request Template--Peak Flow Impairment.docx SEF Shortfall PV GR 11_14.pptx

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi all,

I'd like to apologize for our schedules not allowing us to send anything sooner. Below is a list of the study requests we are working on and attached is the first one:

1. Peak Flow Impairment (including SEF Shortfall Analysis Powerpoint attachment)
2. Information Sharing
3. Hydropower Peaking Operations

We will submit #2 and #3 as soon as possible. We are looking forward to today's meeting.

Thanks,

Greg

Greg Reis, Information and Restoration Specialist
Mono Lake Committee
(760) 647-6595 | (760) 647-6386 x141
Hwy 395 at Third Street, P.O. Box 29, Lee Vining, CA 93541
www.monolake.org| www.monobasinresearch.org
Saving Mono Lake for future generations through
protection, restoration, education, and science.
Long Live Mono Lake!

From: Carissa Shoemaker [mailto:Carissa.Shoemaker@erm.com]
Sent: Thursday, February 11, 2021 7:42 PM
To: Chris Shutes <BlancaPaloma@msn.com>; Nick.Buckmaster@wildlife.ca.gov; Chase.Hildeburn@Waterboards.ca.gov; Paul.Pau@ladwp.com; Saeed.Jorat@ladwp.com; Geoffrey McQuilkin <geoff@monolake.org>; alyssa.marquez@wildlife.ca.gov; eric.tillemans@ladwp.com; Adam.Perez@ladwp.com; ed.hancock@waterboards.ca.gov; easternsierraartist@gmail.com; Claire Landowski <claire@monolake.org>; Greg Reis <greg@monolake.org>; Adam Cohen <acohen@stillwatersci.com>; Christina McDonald <cmcdonald@northforkrancheria-nsn.gov>; Charles.partridge@sce.com; Rwgoode911@hotmail.com; Torres, Thomas - FS <thomas.torres@usda.gov>; cshutes@calsport.org; todd.ellsworth@usda.gov; nathan.sill@usda.gov; tristan.leong@usda.gov; Chad_Mellison@fws.gov; sb@snowhydrology.com; sheila.irons@usda.gov; Sanchez, Monique - FS <monique.sanchez@usda.gov>; adam.barnett@usda.gov; justin_barrett@fws.gov; s.manning@bigpinepaiute.org;

d.gutierrez@bigpinepaiute.org; c.levine@bigpinepaiute.org
Cc: Matthew Woodhall <Matthew.Woodhall@sce.com>; Martin Ostendorf <Martin.Ostendorf@sce.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Lyle.Laven@sce.com; seth.carr@sce.com; vince.white@sce.com; talpaugh@kearnswest.com; Mark Sebarrotin <msebarrotin@kearnswest.com>; Michael Harty <jmharty@kearnswest.com>
Subject: Lee Vining Aquatics TWG February Agenda & January Notes
Hello Lee Vining Aquatic Resources TWG members,
Attached for your review are draft meeting notes from the January TWG and an agenda for the upcoming February TWG.
I'd also like to take this opportunity to remind you about the updated "homework" sent out on February 5, and due next week on February 17. I've received responses from a small handful of TWG members.
Please let me know if you have questions about the attached materials, homework, or anything else TWG-related.
Thanks

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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Lee Vining Relicensing Study Request:
Reducing Peak Flow Impairment to benefit alluvial reaches downstream of the project area

Requestor Name:	Greg Reis
Agency /Affiliation:	Mono Lake Committee
Primary Resource Area:	Hydrology and Operations – Aquatic Resources
Proposed Study Title:	Reducing peak flow impairment to benefit alluvial reaches downstream of the project area

Introduction

In 1941, the Los Angeles Department of Water and Power (DWP) began diverting water from Lee Vining Creek into the L.A. Aqueduct. For the next 45 years the creek was often completely dewatered below the diversion dam, except when floods exceeded the capacity of the diversion. This destroyed the stream ecosystem downstream of the dam and deprived Mono Lake of needed volume. Thirty-five years ago, court-ordered minimum flows were first established below the DWP diversion dam on Lee Vining Creek. Since then, there have been many studies, restoration projects, and flow requirements focused on restoring the conditions that benefitted the pre-1941 fishery downstream of the diversion dam.

The long-term approach to the Water Board-ordered restoration effort is to use components of the natural hydrograph to restore functional and self-sustaining stream systems with healthy riparian ecosystem components. The independent Stream Scientists in charge of the restoration effort have identified peak flow magnitude as a key driver of necessary natural processes, recommending that all flows in excess of 250 cfs be bypassed to the downstream reaches, and that higher peak flow magnitudes than those derived from current SCE releases be achieved.

The Lee Vining Hydropower project historically has been operated to store water in three reservoirs during the spring snowmelt runoff. This operation impairs the peak flows downstream, reducing the energy and stage needed for the restoration of the reaches downstream of the diversion dam. The 2010 Synthesis Report identified desired peak flow recurrence intervals, and slides 10-16 of November 15, 2011 Powerpoint presentation "Rush Creek and Lee Vining Creek Peak SEF Shortfall Analysis and Maximizing SEFs with Existing Facilities" (SEF Shortfall Powerpoint) frame the issue. The goal of this study would be to determine how to achieve the desired peak flow recurrence intervals by making operational changes to the Lee Vining Hydropower Project.

1. Study goals and objectives

18 CFR §5.9(b)(1): Describe the goals and objectives of each study proposal and the information to be obtained.

- The goal of the study is to determine how to achieve the desired peak flow recurrence intervals identified in "Mono Basin Restoration and Monitoring Program: Synthesis of Instream Flow Recommendations to the State Water Resources Control Board and the Los Angeles Department of Water and Power, Final Report" McBain & Trush, Inc. and Ross Taylor and Associates, April 30, 2010 (Synthesis Report). Information obtained would include
    1. Through a review of historical data, quantify the peak flow impairment from each SCE reservoir each year for the three highest spring snowmelt peaks each year.
    2. Quantify the additional flow needed in each year based on the recommended Stream Ecosystem Flows (SEFs) in Synthesis Report Table 4-2 and Figure 4-6 (reproduced here).

Table 4-2. Recommended minimum flood peak magnitudes and recurrence intervals for Lee Vining Creek.

Recurrence Interval (years)	Lee Vining Creek Unimpaired (cfs)	Lee Vining Creek above Intake (cfs)	Lee Vining Creek Recommended SEFs (cfs)
2	373	260	300
3	420	300	370
5	510	380	440
10	630	475	540
25	680	630	650

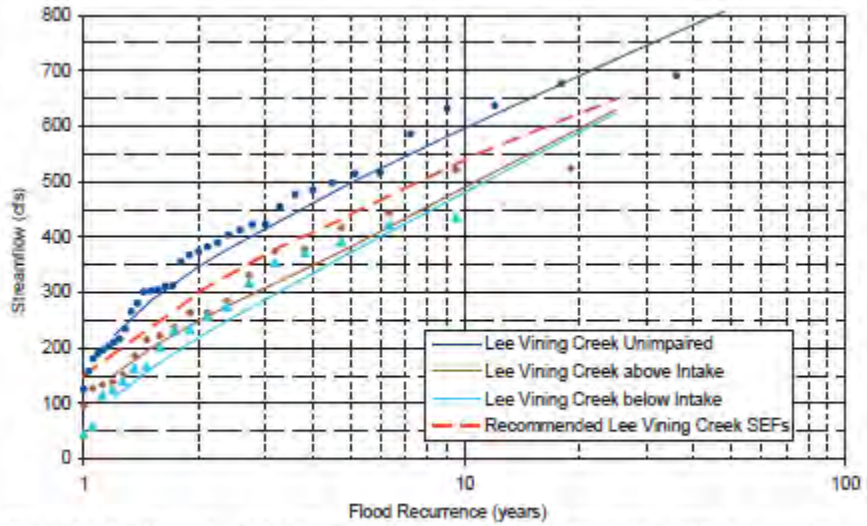


Figure 4-6. Lee Vining Creek flood frequency curves computed for RYs 1973 to 2008 (unimpaired), and RYs 1990 to 2008 (above and below Intake).

    3. Evaluate feasibility of releasing additional peak flows through the development of operational scenarios for each year.
    4. Quantify how much of the additional peak flow the project is capable of reliably delivering and develop operational rules that would guide actions.
    5. Model how much generation cost there would be to delivering the additional peak flow and identify options for mitigating the reduced generation.
    6. Identify any forecasting and coordination constraints and ways to overcome those constraints.

2. Relevant Resource Management Goals and Public Interest Considerations

18 CFR §5.9(b)(2): If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied.

- The State Water Board goal for restoration of Lee Vining Creek downstream of the DWP diversion dam is to restore the conditions that benefitted the pre-1941 fishery, including "functional and self-sustaining stream systems with healthy riparian ecosystem components" and "trout in good condition."
- Synthesis Report authors (Stream Scientists) identified eight objectives during the 12-year monitoring program below the DWP diversion dam; objective 2 was to "accelerate recovery of the Lee Vining Creek ecosystem by encouraging SCE's assistance in releasing higher peak snowmelt runoff events." The Synthesis Report is being implemented through a 2013 settlement agreement between DWP, CDFW, Cal Trout, and the Mono Lake Committee. Changing DWP's water rights licenses to match the 2013 settlement agreement is accomplished through annual Temporary Urgency Change Petitions, with long-term license amendments pending before the State Water Board.
- A primary tool of the restoration program is flow management. Most major geomorphic work is accomplished by peak streamflows greater than 250 cfs. In order to maximize the impaired spring snowmelt peak flows in Lee Vining Creek, DWP must cease diverting water when flow at its diversion dam exceeds 250 cfs.

18 CFR §5.9(b)(3): If the requester is a not a resource agency, explain any relevant public interest considerations in regard to the proposed study.
The Mono Lake Committee has been a party to the State Water Board-ordered restoration of Lee Vining Creek since it first filed lawsuits compelling the rewatering of Lee Vining Creek downstream of the DWP diversion dam in 1986. The Committee is a non-profit citizen's group dedicated to protecting and restoring the Mono Basin ecosystem, educating the public about the Mono Basin and the impacts of excessive water use, and promoting cooperative solutions that meet real water needs without transferring environmental problems to other areas.

3. Existing Information and Need for Additional Information
18 CFR §5.9 (b)(4): Describe existing information concerning the subject of the study proposal, and the need for additional information.

- The Synthesis Report, including appendices and related study reports.
- Peter Vorster and Greg Reis analysis of needed additional flows (SEF Shortfall Powerpoint, 11/15/11). Powerpoint presentation describes need for additional information, including on slides 11-12 assuming a 40 cfs additional release from Saddlebag Lake Reservoir could be made, and on the last slide an excerpt from an SCE letter expressing a willingness to look at the issue if presented with a more detailed study request.

3. Project Nexus
18 CFR §5.9(b)(5): Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements.

- The peak flow reaching the DWP diversion dam is a combination of unregulated flow and releases from SCE hydropower dams. In most years when additional peak flow is needed, SCE has the capacity to release more and has expressed willingness to discuss (see SEF Shortfall Powerpoint, 11/15/11, Slides 10-16).
- Influence of concerns at TPR site and culvert capacity at Saddlebag Lake Road
- Forecasting issues (including snow surveys, snow pillows)
- Information sharing issues (see separate "Information Sharing" study report)

5. Methods

18 CFR §5.9(b)(6): Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge.

Review Synthesis Report, Review daily hydrology of a sample of years and the necessary additional flow needed from the project reservoirs, determine feasibility of operating to reduce the impairment of the peak flow. For an initial analysis, see slides 11 & 12 of the SEF Shortfall Powerpoint.

6. Level of Effort and Cost

18 CFR §5.9(b)(7): Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

Low cost—most analysis of the flow need has already been done (see SEF Shortfall Powerpoint). The main effort remaining is for SCE to determine what additional peak flow increment it can feasibly and reliably deliver, and what operational rules, forecasting, and information sharing is necessary for implementation.

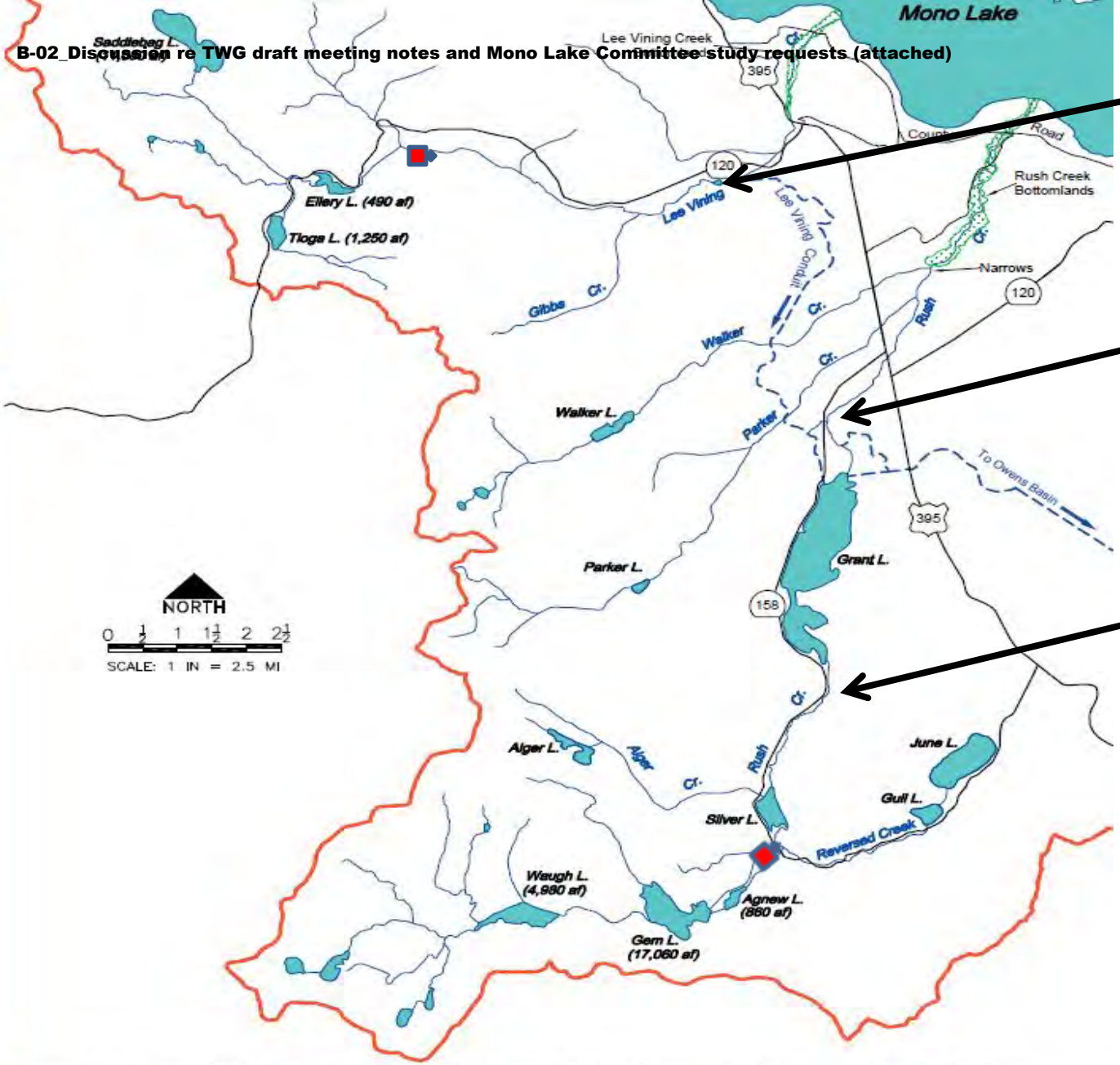
Rush Creek and Lee Vining Creek Peak SEF Shortfall Analysis and Maximizing SEF's with Existing Facilities

Presented by Mono Lake Committee

To the Core Working Group

11/15/11

Photo Lee Vining Cr at Saddlebag Rd @ 6pm on 6/5/10
Saddlebag outflow: 8 cfs
Tioga outflow: 36 cfs (51 cfs instantaneous)
Ellery spill: 254 cfs
At DWP diversion: 409 cfs (562 cfs unimpaired)



Lee Vining Cr

Rush Cr

Rush @ Damsite

Map from Synthesis Report Fig. 1-1 (p. 6).

Figure 1-1. Major hydrologic features of the Mono Basin, CA and the location of Rush, Parker, Walker, and Lee Vining creeks. Storage reservoirs in the upper basins of Lee Vining and Rush creeks (with reservoir capacities indicated in the figure) are operated by Southern California Edison (SCE). Streamflow regulation and diversions occur (from north to south) via the Lee Vining Conduit,

Synthesis Report Peak SEF Prescriptions: Rush Creek

Recurrence Interval (years)	Rush Creek Unimpaired (mean daily cfs)	Rush Creek at Damsite (mean daily cfs)	Rush Creek Recommended SEFs (mean daily cfs)
2	550	225	380
3	600	280	450
5	715	380	550
10	800	480	650
25	1000	640	750

Table 5-1

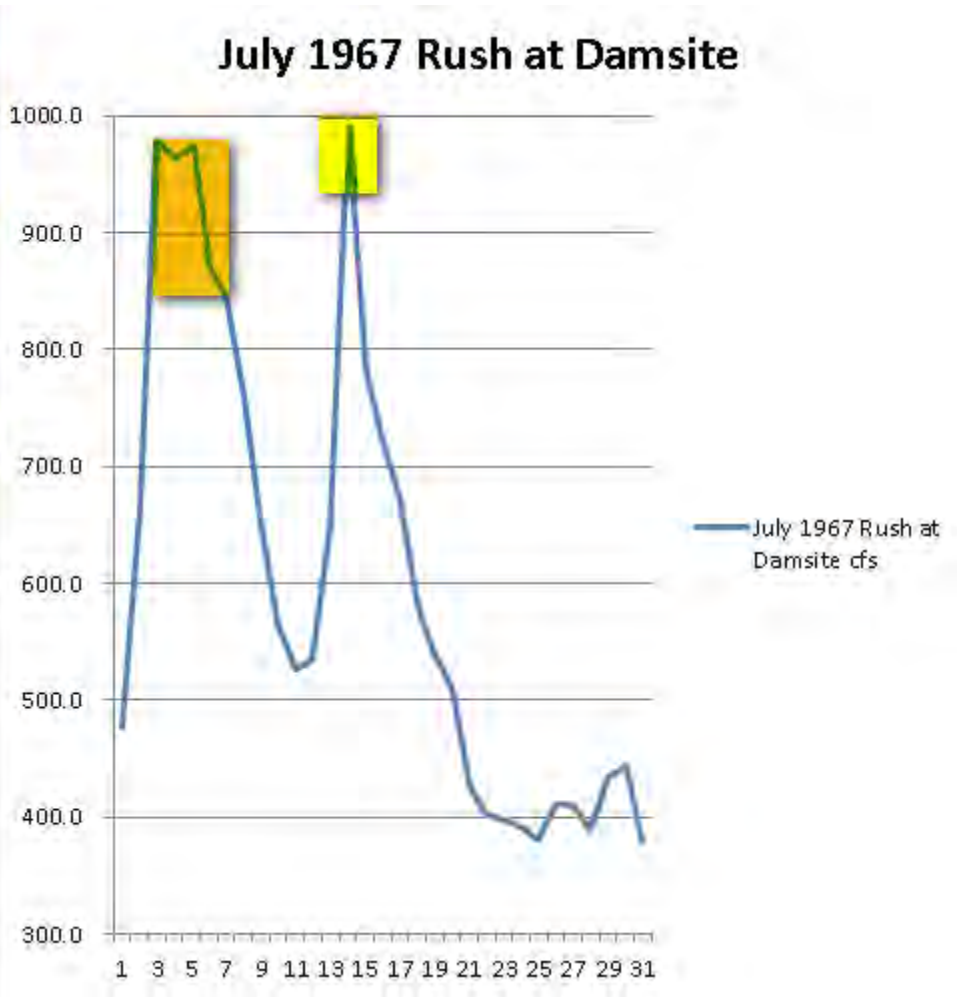
5 consecutive days with the highest low flow

Highest flow of the highest 5 days

Lowest flow of the 5 days
(This is the only 5-day period with all the days at least this high. Since it is at least 750 cfs, this period would comply with the requirement)

Highest one-day flow

477.1
664.4
978.8
965.5
975.9
871.2
845.8
759.3
655.1
563.6
527.0
535.6
648.4
992.1
781.2
723.1
671.3
578.8
539.8
510.2
425.1
403.8
398.1
390.5
381.1
411.6
409.7
388.6
433.0
444.9
379.2



B-02_Discussion re TWG draft meeting notes and Mono Lake Committee study requests (attached)

Rush Creek SEF Shortfall (cfs based on inflow)					Actual flow	Actual flow	Actual flow	Shortfall	Unimpaired	Unimpaired	Unimpaired	Date of	Gem	Date of spill	Gem TAF
Yr Type	Year	Target Flow	Target Days	Actual Dates	1 day peak	3 or 5 day high	3 or 5 day low	Range	1-day peak	3/5 day low	3/5 d volume	unimp pk	spilling?	17.2+ TAF	during dates
EW	1967	750	5	7/3-7/7	992	978	846	-96 to -228	1002	868	126%	1-Jul	yes	August	(16.3 7/1)
EW	1995	750	5	7/7-7/11	634	552	483	198-267	1144	816	125%	9-Jul	no	7/19-8/28	12.4-15.5
EW	1969	750	5	6/3-6/7, 6/20-6/24	508	458	454	296-292	807	694	98%	6/4-6/5	no	August	(7.6 6/1)
EW	1983	750	5	7/3-7/7	483	483	447	267-303	850	706	102%	5-Jul	no	August	(11.8 7/1)
EW	1982	750	5	7/25-7/29	372	372	332	378-418	714	566	84%	17-Jun		August	(12.3 7/1)
W	2006	650	5	6/5-6/9	483	483	456	167-194	644	536	89%	26-Jun	no	7/26-8/2	12.0-12.7
W	1998	650	5	7/9-7/13	495	468	432	182-218	726	575	94%	9-Jul	no	7/18-7/25, 8/	15.6-16.4
W	1978	650	5	7/14-7/18	514	514	417	136-233	722	518	96%	8-Jun	no	August	(12.4 7/1)
W	2005	650	5	6/13-6/17	441	441	403	209-247	751	522	90%	27-May	no	7/14-8/2	12.9-13.3
W	1956	650	5	7/7-7/11	391	391	383	259-267	695	538	94%	28-Jun			
W	1986	650	5	7/2-7/6	425	425	344	225-306	1078	801	134%	1-Jun	yes	July	(17.6 7/1)
WN	1958	550	3	7/8-7/10	439	439	433	111-117	719	641	121%	24-Jun			
WN	2010	550	3	7/1-7/3	478	478	410	72-140	1081	1001	187%	7-Jun	yes	6/29-7/11, 7/	17.5-17.2
WN	1980	550	3	6/30-7/2	414	414	404	136-146	801	734	139%	30-Jun	no		(13.5 7/1)
WN	1993	550	3	7/6-7/8	388	386	383	164-167	639	538	107%	27-Jun	no	8/5-8/7	15.2-15.5
WN	1996	550	3	6/23-6/25	306	306	303	244-247	620	565	109%	7-Jun		no spill	12.7
WN	1974	550	3	8/1-8/3	337	337	261	213-289	620	533	105%	6-Jun	yes	August	(17.5 8/1)
WN	1973	550	3	5/30-6/1	275	260	253	290-297	586	559	104%	30-May		July	(10.5 6/1)
WN	1962	550	3	6/22-6/24	249	249	239	301-311	529	518	95%	22-Jun	no		(11.0 7/1)
WN	1965	550	3	8/13-8/15	254	254	231	296-319	642	425	84%	22-Jun			
WN	1984	550	3	5/24-5/26	207	207	206	343-344	563	504	96%	24-May	no		(7.7 6/1)
WN	1997	550	3	5/15-5/17	211	208	200	342-350	547	524	97%	15-May	no	7/10-7/18	7.3-7.6
WN	1963	550	3	6/4-6/6	120	115	113	435-437	702	635	121%	18-Jun			(17.2 8/1)

Highest peak was outside the 3 or 5 consecutive days with the highest low flow

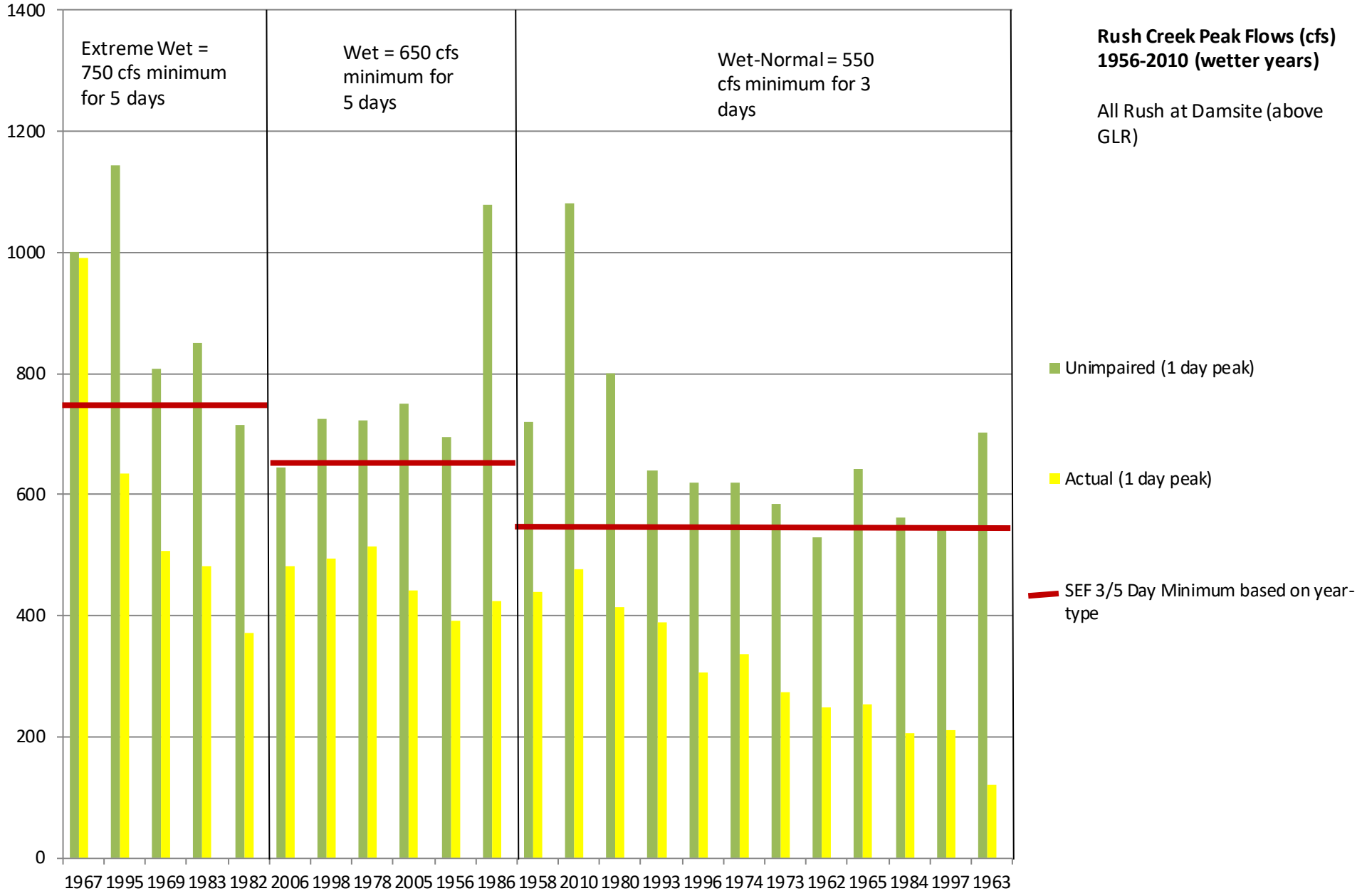
Shortfall is the target minus the low, or the greatest 1-day shortfall during the highest 3 or 5 days.

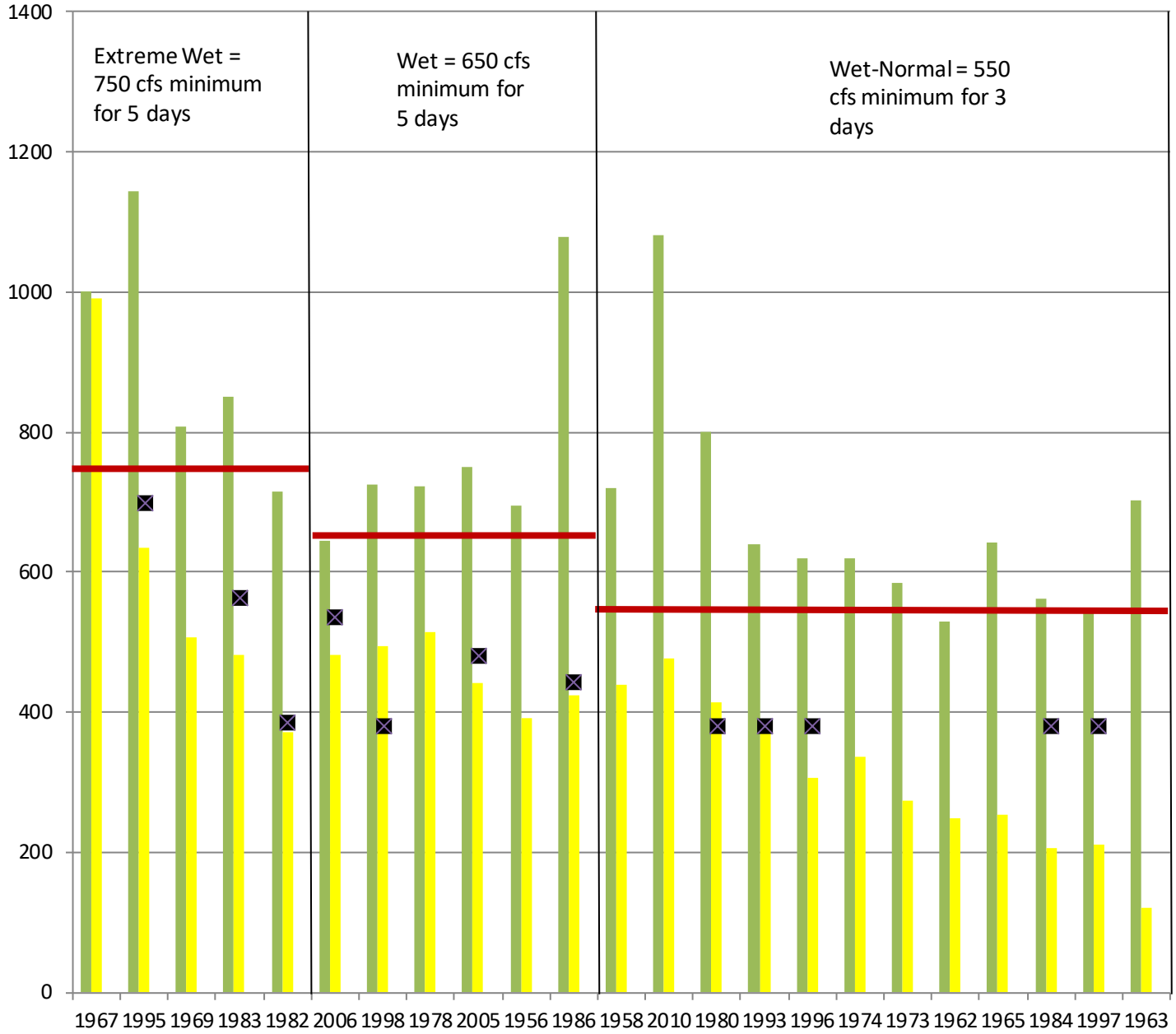
Data from Synthesis Report and DWP except:

pre-1980 at Damsite from Stacy Li data entry from LADWP hard copy

Unimpaired from McBain & Trush (sum of damsite and three reservoir storage changes)

Gem storage from USGS (monthly from CDEC)


Extreme Wet = 750 cfs minimum for 5 days
Wet = 650 cfs minimum for 5 days
Wet-Normal = 550 cfs minimum for 3 days
1400
1200
1000
800
600
400
200
0
1967 1995 1969 1983 1982 2006 1998 1978 2005 1956 1986 1958 2010 1980 1993 1996 1974 1973 1962 1965 1984 1997 1963
Rush Creek Peak Flows (cfs) 1956-2010 (wetter years)
All Rush at Damsite (above GLR)
Unimpaired (1 day peak)
Actual (1 day peak)
SEF 3/5 Day Minimum based on year-type



Rush Creek Peak Flows (cfs) 1956-2010 (wetter years)

All Rush at Damsite (above GLR) except eSTREAM model output is below GLR spillway and MGORD

- Unimpaired (1 day peak)
- Actual (1 day peak)
- SEF 3/5 Day Minimum based on year-type
- eSTREAM modeled 1-day peak below GLR (MGORD + spill) 6410 - Hybrid, with existing DWP facilities and historic SCE operations

Rush Creek: Issues requiring further investigation to determine if increased flows could be made available

- Willingness of SCE to change operations to increase outflows at the proper time
- Interest and ability of SCE and USFS to implement via existing FERC license conditions

Rush Creek: Implementation issues, assuming increased flows could be made available

- Coordination and communication between DWP and SCE including establishing protocols for implementation
- Coordination and communication between other parties (MLC, DFG, FS, Caltrans), DWP, and SCE including monitoring (e.g. culverts under roads, stream conditions) and forecasting (assisting in determining when peak flows are occurring)
- Given travel time to affect Grant outflow, need to forecast peaks many days in advance
- Grant Reservoir is operated to assure reservoir is spilling during peak inflows
- Coordination with Walker and Parker inflows to Rush Creek to maximize flows in bottomlands
- Effect of Silver Lake on attenuating flows

Synthesis Report Peak SEF Prescriptions: Lee Vining Creek

Adapted by Mark Drew from Synthesis Report Table 4-2

Recommended minimal flood peak magnitudes, recurrence internvals, and preliminary marginal increases, duration and timing in SCE flows *

Recurrence Interval (years)	Year Type	Lee Vining Creek Unipaired (cfs)	Lee Vining Creek above intake (cfs)	Lee Vining Creek Recommended SEFs	Preliminary Marginal Change (cfs)	Target Duration for Marginal Increase in Lee Vining	Target time period for increase in Lee Vining flows
2	Normal	373	260	300	40	< 1 week	May 20-June 20
3		420	300	370	70	< 1 week	June 1 - July 1
5		510	380	440	60	< 1 week	June 10- July 10
10		630	475	540	65	< 1 week	June 15 - July 15
25	Extreme-Wet	680	630	650	20	< 1 week	June 15 - July 15

* Derived from Table 4-2 (page 82) of the Final Synthesis Report

Notes -

1. The marginal change between the Lee Vining above intake and the Lee Vining Creek recommended will be different with additional data analysis and when the same base periods are used in the analysis
2. Target time period for increase in flows are given as an example and require additional analysis to pinpoint

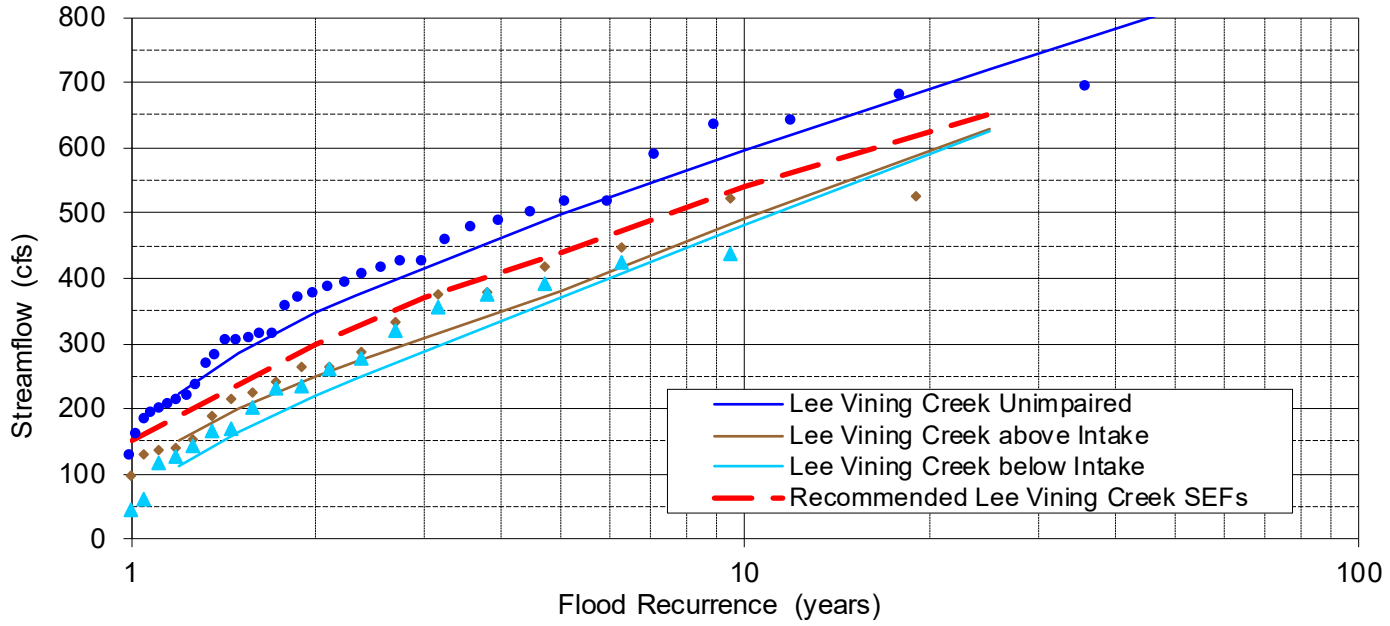
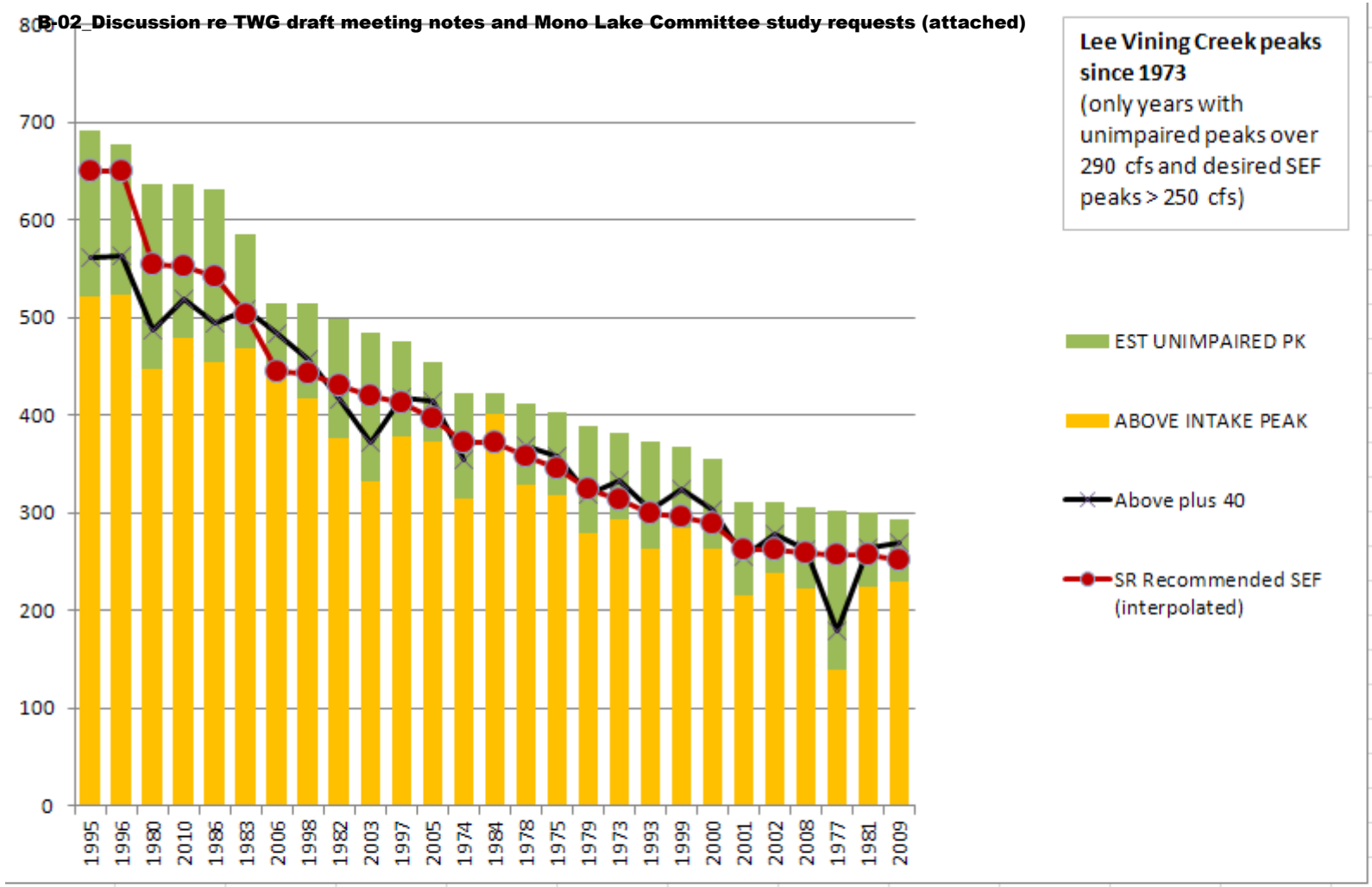


Table 4-2
Figure 4-6



NOTES

Bars are actual data

SR Recommended SEF is a linear interpolation between the five points in table 4-2 (as well as the 1-year flood)

CONCLUSIONS

Where the black horizontal line is higher than the red circles, the recommended SEF could be met by opening up the Saddlebag outlet all the way.

Where the black line is slightly lower than the red circles, additional water would have to be released from Tioga as well.

Where the black line is a lot lower than the red circles, the recommended SEF is probably not attainable.

Lee Vining Creek

Columns A-E from Table 2-4 in Synthesis Report
Additional years other than 1990-2009 added subsequently (2011 preliminary)

YEAR	YR TYPE	EST UNIMPAIRED PK	ABOVE INTAKE PEAK	DATE ABOVE PK	Desired flow	Shortfall	SCE help needed	Above plus 40	Possible with 40	Shortfall above 40 needed from Tioga	Possible from Tioga	Feasible
1995	Ex-Wet	691	522	9-Jul	650	128	YES	562	no	88	no	
1996	Wet-Norm	677	524	8-Jun	650	126	YES	564	no	86	no	
1980		637	447	1-Jul	555	108	YES	487	no	68.4	no	
2010	Wet-Norm	636	480	7-Jun	553	73	YES	520	no	33.2	maybe	
1986		631	455	3-Jun	542	87	YES	495	no	47.2	maybe	
1983		585	469	18-Jun	502	33	YES	509	yes			
2006	Wet	515	444	7-Jun	444	0	NO	484				
1998	Wet	514	417	9-Jul	443	26	YES	457	yes			
1982		498	377	18-Jun	431	54	YES	417	no	14	probably	
2003	DNI	484	332	30-May	420	88	YES	372	no	48	maybe	
1997	Wet-Norm	476	378	31-May	414	36	YES	418	yes			
2005	Wet-Norm	455	374	5/28, jun 15	397	23	YES	414	yes			
1974		423	314	7-Jun	372	58	YES	354	no	18	probably	
1984		422	402	19-Jul	372	-30	NO					
1978		412	328	9-Jun	358	30	YES	368	yes			
1975		404	318	2-Jun	346	28	YES	358	yes			
1979		389	280	6/6-6/7	324	44	YES	320	no	4	yes	
1973		382	293	9-Jun	313	20	YES	333	yes			
1993	Wet-Norm	373	264	20-Jun	300	36	YES	304	yes			
1999	Normal	367	285	19-Jun	296	11	YES	325	yes			
2000	Normal	355	264	28-May	289	25	YES	304	yes			
2001	DNI	312	215	17-May	263	48	YES	255	no	8	yes	
2002	DNII	311	238	1-Jun	262	24	YES	278	yes			
2008	Normal	305	222	20-May	259	37	YES	262	yes			
1977		303	139	10-Jun	258	119	YES	179	no	79	no	
1981		301	224	9-Jun	256	32	YES	264	yes			
2009	Normal	293	230	1-Jun	252	22	YES	270	yes			

Lee Vining Creek: Issues requiring further investigation to determine if increased flows could be made available

- Incremental increase in outflow capacity from Saddlebag (assumed 40 cfs)
- Impact of greater flow in stream reach below Saddlebag Lake
- Incremental increase potential in Tioga Lake outflow at same time of Saddlebag release
- Impact of increased Tioga releases on Tioga Pass Resort
- Interest and ability of SCE and USFS to implement via existing FERC license conditions

Lee Vining Creek: Implementation issues, assuming increased flows could be made available

- Given travel time between reservoir release and DWP diversion dam, need to forecast peaks many days in advance
- Coordination and communication between DWP and SCE including establishing protocols for implementation
- Coordination and communication between other parties (MLC, DFG, FS, Caltrans), DWP, SCE including monitoring (e.g. culverts under roads, stream conditions) and forecasting (assisting in determining when peak flows are occurring)

We've been here before

Order 98-05 states:

(3) The SRFs specified in this order are minimum flows and are in addition to the flow requirements set forth in Decision 1631. **Licensee shall in all years attempt to maximize SRFs through coordination with Southern California Edison (SCE)** and may encourage SCE to coordinate their spills and releases with spills from Grant Lake. Licensee's coordination with SCE may include granting SCE waivers from the 5 percent storage rule otherwise applicable to SCE facilities, developing annual operation plans in consultation with SCE, and encouraging SCE to coordinate the release of excess water from Tioga Lake with peak flows in Lee Vining Creek. In wet and extreme wet years, Licensee shall attempt to maximize SRFs in Rush Creek through operation of Grant Lake to maximize the probability and magnitude of spills with a target of holding 40,000 acre-feet of water in storage at Grant Lake on April 1. If Licensee is unable to achieve this target, it shall provide a written explanation to the Chief of the Division of Water Rights, and to other parties upon request, by May 1 of each year.

Next Steps

SCE's letter in the feasibility report states:

As you are aware, these recommendations for the most part are the exact opposite of what is already required in SCE's U.S. Forest Service (USFS) 4(e) conditions and Federal Energy Regulatory Commission (FERC) licenses, which necessitate that we accumulate and hold storage for recreation purposes during the summer months, and then drain the storage during the winter months before the inflows start arriving with the next spring runoff. In addition, these recommendations would conflict with SCE's existing water rights, and with the long-standing contractual arrangements between SCE and LADWP pertaining to the operations of those reservoirs.

Consequently, as an initial, generalized response, we have to say that we can not implement the recommendations in the report. Nevertheless, we do not rule out the possibility of attempting to coordinate our operations with you to achieve at least some of the report's recommendations, especially during years of above normal snowpacks when there are unavoidable spill conditions.

However, the determinations of any such opportunities would require more specific information in terms of the actual modifications to the existing operations of SCE facilities that would be needed. Accordingly, upon being presented with more detailed requests by either LADWP or the SWRCB, we would be happy to sit down with you and discuss the possibilities at that time.

From: Steve Norton
To: Matthew Woodhall; Finlay Anderson; Shannon Luoma; Carissa Shoemaker
Cc: Brad Blood
Subject: Lee Vining Relicensing Discussions with USFWS
Date: Thursday, April 22, 2021 11:39:09 AM
Attachments: image002.png

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All,
This morning I was able to speak with Chad Mellison (USFWS) about his thoughts on the Lee Vining Relicensing Project. A summary of our conversation is below.

- Regarding the Section 7 process: he said he's undecided regarding informal v. formal consultation. But that said, we both reiterated throughout the call that no changes would occur and showing no impacts should be easy.
- He does not see mark-recapture studies as necessary to answer questions associated project impacts.
- He has concerns about effects fluctuating lake levels at Saddlebag on Yosemite toad during the breeding season.
    - I reassured him Saddlebag levels do not fluctuate significantly and we would add some data to this in the PAD or subsequent studies. He felt better after hearing this.
    - He noted some concerns about effects of lake levels on YOTO breeding habitat adjacent to Tioga and Ellery, but didn't seem too hung up on this.
- Regarding the Study Area, I told him we are proposing to survey O&M areas and previously found YOTO breeding sites (the 2 locations at Saddlebag).
    - I also told him SCE has been looking all around for YOTO during larger O&M events (dam work at Tioga, etc) and has never found them outside of Saddlebag. He appreciated that context.
    - We briefly discussed CDFWs interest in the inlet to Ellery for YOTO, but that may not be part of the study area.
- He asked if SCE has anything to do with fishery management at the lakes (financial support, etc). I told him no and that I would provide a more formal statement in a different forum (either in the PAD or as a comment during the next TWG).
- He also noted we need to be clear that yellow legged frog are not in the FERC boundary. He agrees they are not there, but wants to make sure we have language and reasoning supporting this.

-Steve

Steve Norton

Senior Biologist/Project Manager – Resource Management
5 Hutton Centre Drive, Suite 300, Santa Ana, CA 92707
714.481.8037 (office/cell)
www.Psomas.com

B-04.1_Update re study plans

From:	Carissa Shoemaker
To:	kutzanuumu@yahoo.com; adam.barnett@usda.gov; justin_barrett@fws.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; James.Erdman@wildlife.ca.gov; jora@friendsoftheinyo.org; nora.gamino@usda.gov; Rwgoode911@hotmail.com; katie@accessfund.org; ed.hancock@waterboards.ca.gov; Chase.Hildeburn@Waterboards.ca.gov; sheila.irons@usda.gov; Saeed.Jorat@ladwp.com; claire@monolake.org; tristan.leong@usda.gov; alyssa.marquez@wildlife.ca.gov; cmcdonald@northforkrancheria-nsn.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; easternsierraartist@gmail.com; megan.mullowney@usda.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; Lawson.reif@usda.gov; greg@monolake.org; monique.sanchez@usda.gov; cshutes@calsport.org; nathan.sill@usda.gov; eric.tillemans@ladwp.com; thomas.torres@usda.gov
Cc:	Finlay Anderson; Shannon Luoma; Matthew Harper; Matthew Woodhall; Martin Ostendorf; Kelly Larimer; Audry Williams; Steve Norton; Allison Rudalevige; Heather Bowen Neff; Terra Alpaugh
Subject:	Update on Lee Vining Study Plans
Date:	Tuesday, June 15, 2021 1:56:00 PM
Attachments:	image001.png

Good afternoon Lee Vining TWG participants,

Summary

At our last Recreation, Aquatics, and Terrestrial TWG meetings, the SCE Relicensing Team communicated that draft Study Plan outlines would be distributed within a couple of weeks and that any feedback on those plans would be incorporated into the version of the outlines that would accompany the PAD. For reasons discussed below, we are now proposing to provide these draft outlines in the PAD. We think this will be avoid some confusion, while still providing you with ample opportunities for review.

Rationale

When we discussed this at the TWG, there was some discussion about the need for a short turnaround on review and some stakeholders were skeptical of their ability to meet those needs, given other competing priorities. Recognizing that we are a full year away from implementing studies and that there is ample time in the remainder of this year to continue to dialogue around studies, the relicensing team is now proposing an alternative to that schedule and process that should result in less confusion and a more thoughtful process. SCE would like to complete its development of Study Plan outlines and include them in the PAD for your review, rather than collecting additional review comments between now and August.

SCE is proposing to utilize the Traditional Licensing Process which provides for 1) a site visit following issuance of the PAD; 2) a Joint Agency Meeting (JAM) to discuss the project and anticipated studies; and 3) a comment period for agencies, Tribes, and other interested stakeholders to provide comment. With a PAD issuance of early August, comments on the PAD, proposed studies, and additional study request would be due at the end of November. SCE would provide revised Study Plans in mid-January that would further address and presumably resolve outstanding questions of objectives and methods.

Since our last TWG meeting, the team has been adding significant detail to the outlines to address comments made in the TWG; most significantly by including objectives in numerous studies to evaluate potential impacts of SCE's intra-day mode of operations (optimizing generation to meet load requirements) on the reach between the Poole Powerhouse and the LADWP diversion. As well, a new study has been added to our list to look at Lower Lee Vining Creek channel structure in order to assess fluvial structure and channel morphology.

The Study Plan development schedule would be as follows:

- PAD issuance in the first week of August, with an Appendix containing the Study Plan outlines
- Site Visit tentatively scheduled week of September 28 (details to follow)
- Joint Agency Meeting, to be held virtually November 15 (details to follow)
- Comments on Study Plans and PAD would be due **January 15**

Please let Finlay Anderson (finlay.anderson@kleinschmditgroup.com) or Matthew Woodhall (matthew.woodhall@sce.com) know if you have questions or concerns.

Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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From: Sill, Nathan -FS
To: Carissa Shoemaker
Subject: RE: [External Email]Update on Lee Vining Study Plans
Date: Tuesday, June 15, 2021 4:41:17 PM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.png

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Sounds good, I think I prefer this approach. I was concerned about our staff's ability to meet those timelines. I appreciate the heads up. We'll look for the PAD in August.

Nathan Sill
Resources/Planning Staff Officer
Forest Service
Inyo National Forest
p: 760-873-2404
c: 626-698-8996
f: 760-873-2486
nathan.sill@usda.gov
351 Pacu Ln., Suite 200
Bishop, CA 93514
www.fs.fed.us

Caring for the land and serving people

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Tuesday, June 15, 2021 1:56 PM
To: kutzanuumu@yahoo.com; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov; jora@friendsoftheinyo.org; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com; katie@accessfund.org; ed.hancock@waterboards.ca.gov; Chase.Hildeburn@Waterboards.ca.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com; claire@monolake.org; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov; cmcdonald@northforkrancheria-nsn.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; easternsierraartist@gmail.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; Reif, Lawson -FS <lawson.reif@usda.gov>; greg@monolake.org; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org; Sill, Nathan -FS <nathan.sill@usda.gov>; eric.tillemans@ladwp.com; Torres, Thomas - FS <thomas.torres@usda.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Matthew Woodhall <matthew.woodhall@sce.com>;

Martin Ostendorf <Martin.Ostendorf@sce.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; Audry Williams <Audry.Williams@sce.com>; Steve Norton <steve.norton@psomas.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Heather Bowen Neff <heather@stillwatersci.com>; Terra Alpaugh <talpaugh@kearnswest.com>

Subject: [External Email]Update on Lee Vining Study Plans

[External Email]
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Good afternoon Lee Vining TWG participants,

Summary

At our last Recreation, Aquatics, and Terrestrial TWG meetings, the SCE Relicensing Team communicated that draft Study Plan outlines would be distributed within a couple of weeks and that any feedback on those plans would be incorporated into the version of the outlines that would accompany the PAD. For reasons discussed below, we are now proposing to provide these draft outlines in the PAD. We think this will be avoid some confusion, while still providing you with ample opportunities for review.

Rationale

When we discussed this at the TWG, there was some discussion about the need for a short turnaround on review and some stakeholders were skeptical of their ability to meet those needs, given other competing priorities. Recognizing that we are a full year away from implementing studies and that there is ample time in the remainder of this year to continue to dialogue around studies, the relicensing team is now proposing an alternative to that schedule and process that should result in less confusion and a more thoughtful process. SCE would like to complete its development of Study Plan outlines and include them in the PAD for your review, rather than collecting additional review comments between now and August.

SCE is proposing to utilize the Traditional Licensing Process which provides for 1) a site visit following issuance of the PAD; 2) a Joint Agency Meeting (JAM) to discuss the project and anticipated studies; and 3) a comment period for agencies, Tribes, and other interested stakeholders to provide comment. With a PAD issuance of early August, comments on the PAD, proposed studies, and additional study request would be due at the end of November. SCE would provide revised Study Plans in mid-January that would further address and presumably resolve outstanding questions of objectives and methods.

Since our last TWG meeting, the team has been adding significant detail to the outlines to address comments made in the TWG; most significantly by including objectives in numerous studies to evaluate potential impacts of SCE's intra-day mode of operations (optimizing generation to meet load requirements) on the reach between the Poole Powerhouse and the LADWP diversion. As well, a new study has been added to our list to look at Lower Lee Vining Creek channel structure in order to assess fluvial structure and channel morphology.

The Study Plan development schedule would be as follows:

- PAD issuance in the first week of August, with an Appendix containing the Study Plan outlines
- Site Visit tentatively scheduled week of September 28 (details to follow)
- Joint Agency Meeting, to be held virtually November 15 (details to follow)
- Comments on Study Plans and PAD would be due **January 15**

Please let Finlay Anderson (finlay.anderson@kleinschmditgroup.com) or Matthew Woodhall (matthew.woodhall@sce.com) know if you have questions or concerns.

Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her
I am currently working Weds, Thurs, & Fri; off Mon & Tues.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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Emily Waters

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Friday, December 10, 2021 1:30 PM
To: Carissa Shoemaker; Shannon Luoma
Subject: FW: Hatchery Chytrid (bd) Testing Policies - Lee Vining Hydroelectric Project

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For consultation record

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, November 17, 2021 4:09 PM
To: Steve Norton <steve.norton@psomas.com>
Cc: Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>; Escallier, Michael@Wildlife <Michael.Escallier@wildlife.ca.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>
Subject: RE: Hatchery Chytrid (bd) Testing Policies - Lee Vining Hydroelectric Project

Steve,
The CDFW does not test for Bd in our routine hatchery pathology screening.
Two of the three Eastern Sierra hatcheries are fed by well water and the other is a spring source.
I hope that helps.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, November 17, 2021 4:03 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Subject: RE: Hatchery Chytrid (bd) Testing Policies - Lee Vining Hydroelectric Project

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Thanks, Jim!

Steve Norton

PSOMAS 75 1946-2021

Senior Biologist/Project Manager – Resource Management
5 Hutton Centre Drive, Suite 300, Santa Ana, CA 92707
714.481.8037 (office/cell)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, November 17, 2021 3:29 PM
To: Steve Norton <steve.norton@psomas.com>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>; Escallier, Michael@Wildlife <Michael.Escallier@wildlife.ca.gov>
Subject: RE: Hatchery Chytrid (bd) Testing Policies - Lee Vining Hydroelectric Project

Hi Steve,
Great question. I do not know the answer to that off the top of my head.
I will contact the CDFW pathology lab that tests our hatcheries to check.
I'll get back to you as soon as I find out.
Sierrally, Jim

Thank you for contacting the California Department of Fish and Wildlife. This email message is intended only for the addressee(s) and contains information that may be confidential and/or copyright. If you are not the intended recipient please notify the sender by reply email and immediately delete this email. Use, disclosure or reproduction of this email by anyone other than the intended recipient(s) is strictly prohibited. No representation is made that this email or any attachments are free of viruses. Virus scanning is recommended and is the responsibility of the recipient. Thank you.

James Erdman Environmental Scientist
California Department of Fish & Wildlife
Inland Desert-Region 6-North
Bishop Field Office
787 North Main St., Suite 220
Bishop, Ca. 93514
Ph. (760)-873-6071
Fax (760)-872-1284
James.Erdman@wildlife.ca.gov

Every Californian should conserve water. Find out how at:

SaveOurWater.com · Drought.CA.gov

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, November 17, 2021 2:18 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>
Subject: Hatchery Chytrid (bd) Testing Policies - Lee Vining Hydroelectric Project

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Hi Jim and Alyssa,
Do either of you know if CDFW hatcheries test or plan to test for Batrachochytrium dendrobatidis (chytrid) in their facilities?

I left a message with Hot Creek but have not yet heard back. Is there anyone else I can contact that would know if any of the local hatcheries test for bd?

Thanks and I hope you're both doing well!
-Steve

Steve Norton

Senior Biologist/Project Manager – Resource Management
5 Hutton Centre Drive, Suite 300, Santa Ana, CA 92707
714.481.8037 (office/cell)
www.Psomas.com

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Boulevard, Suite C-220
Ontario, CA 91764
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

Via e-mail

January 14, 2022
Kimberly D. Bose, Secretary
Nathaniel J. Davis, St., Deputy Secretary
Federal Energy Regulatory Commission
825 First Street, NE
Washington, DC 20426

Subject: Comments on the Lee Vining Creek FERC Pre-Application Document (PAD) and Study Requests (FERC Project # 1388)

Dear Secretary Bose,

Thank you for giving the California Department of Fish and Wildlife (CDFW) the opportunity to comment on the Pre-Application Document (PAD) and Study Requests as part of the Southern California Edison (SCE) Lee Vining Creek Federal Energy Regulatory Commission (FERC) Relicensing Project #1388 (Project). The PAD and Study Requests were filed with FERC and made available to the public on August 12, 2021. CDFW has since completed a cursory review of these documents and is providing comments no later than 60 days after the Joint Agency Meeting that was held on November 16, 2021 (18 CFR §16.8 (b)(5)). CDFW requests that SCE consider the comments contained in this letter.

AUTHORITIES

CDFW is the relevant State fish and wildlife agency for resource consultation pursuant to the Federal Power Act Section 10(j) (16U.S.C. section 803(j)). The fish and wildlife resources of the State of California are held in trust for the people of the State by and through CDFW (Fish and G. Code § 711.7). CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species (Fish and G. Code § 1802). The mission of CDFW is to manage California's diverse fish, wildlife, and plant resources, and the habitats on which they depend, for their ecological values and for their use and enjoyment by the public.

COMMENTS AND RECOMMENDATIONS

Below are CDFW's comments regarding our Study Proposals which SCE did not adopt. CDFW is also commenting on the Study Proposals adopted by SCE. In addition, CDFW is providing general comments about the adopted Study Proposals.

1. Riparian Monitoring and Community Health (Not adopted by SCE)

CDFW Comment: On page 6-12 of the PAD SCE provides a rational for not adopting CDFW's proposed Riparian Monitoring and Community Health Study. SCE states that "*sufficient data exists from ongoing Riparian Monitoring Evaluations conducted as part of the existing license—the most recent evaluation is being conducted during the summer of 2021. With regard to Bishop Creek, black cottonwood (Populus trichocarpa) is not present in Lee Vining Canyon and there are no data to suggest any impairment of riparian conditions"*. However, the analyses and conclusions drawn from the ongoing Riparian Monitoring Evaluations data and provided in the Monitoring Reports currently available to CDFW (e.g., Read, E. 2017, Read, E. 2012) are insufficient and do not allow for determination of Project effects. CDFW requests that all Riparian Monitoring Reports and associated raw data, including infrared aerial photographs, are provided to CDFW to facilitate further statistical analysis (e.g., impacts of stream flow on riparian recruitment) to determine Project impacts on the riparian community of Lee Vining Creek.

CDFW Comment: CDFW requests information (e.g., location [latitude, longitude], type, status) on the riparian monitoring infrastructure (e.g., stream flow discharge gauges, precipitation measurement stations, stream gauge and soil moisture electronic sensors).

CDFW Comment: It is CDFW's understanding that SCE has been gathering infrared aerial photographs that extend from Saddlebag Lake to the junction of U.S. Route 395 and State Route 120. However, SCE has limited their riparian habitat analysis to the monitored stream reach above the confluence of Lee Vining and Slate Creeks, as reported in the Riparian Monitoring Reports. Additionally, the analysis reported on in the Monitoring Reports (Read, E. 2017, Read, E. 2012) of the infrared aerial photographs appears to only be a visual comparison between years. In the Read, E. 2012 Monitoring Report, it is noted that Geographic Information Systems (GIS) and digital imagery software was used to compare the infrared aerial photographs, but no quantitative data is provided. CDFW does not consider this a scientific comparison and therefore cannot agree with SCE's determination that there has been no data showing impairment of riparian conditions. GIS can be used to scientifically analyze infrared data and determine changes in the riparian community. Please see **Attachment 1** for CDFW's Study Request to use GIS to quantitatively analyze the existing infrared data to determine changes in the riparian community in the Lee Vining Creek Project impact area.

2. **WQ-1** Stream and Reservoir Water Quality Technical Study Plan

CDFW Comment: The Stream and Reservoir Water Quality Technical Study plan should include nutrient monitoring of the hypolimnion/outlets of Project

reservoirs to determine the potential impact on the growth and spread of the non-native, invasive Didymo (*Didymosphenia geminate)*. Didymo can grow into thick mats that can cover up to 100% of the creek or river bottom and negatively affect stream ecology.

3. **AQ-1** Reservoir Fish Population Technical Study Plan

CDFW Comment: The nexus rational that CDFW provided should also include an acknowledgement that the hydroelectric Project creates the reservoirs.

CDFW Comment: Boat electrofishing should occur at night to increase capture efficiency.

4. **TERR-1** General Botanical Resources Survey

CDFW Comment: In the Study Goals and Objectives, SCE should include the objective of documenting the maintenance activities (i.e., location, activity, maintenance schedule, equipment used, potential impacts) that could impact special-status plants.

CDFW Comment: CDFW request that the raw data from all the past required Riparian Monitoring Surveys is provided to the Technical Working Group members.

CDFW Comment: CDFW recommends that the General Botanical Resource Surveys for special-status native plants follow the guidelines provided in the State of California, California Natural Resource Agency and Department of Fish and Wildlife's *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities*. This includes conducting multiple visits to the Project area (e.g., in early, mid and late-season) to adequately capture the floristic diversity at a level necessary to determine if special-status plants are present in the Project area. The protocol also describes that additional focused surveys may be needed that are limited to habitats known to support special-status plants. CDFW recommends that SCE identify habitats that may support specific special-status plants and may require focuses surveys.

CDFW Comment: CDFW recommends that the prevalence (estimated total numbers, percent cover, density, etc.) of the special-status plants and sensitive natural communities is documented during survey efforts. This data is useful to assess the significance of a particular plant population or natural community.

CDFW Comment: Following are the relevant regulations regarding the protection of special-status plants. Certain species are in danger of extinction because their habitats have been severely reduced in acreage, are threatened with destruction or adverse modification, or because of a combination of these and other factors. The California Endangered Species Act (CESA) and Native Plant Protection Act (NPPA) provide additional protections for such species, including take prohibitions (Fish & G. Code, § 2050 *et seq.*; Fish & G. Code, § 1908). Botanical field surveys are one of the preliminary steps to detect special-status plant species and sensitive natural communities that may be impacted by a project.

5. **TERR-2** General Wildlife Resources Survey Technical Study Plan

CDFW Comment: Suitable nesting habitat for state listed as threatened willow flycatcher (*Empidonax traillii*) should be defined.

CDFW Comment: CDFW would like to provide input from our Wildlife Branch on trail camera locations and placement prior to implementation.

CDFW Comment: CDFW will remain closely involved in the planning and implementation of the Yosemite toad (*Anaxyrus canorus*) surveys. Yosemite toad is a California species of special concern.

6. **REC -1** Recreation Use Assessment Technical Study Plan

CDFW Comment: CDFW is supportive of the recreation creel survey as described. CDFW would like to review the proposed survey dates/schedule prior to implementation.

GENERAL RECOMMENDATIONS

- Fisheries monitoring should be focused on documenting the need for stocking and evaluating angler use.

- SCE should provide raw data gathered under each Relicensing Study to the Technical Working Group Members.

- Each Relicensing Study Report (e.g., Progress Reports) should include all data collected and data analysis conducted up to that point. The Reports should clearly state or signify what new information has been added since the last report.

CONCLUSION

CDFW appreciates the opportunity to comment on the PAD and Study Requests for the Lee Vining FERC Relicensing Project. CDFW looks forward to further discussions with the Technical Working Group members.

If you have any question pertaining to this letter, please contact Alyssa Marquez, at (760) 567-0332 or Alyssa.Marquez@Wildlife.ca.gov

Sincerely,

Patricia A. Moyer

Trisha Moyer, Habitat Conservation Program Supervisor

cc: Trisha Moyer, CDFW
Alyssa Marquez, CDFW
Brandy Wood, CDFW
Nick Buckmaster, CDFW
Jim Erdman, CDFW

Attachment 1

Lee Vining Relicensing Study Request Template

Requestor Name:	Alyssa Marquez
Agency /Affiliation:	California Department of Fish and Wildlife
Primary Resource Area:	Botanical Resource Surveys (Riparian Community)
Proposed Study Title:	Infrared Aerial Photography GIS Analysis

1. Study goals and objectives

18 CFR §5.9(b)(1): Describe the goals and objectives of each study proposal and the information to be obtained.

- **Goal 1**: Use GIS to analyze infrared aerial photography (collected by SCE or other sources) to determine if there have been changes in the riparian community of Lee Vining Creek.
    - **Objective1**: Gather all infrared aerial photography collected by SCE in the Lee Vining Creek area and from other sources as necessary.
    - **Objective 2**: Use GIS analyses (e.g.,) to compare the riparian communities between years.

- **Goal 2:** Determine how existing operations are impacting riparian communities.
    - **Objective 1.** Use existing data on Project operations (e.g., flow release timing, flow magnitude, reservoir level, water temperature changes and water chemistry) in conjunction with measured environmental factors and infrared aerial photography to analyze how riparian communities may be impacted by Project operations.

2. Relevant Resource Management Goals and Public Interest Considerations

18 CFR §5.9(b)(2): If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied.

- It is the goal of CDFW to preserve, protect, and as needed, to restore habitat necessary to support native fish, wildlife, and plant species within the FERC-designated boundaries of the Project, as well as the areas adjacent to the Project in which resources are affected by ongoing Project operations and maintenance activities and recreational use.

- **Fish and Game Code § 1389**. "*The preservation and enhancement of riparian habitat shall be a primary concern of the Wildlife Conservation Board and the department, and of all state agencies whose activities impact riparian habitat*.."

- **Fish and Game Code § 1386**. "*The legislature finds and declares all of the following:*

  (a) - California's rivers, wetlands, and waterways, and the fisheries and wildlife habitat they provide, are valuable and finite resources that benefit the people of the state and are threatened with deterioration or degeneration that may endanger the natural beauty and productivity of these valuable resources.

  (b) The public interest requires the coordinated protection of rivers and riparian resources in order to maintain an equilibrium between the natural endowment of, and manmade alterations to, California's river environment, and in order to preserve the scenic beauty of these natural resources and the recreational and economic benefits they provide.

  (c) By virtue of the special conditions and circumstances of the natural ecology, the increasing human populations and needs in the state, and the numerous governmental agencies with an interest in coordinating activities which affect rivers and riparian habitat resources, there is a need for a coordinated state rivers and riparian habitat protection program."

18 CFR §5.9(b)(3): If the requester is a not a resource agency, explain any relevant public interest considerations in regard to the proposed study.

NA

3. Existing Information and Need for Additional Information

18 CFR §5.9 (b)(4): Describe existing information concerning the subject of the study proposal, and the need for additional information.

It is CDFW's understanding that SCE has been gathering infrared aerial photographs that extend from Saddle bag Lake to the junction of Highway 395 and 120, but they have limited their analysis in the required Monitoring Reports to the monitored stream reach above the confluence of Lee Vining and Slate Creeks. Additionally, the analysis conducted in the Monitoring Reports of the infrared aerial photographs appears to only be a visual comparison from different years. CDFW does not consider this a scientific comparison and therefore cannot agree with SCE's determination that there has been no data showing impairment of riparian conditions. Geographic Information Systems (GIS) can be used to scientifically analyze infrared data and determine changes in the riparian community is the standard to analyzing this type of data.

4. Project Nexus

18 CFR §5.9(b)(5): Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements.

Project operations alter flows within Lee Vining Creek from the natural hydrograph and therefore impact the riparian communities downstream. Under SCE's existing Monitoring Program, they are required to take infrared aerial photographs from Saddlebag Lake to the junction of Highway 395 and 120. To date this infrared imagery has not been scientifically analyzed. This infrared imagery could provide insight into changes in the riparian community if analyzed appropriately with GIS.

5. Methods

18 CFR §5.9(b)(6): Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge.

Method 1: Gather all infrared aerial imagery from SCE. Determine what years we have data from, what years are missing. If there are years that are missing look to see if we can get that data somewhere else (Satellite sensors like Landsat and Sentinel-2 the necessary bands to conduct analyses).

Method 2. Use GIS to conduct a Normalized Difference Vegetation Index (NDVI) or other similar vegetation index to conduct a quantitative analysis of changes in the riparian community. NDVI describes the difference between visible and near-infrared reflectance (vegetation reflects) and red light (vegetation absorbs). NDVI can measure variables such as vegetation cover, leaf area index, can be used to estimate the density of green on an area of land, and can be a good indicator of drought (when water limits vegetation growth, it has a lower relative NDVI and density of vegetation).

Method 3**:** Use data (e.g. soil moisture, vegetation surveys) from on the ground riparian monitoring surveys (as required in current Monitoring Program) to further analyze impacts from Project operations.

6. Level of Effort and Cost

18 CFR §5.9(b)(7): Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

- Need to have subscription to other ArcGIS or similar free software. Most agencies or consulting firms have access to ArcGIS or similar free software.

- Consultant's time to conduct analysis. Analysis is not overly complicated if the consultant is familiar with the process.

- There are several free sources where satellite Imagery can be downloaded from but the resolution may not be sufficient

    - USGS Earth Explorer
    - Sentinel Open Access Hub
    - NASA Earthdata Search
    - NOAA Data Access Viewer

References

Read, Edith. 2012. Riparian, Aquatic Habitat, and Fish Population Monitoring: Phase 2 (Year 2) Compared to Baseline and 2006 – Lee Vining Creek (FERC No. 1388).

Read, Edith. 2017. Riparian Monitoring: Phase 2 Year 3 (2016) Compared to Previous Years - Lee Vining Creek (FERC No. 1388).

State of California, California Natural Resources Agency and Department of Fish and Wildlife. 2018. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities.

United States Department of Agriculture | Forest Service | Pacific Southwest Region

Inyo National Forest
351 Pacu Lane, Suite 200
Bishop, CA 93514
(760) 873-2400 Voice
(760) 873-2538 Text (TDD)

2770.

Date: January 14, 2022

Wayne Allen
Southern California Edison
Principal Manager
Hydro Licensing & Implementation
1515 Walnut Grove Ave.
Rosemead, CA 91770

SUBJECT: Comments on Preliminary Application Document (PAD) and Initial Study Requests for Lee Vining Creek Hydroelectric. Project, FERC No. 1388

Dear Mr. Allen:

The Forest Service has reviewed the Pre-Application Document (PAD) that Southern California Edison filed with the Federal Energy Regulatory Commission (FERC) on August 12, 2021 for the Lee Vining Project #1388. FERC has approved SCE using the Traditional Licensing (TLP) Process for this project.

Enclosed are our comments on the PAD and Initial Study Requests. The disciplines that provided input include hydrology, botany, wildlife, and recreation.

The Forest Service looks forward to the continued collaborative involvement FERC's TLP process for the relicensing of the Lee Vining Project. Any questions can be directed to Sheila Irons, Inyo FERC coordinator: Sheila.irons@usda.gov or 760-965-9609.

Sincerely,

LESLEY YEN
Forest Supervisor

Enclosure

Attachment 1: USFS COMMENTS LEE VINING P-1388

PAD Comments

PAD VOLUME I COMMENTS

Section 3. 0 GENERAL DESCRIPTION OF THE RIVER BASIN

3.8 Climate

The PAD briefly talks about climate. Climate and climate change will undoubtedly have an impact on the handful of glaciers that feed Saddlebag Lake. Is climate change a concern? Models show a low-to-no snow Sierra Nevada as early as 35 to 60 years out (Siirila-Woodburn et al, 2021), which is within the time frame for the relicense. Additionally, it is predicted that precipitation will occur more than snow (Swain et al, 2018). How will this change in precipitation and potential loss of glaciers impact operations and the ability to meet minimum flow requirements and maintain adequate reservoir levels? Also, how will more persistent droughts impact operations?

How will climate change affect operation and maintenance? How will operations change to address the loss of glaciers above Saddlebag lake and the change from snow dominated precipitation to rain dominated?

Section 4.0 PROJECT LOCATION, FACILITIES, AND OPERATIONS

Table 4.5-1. SCE Gaging Stations

Are all of these listed as part of the facilities?

4.5.6 ACCESS ROADS AND TRAILS

Is there a reason why Poole Powerhouse Road is not included in the project boundary? It appears that this road was constructed for access to the Powerhouse well before it was used for access to the campgrounds. The road is also as source of sediment due to the proximity to Lee Vining Creek. The project boundary should at least include the section beyond Big Bend Campground. The primary use of the road past the campgrounds is for accessing Poole Powerhouse. The road exists for that purpose. The road segment after Big Bend Campground is not suitable for recreational development and would not have been built other than for access to the powerhouse. Mono County holds a Forest Roads and Trails (FRTA) Easement and plows the road in winter to maintain access to the powerhouse. Plowing is another potential source of sediment input to Lee Vining Creek.

There are issues for FERC boundary and incomplete list of facilities. See included maps.

4.5.7. ANCILLARY AND SUPPORT FACILITIES

All these need to be included in the facilities list.

4.5.8. PROJECT RECREATION SITES

Recreational use of the penstock below Ellery Lake, needs to be included in the study. 52 climbing routes are accessed from the penstock - https://www.mountainproject.com/map/109223681/lee-vining-canyon-tioga-road

4.6.1. WATER MANAGEMENT

Is there a specification for when flows are needed to support proper riparian functioning?

4.6.1.1. Saddlebag Dam

How will the projected loss of glaciers in this watershed effect flows and operation of this dam?

Table 4.6-1. Routine Project Inspection and Maintenance Activities

Maintenance of dirt/native roads and parking areas, including ditch and culvert maintenance

> This road (Poole Powerhouse road) is too close to the water, resulting in excess sediment entering the system.

Herbicide Spraying

> Herbicides should not be used within Riparian Conservation Areas (RCA). Any herbicide use near waterbodies should be in consultation with FS watershed specialist.
>
> Is there a clear plan for when and where herbicide can be used?

Project Boundary

> The current FERC project boundary does not include the stream reach below Poole Powerhouse. Studies have been developed to look at the impacts operations will have on this reach of Lee Vining Creek. The bypass reach should be included in the FERC project boundary in the new license. There are roads near Saddlebag dam that access dam infrastructure that are not included in the FERC project boundary. Since the roads are used to access the dam infrastructure these roads should be included in the FERC project boundary in the new license.

Section 5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

5.1.3.2. Tectonic History

How will the facilities respond to earthquakes? Are they rated for a specific strength of earthquake?

5.1.5.4. Erosion and Sedimentation Associated with Project Facilities

Although proposed operations may remain the same as the current license, this does not equate to impacts remaining the same through the term of a new license. A major rock fall, climate change or changes in land use around the facilities may necessitate changes in operation to maintain standards.

5.1.5.5. Reservoir Shorelines and Streambanks

Unvegetated soil is especially a problem for invasive plant species, we propose that this be addressed in project management plans (vegetation management or erosion plans).

Table 5.2-9. Selected Water Quality Parameters Collected in Lee Vining Creek at Three Sites Downstream of Poole Powerhouse

> The Poole Powerhouse road is too close to the water, resulting in excess sediment entering the system. This road is primarily to access the power plant.

5.4.1. INTRODUCTION

In the botany study plan the buffer for specifies surveys are 50 ft. For the Bishop Creek relicensing it is 500 ft. A 50ft buffer may be inadequate, see botany study request.

5.4.2. INFORMATION SOURCES

TESP/IS(NNIP) are no longer used on the INF. The current terms used in the Inyo National Forest Land Management Plan (LMP) are Species of Conservation Concern (SCC) and Invasive Plant Species (IPS)

5.7 RARE, THREATENED, AND ENDANGERED SPECIES

Table 5.7-1. Potential for Rare, Threatened, or Endangered Wildlife Species to Occur

> Fisher- Fish and Wildlife Service (FWS) has proposed critical habitat for Fisher. It should be noted that proposed critical habitat is not located within project boundary.
>
> Sierra Nevada bighorn sheep- The project area is located between Mt. Gibbs and Mt. Warren herd units. Species occurrence is documented as recently as 2007.
>
> Footnote b. “The species is known to be absent from the Lee Vining FERC Project Boundary and connected tributaries; however, plans to reintroduce the species into features upstream from the Project Boundary are anticipated in 2022. (CDFW, 2021)”. Comment: This is important to note. This species could very well establish a population within the project boundary.

5.7.4. SPECIAL STATUS PLANTS

SCE has mapped 21 plants along Ellery Lake and 179 plants below the spillway of Rhinedollar dam.

5.7.6 CRITICAL HABITAT

Paragraph 2: Fish and Wildlife Service (FWS) has proposed critical habitat for Fisher. It should be noted that proposed critical habitat is not located within project boundary.
Table 6.1-1. Resource Issues, Data Gaps, and Potential Studies

Wildlife Resources section:

> Noise pollution from O&M should be analyzed. No information is contained in the PAD on how loud the regular operation of these facilities are. Possible direct and indirect effects to species could occur.
>
> The potential for *Rana sierrae* to eventually disperse into the project area should be analyzed. California Department of Fish and Wildlife (CDFW) reintroductions are planned in the future.
>
> What is the justification for only surveying within a 200ft buffer? Many stream dependent species have a dispersal rate far greater than 200 ft. The section on "Movement" in the Yosemite Toad Conservation Assessment does a great job at highlighting dispersal ranges for this species. "Martin (2008) reported a maximum dispersal distance of 657meters (2214 feet) from breeding pools to upslope habitat." Page 19.
>
> "Exact locations of cameras will be determined in consultation with the relevant stakeholders.": Camera locations are to capture any avoidance behavior, occupancy, and habitat connectivity zones/corridors/migratory routes within and through the project area.

5.8.5.1 The project is on the Mono Lake Ranger District, not the White Mountain Ranger District.

5.8.5.5. Climbing

Recreational use of the penstock below Ellery Lake, needs to be included in the study. 52 climbing routes accessed from the penstock - https://www.mountainproject.com/map/105798288/sierra-eastside

5.8.10 There are 86 miles of the Pacific Crest Trail on the Inyo NF, not 1,378 miles.

Table 6.1-1. Resource Issues, Data Gaps, and Potential Studies/Recreation Use

The recreational use of the Penstock below Rhinedollar dam should be evaluated.

Table 6.1-1. Resource Issues, Data Gaps, and Potential Studies/Facilities

A list of all facilities needs to be provided, it should include all buildings, roads, and structures spillways, dams, penstock, gauging stations and any other constructed or modified items or entities that is used by hydroelectric generation

Table 6.3-1. Studies or Study Elements Not Adopted (see Appendix B, Consultation Record)/Riparian Monitoring and Community Health

Contrary to the SCE response, there are black cottonwood in the Lee Vining canyon. How was there a determination of no impairment if you are not monitoring in a location that includes black cottonwood?

PAD VOLUME II COMMENTS

APPENDIX C PROPOSED TECHNICAL STUDY PLANS

WQ-1 Stream and Reservoir Water Quality

Study should evaluate how much sediment Poole Powerhouse Road contributes to Lee Vining Creek. Use of this road past Big Bend CG is mainly by SCE. There is a clear nexus between use of this road by SCE and potential sediment contribution to Lee Vining Creek.

AQ-5 Operations Model

Will this study to look at the potential impacts that climate change will have on operations? There is a clear nexus between the potential loss of glaciers and a shift in precipitation from snow dominated to rain dominated and a shorter and earlier runoff season. In addition, impacts from persistent and ongoing drought can be anticipated. See "Inyo National Forest Climate Change Trend Summary 2021"

How will operations be modified with the projected loss of water storage in glaciers and a transition from snow to rain dominated precipitation?

AQ-6 Lower Lee Vining Creek Channel Morphology

This study only looks at the reach between the Poole Powerhouse and LADWP diversion. Variable flow releases below Saddlebag Lake and Tioga Lake can affect sediment supply and channel morphology, similar to variable flow releases below Poole Powerhouse . For that reason, this study should include the reach of Lee Vining Creek below Saddlebag Dam and the reach of Glacier Creek below Tioga Lake.

TERR-1 General Botanical Resources Survey

2.0 PROJECT NEXUS AND HOW THE RESULTS WILL BE USED

“Project maintenance activities” should read “Project operations and maintenance activities…” in all three bullets.

4.0 EXTENT OF STUDY AREA AND STUDY SITE

The buffer was 500 ft on the Bishop Creek FERC relicensing on the Inyo National Forest, why is this different?

We need riparian monitoring below Poole. Operation of the Project effects flows below Poole, we need to understand what is happening to ensure we are meeting the requirements of the LMP.

5.0 EXISTING INFORMATION

The report titled "Lee Vining Creek (FERC No. 1388) Riparian Monitoring Phase 2 Year 3 (2016) Compared to Previous Years" shows a reduction in the riparian herbaceous species richness of 50% at site 1 over 2011 & 2016, a 50% decrease at site 2 for 2016, and a 60% decrease at site 3 for 2016. Riparian shrub data supplied by Klienschmidt shows at site 1 a 63.22% reduction in the number of willows since 2006, an 81.82% reduction at site 2 and an 83.57% reduction at site 3.

6.3. REPORTING

Analyses and reports will examine impacts to individual riparian species as directed byLMP.

All reports need to be accompanied by the raw data in a spreadsheet and the spatial data in either a google earth format or an Arc GIS format.

7.0 SCHEDULE

The number of riparian monitoring sites should be increased. The study should include riparian monitoring sites downstream from the Poole Powerhouse and above Ellery lake. Operations impact flows below Poole, and we need to understand what is happening to ensure we are meeting the requirements of the LMP. The report titled "Lee Vining Creek (FERC No. 1388) Riparian Monitoring Phase 2 Year 3 (2016) Compared to Previous Years" shows a reduction in the riparian herbaceous species richness of 50% at site 1 over 2011 & 2016, a 50% decrease at site 2 for 2016, and a 60% decrease at site 3 for 2016. Riparian shrub data supplied by Klienschmidt shows at site 1 a 63.22% reduction in the number of willows since 2006, an 81.82% reduction at site 2 and an 83.57% reduction at site 3.

REC-1 RECREATION USE ASSESSMENT TECHNICAL STUDY PLAN

Use of the Rhinedollar dam penstock to access climbing routes needs to be evaluated.

LAND-1 PROJECT LANDS AND ROADS TECHNICAL STUDY PLAN

3.0 STUDY GOALS AND OBJECTIVES: An accurate list of all facilities needs to be provided. It should include all buildings, roads, and structures spillways, dams, penstock, gauging stations and any other constructed or modified items or entities that is used by hydroelectric generation), the list of facilities needs to be accurate and complete. See included maps.

STUDY PLAN REQUEST

Lee Vining Creek Riparian Study

Criteria 1 - Goals and Objectives of the study.

The goal of this study is to provide more comprehensive information on the status of riparian vegetation by expanding the monitoring performed as part of the current license to lower elevation sites and sites farther downstream in the watershed. The current sites are at the highest elevation segment of free-flowing water that is affected by the hydroelectric generating system. It is also the area that would be least likely to show effects because it has the least amount of hydroelectric infrastructure above the monitoring site for any free-flowing segment of this system (see map 1).

The objective of this study is to gather the information necessary to make data-based decisions on the operation of the hydroelectric facilities in the Lee Vining Creek watershed on the Inyo National Forest.

Criteria 2 - Explain the relevant resource management goals.

The Land Management Plan for the Inyo National Forest (2019) provides the following guidance for riparian vegetation.

Desired Conditions (WTR-FW-DC) (page 11-12)

01 Adequate quantity and timing of water flows support ecological structure and functions, including aquatic species diversity and *riparian vegetation*. Watersheds are resilient to changes in air temperatures, snowpack, timing of runoff, and other effects of climate change.

02 Water quality supports State-designated beneficial uses of water. Water quality is sustained at a level that retains the biological, physical, and chemical integrity of aquatic systems and benefits the survival, growth, reproduction and migration of native aquatic and *riparian species*.

03 Watersheds are fully functioning or trending toward fully functioning and resilient; recover from natural and human disturbances at a rate appropriate with the capability of the site; and have a high degree of hydrologic connectivity laterally across the floodplain and valley bottom and vertically between surface and subsurface flows. Physical (geomorphic, hydrologic) connectivity and associated surface processes (such as runoff, flooding, in-stream flow regime, erosion, and sedimentation) are maintained and restored. Watersheds provide important ecosystem services such as high quality water, recharge of streams and shallow groundwater, and maintenance of *riparian communities*. Watersheds sustain long-term soil productivity.

04 Soil and vegetation functions in upland and *riparian areas* are sustained and resilient. Healthy soils provide the base for resilient landscapes and nutritive forage for browsing and grazing animals, and support timber production. Healthy upland and *riparian areas* support healthy fish and wildlife populations, enhance recreation opportunities, and maintain water quality.

05 Infrastructure (administrative sites, recreation facilities, and roads) has minimal adverse effects to *riparian* and aquatic resources.

Guideline (WTR-FW-GDL) (page12-13)
01 Minimize the effects of stream diversions or other flow modifications on at-risk species as well as other beneficial uses during relicensing; planning for State and other authorized water use; and water rights. Determine and recommend in-stream flow requirements and habitat conditions that maintain, enhance, or restore all life stages of native aquatic species and maintain or restore *riparian resources*, channel integrity and aquatic passage.

Criteria 3 - Explain any relevant public interest considerations.

The requestor is a resource agency.

Criteria 4 - Describe the existing information concerning the subject of the study proposal

The currently available data from the riparian monitoring required by the current license show that there has been an average decline of 76% in the number of willows across all three monitoring sites since 2001 (see chart 01).

The 2017 report from the current license monitoring indicated a decline of species richness in the riparian herbaceous species. Unfortunately, this data was not available for review and consequently no management actions can be assessed without further study throughout the system.

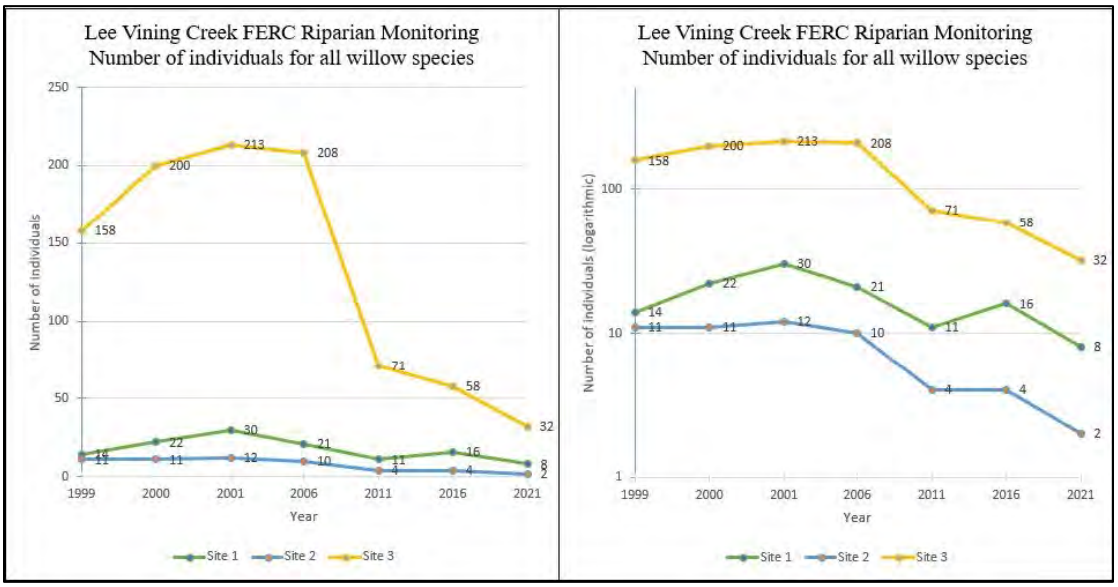


Chart 01. The decline in the number of willows for all three monitoring sites. This is an aggregate of the four willow species present in the monitoring plots. The chart on the right uses a logarithmic scale on the vertical axis so that the lower number counts can be viewed.

This data was collected at three monitoring sites below the Saddlebag Lake Dam. It represents only 0.5 miles of approximately 10 miles of the Lee Vining Creek system

that flows though FS managed land that is affected by the hydroelectric system. At 10,000 feet in elevation, this dam is highest FERC infrastructure in the Lee Vining Creek watershed and consequently the monitoring sites do not provide information concerning the effects of hydroelectric operations on the lower 9.5 miles of Lee Vining Creek watershed which drops to 7,200 ft in elevation (see map 01).

The available data show a decline in willows, but without further study across the watershed in consideration with channel geomorphic and stream flow a plausible explanation of this decline other than the effects of the hydroelectric system is not really possible. This is why the licensee's proposed study is not adequate, the study needs to cover more area to fully understand the project impacts on the botanical resources. This will inform the development of conditions.

Criteria 5 - Explain the nexus between project operations and effects on the resources to be studied.

Riparian systems are defined by the effects of water to the systems. In a high gradient stream system like Lee Vining Creek, it is not only the presence of water but the disturbance of the water through scouring of the channel and banks and/or deposition of sediment that affects the habitat for riparian vegetation. The timing and magnitude of these events are critical to maintaining natural geomorphic and hydrological conditions necessary for the native vegetation composition and structure which in turn provides the conditions that maintain the suitability of aquatic and terrestrial habitat for desired species (especially fish and birds).

Hydroelectric facilities by their very design change the amount and timing of water and sediment flow through a stream system.

With the decline in the number of willows at the existing monitoring sites, it is important to understand what is happening throughout the system and attempt to understand the cause of the decline and evaluate which management options might be effective to mitigate this decline.

The data from the current monitoring is from the highest elevation free-flowing section of the Lee Vining Creek watershed that is affected by the hydroelectric facilities, it also least amount of hydroelectric infrastructure, so it represents only a small portion of the entire system. An expansion of the current monitoring to at least two more sites, one at mid-elevation (above Ellery Lake) and one at low elevation (below Poole Power plant) will provide a more comprehensive understanding of what is happening throughout the entire hydroelectric affected system. The information from this study would be used to make possible changes to the flow regime that would address some of the impacts.

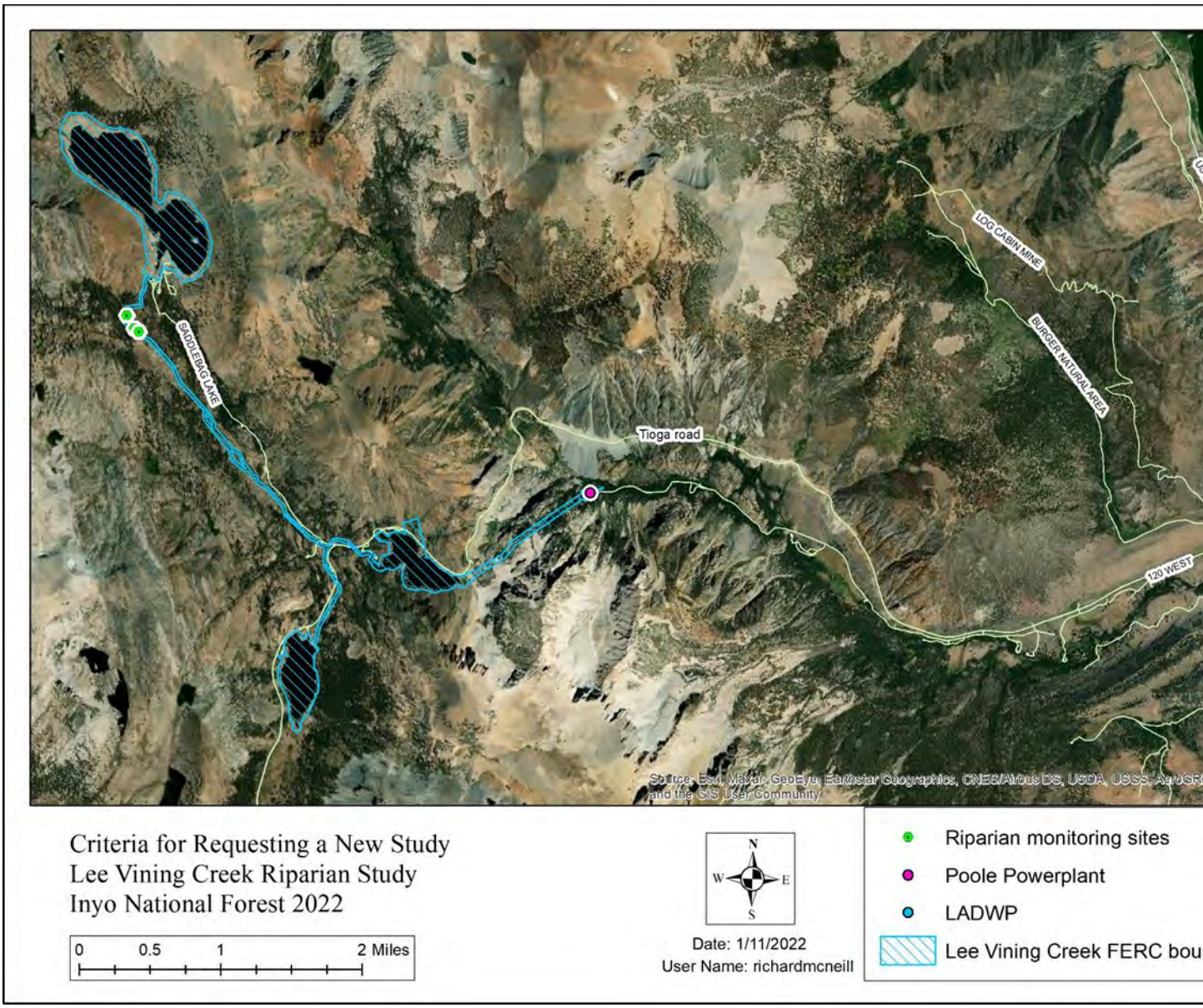
Criteria 6 - Explain how any proposal study methodology is consistent with generally accepted practice.

Riparian vegetation studies are common in hydroelectric relicensing projects to determine vegetation condition and whether management actions concerning stream flow, and sediment measures will be necessary. This study is consistent with the goals,

objectives, and methods outlined for the recent FERC hydroelectric relicensing effort on Bishop Creek FERC and other FERC relicensing projects in California. The methodology would be the same methodology that is currently being used in the ongoing monitoring, but the change would be to include additional study sites.

Criteria 7 - Describe considerations of level of effort and cost.

The riparian monitoring required under the current license includes three sites below Saddlebag Lake. The relicensing study should include at least an additional six sites, three new sites above Ellery Lake and three new sites below Poole Power Plant. This would be a total of nine sites, the overall cost and effort for monitoring nine riparian monitoring sites in a year would be three times the current cost and effort needed to monitor the sites required under the current license. An additional two years of data from the relicensing study with the data collected as part of the current license would likely be sufficient to make reasonable management decisions concerning the riparian resources of Lee Vining Creek. Two years of study is needed because of highly variable climatic conditions. Any given year might be an exceptionally high or low water year and will skew the data. Therefore, two years of data, instead of just one year, are needed to eliminate highly variable climatic conditions.



Map 01. Lee Vining Creek FERC boundary and riparian monitoring sites.

From:	Carissa Shoemaker
Cc:	finlay.anderson@kleinschmidtgroup.com; Shannon.Luoma@KleinschmidtGroup.com; martin.ostendorf@sce.com; matthew.woodhall@sce.com; Kelly.Larimer@KleinschmidtGroup.com
Bcc:	events@mammothmuseum.org; frontierpacktrain@gmail.com; frontierpacktrain@gmail.com; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; triplepointh2o@gmail.com; jonathan.aguayo@psomas.com; victor.aguirreorozco@usda.gov; wayne.allen@sce.com; talpaugh@kearnswest.com; holly@inyo-monowater.org; dawn.alvarez@usda.gov; Philipana@aol.com; markbagley02@gmail.com; Rose.Banks@wildlife.ca.gov; adam.barnett@usda.gov; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Jacqueline.beidl@usda.gov; bbell@co.tuolumne.ca.us; ethan@stillwaterscl.com; hydroesq@schat.net; lbergeron@pcta.org; bblood@psomas.com; ashley.blythehaverstock@usda.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; burger@stillwaterscl.com; bburman@usbr.gov; seth.carr@sce.com; acohen@stillwaterscl.com; rcollins@caltrout.org; lcompas@hrassoc.com; lisa@monolake.org; cdaly@mackaysposito.com; shellydk@frontiernet.net; robbie@monolake.org; matt.driscoll@sierranevada.ca.gov; Lauren@stillwaterscl.com; gardenofegan@suddenlink.net; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; James.Erdman@wildlife.ca.gov; stephanie.fincher@sce.com; jora@friendsoftheinyo.org; nora.gamino@usda.gov; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; pgunsolley@gmail.com; ed.hancock@waterboards.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; jmharty@kearnswest.com; jenny@sierranevadaalliance.org; bryan.hatchell@colorado.edu; ghaverst@blm.gov; kelly.henderson@sce.com; Michael.Hross@KleinschmidtGroup.com; sheila.irons@usda.gov; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; lilian_jonas@contractor.nps.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com; jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon.Kulik@KleinschmidtGroup.com; claire@monolake.org; tristan.leong@usda.gov; russ@stillwaterscl.com; info@rockcreekpackstation.com; alyssa.marquez@wildlife.ca.gov; pmcfarland395@gmail.com; Richard.McNeill@usda.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; hmiller@hrassoc.com; david.moore@sce.com; Erin.Moore@usda.gov; Patricia.Moyer@Wildlife.ca.gov; easternsierraartist@gmail.com; megan.mullowney@usda.gov; heather@stillwaterscl.com; samantha.nelson@sce.com; Jill.north@waterboards.ca.gov; steve.norton@psomas.com; Krista@stillwaterscl.com; martin.ostendorf@sce.com; Fatima.Oswald@Kleinschmidtgroup.com; steve.parmenter@wildlife.ca.gov; Charles.partridge@sce.com; Mparuolo@mono.ca.gov; mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; marshmistress@msn.com; greg@monolake.org; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; calvin.rossi@sce.com; allison.rudalevige@psomas.com; monique.sanchez@usda.gov; jstarost@blm.gov; kary.schlick@usda.gov; wendy@friendsoftheinyo.org; cshutes@calsport.org; nathan.sill@usda.gov; barb@farwestern.com; esommerauer@stillwaterscl.com; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; daniel.sussman@waterboards.ca.gov; parker.thaler@Waterboards.ca.gov; shawna_theisen@fws.gov; lthurston@stillwaterscl.com; eric.tillemans@ladwp.com; thomas.torres@usda.gov; LTryba@kearnswest.com; nicolas.von@sce.com; curator@monobasinhistory.org; Jameisha.Washington@usda.gov; jennifer.watts@waterboards.ca.gov; johnwentworth@mltpa.org; eric@friendsoftheriver.org; vince.white@sce.com; Scott@stillwaterscl.com; Audry.Williams@sce.com; Brandy.Wood@Wildlife.ca.gov; daniel.yarborough@usda.gov; Andrew.Yoder@kleinschmidtgroup.com
Subject:	Lee Vining Study Plan Meeting Info
Date:	Wednesday, January 19, 2022 3:45:00 PM
Attachments:	image001.png

Hello Lee Vining Relicensing participants,

Thank you for your involvement in our relicensing process to date and your review and feedback on the PAD and Draft Study Plans. As outlined in the Lee Vining PAD Process Plan and Schedule, SCE intends to hold a Study Plan Meeting on March 28, 2022 at 1pm PST to discuss the Revised Study Plans. The Plans will be modified versions from those previously filed with the PAD in August 2020, based on comments received during the FERC comment period. The Relicensing Team will distribute the revised study plans prior to the meeting so stakeholders have ample time to review. As appropriate, the discussion will include responses to comments received on the plans, and any additional study plan requests. This meeting will follow several other Study Plan-related deadlines, as shown below:

- The relicensing team assesses the comments and new requests, revise Study Plans - due to TWGs February 18.

- Stakeholder comments on revised Study Plans - due March 18.
- Study Plan meeting to discuss revisions and revised plans on March 28.

Please let us know if you have any questions.
Thanks!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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B-08.2_New USFS contact to add to Recreation TWG

From:	Washington, Jameisha - FS, LEE VINING, CA
To:	Carissa Shoemaker
Cc:	Shannon Luoma
Subject:	RE: [External Email]Lee Vining Study Plan Meeting Info
Date:	Thursday, January 20, 2022 3:55:06 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png

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I would like to be in the recreation and land use TWG.
Thank you!

Jameisha Washington
Mono Lake Recreation Officer
Forest Service
Inyo National Forest
P: 760-965-6893
Jameisha.Washington@usda.gov
10806 Hwy. 120 W/P.O. Box 429
Lee Vining, CA 93541
www.fs.fed.us

Caring for the land and serving people

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Thursday, January 20, 2022 3:26 PM
To: Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: RE: [External Email]Lee Vining Study Plan Meeting Info

Hi Jameisha,

Absolutely, we have four TWGs for Lee Vining. Do you want to be in all of them or which one(s)?

- Fish, Aquatics, and Hydrology
- Terrestrial: Botanical and Wildlife
- Cultural and Tribal
- Recreation and Land Use

Thanks!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>
Sent: Thursday, January 20, 2022 12:14 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: [External Email]Lee Vining Study Plan Meeting Info

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Good Morning Carissa,
I know I'm in the technical working group for the Rush Creek FERC, but don't know if I'm in the ones for Lee Vining Creek.
Can I please be added?

Jameisha Washington
Mono Lake Recreation Officer
Forest Service
Inyo National Forest
P: 760-965-6893
Jameisha.Washington@usda.gov
10806 Hwy. 120 W/P.O. Box 429
Lee Vining, CA 93541
www.fs.fed.us

Caring for the land and serving people

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Wednesday, January 19, 2022 3:46 PM
Cc: finlay.anderson@kleinschmidtgroup.com; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Martin Ostendorf <Martin.Ostendorf@sce.com>; matthew.woodhall@sce.com; Kelly.Larimer@KleinschmidtGroup.com
Subject: [External Email]Lee Vining Study Plan Meeting Info

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ERM

1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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From:	Allison Rudalevige
To:	McNeill, Richard - FS, BISHOP, CA
Cc:	Shannon Luoma; Finlay Anderson; Carissa Shoemaker; Brad Blood
Subject:	RE: [External Email]Lee Vining botanical survey preparation
Date:	Wednesday, February 2, 2022 6:41:41 PM
Attachments:	image001.png image002.png

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I'm available Monday (2/7) and Friday (2/11). Possibly in the late afternoon on Tuesday or Thursday but I have field surveys and can't completely anticipate when I'd get home.

Allison D. Rudalevige

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, February 2, 2022 6:40 PM
To: Allison Rudalevige <allison.rudalevige@psomas.com>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Allison Rudalevige <allison.rudalevige@psomas.com>
Subject: Re: [External Email]Lee Vining botanical survey preparation

Sorry, hit the wrong button.
We should probably do a collection permit. It isn't extensive. I am out of the office right now.
Can we schedule something next week?
Get Outlook for iOS

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, February 2, 2022 6:37:49 PM
To: Allison Rudalevige <allison.rudalevige@psomas.com>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Allison Rudalevige <allison.rudalevige@psomas.com>
Subject: Re: [External Email]Lee Vining botanical survey preparation

Hi Allison
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From: Allison Rudalevige <allison.rudalevige@psomas.com>
Sent: Tuesday, February 1, 2022 2:49:46 PM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Allison Rudalevige <allison.rudalevige@psomas.com>
Subject: [External Email]Lee Vining botanical survey preparation

[External Email]
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Hello Richard-

As the Relicensing Team reviews the comments we've received on the Draft Lee Vining Study Plans, we're also beginning to plan for the 2022 plant survey season and wanted to confirm some logistics with you. First, we would like to ensure that we have official permission to collect plant voucher specimens within the boundaries of the INF. Is written permission from the USFS sufficient or is there a particular process we need to follow?

Second, we have reviewed the blooming times of special status plant species with potential to occur in the project area (provided in the PAD). Our survey windows need to be timed to maximize the opportunity to observe these species when identification is easiest (i.e., when they are blooming or fruiting). We were hoping you could provide feedback to help determine the optimal survey timing. Currently, we are considering surveys for the week of July 18 and August 15. Based on your knowledge of the area, do these weeks seem suitable?

Thank you.

Allison D. Rudalevige

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

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Ethan Muhlestein

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Monday, February 14, 2022 9:21 AM
To: Allison Rudalevige
Cc: Shannon Luoma; Finlay Anderson
Subject: Re: Botany collection permit
Attachments: Rudalevige_Botanical_Collection_Permit_20220211.rtf; LISTS INF Botany AtRisk_Invasive_Species 200108.xlsx

Hi Allison

Here is an updated permit that will allow collection in campgrounds and picnic areas and collection of Species of Conservation Concern (SCC).

If you do collect SCC, please ensure that the collections are submitted to a herbarium.

I also attached a recent list of SCC and invasive plants.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Allison Rudalevige <allison.rudalevige@psomas.com>
Sent: Friday, February 11, 2022 11:21
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: RE: Botany collection permit

Hi Richard-

B-09.2_Update permit from USFS re collection of Species of Conservation Concern

I was reviewing the draft permit conditions and have a couple questions regarding the conditions of the permit.

- Other Condition 6 states that "collection of… any Regional Forester's Sensitive Plant species… is prohibited". There are genera with potential to occur in the study area that encompass both common species and USFS Species of Conservation Concern (e.g., there are multiple common and SCC Boechera species known from the project region). I'm concerned that this permit condition would be prohibitive for accurately identifying the species to the taxonomic level necessary to determine whether it was special status. Is this a hardline condition?
- Other Condition 8 prohibits collection from campgrounds or picnic areas. Recreational facilities make up a large part of the botanical study area. Again, is this a hardline condition?

Thank you for advice you can provide on these issues.

Allison D. Rudalevige

PSOMAS 75 1946-2021

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Friday, February 11, 2022 9:12 AM
To: Allison Rudalevige <allison.rudalevige@psomas.com>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: Re: Botany collection permit

Hi Allison

1. Fill out the highlighted areas
2. Convert it to a PDf and sign it
3. Send to me, I will sign it and send it back.
4. Next year, send me an email and we will renew it.

Please keep a copy of the permit with you when collecting.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: McNeill, Richard - FS, BISHOP, CA
Sent: Monday, February 7, 2022 08:11
To: Allison Rudalevige <allison.rudalevige@psomas.com>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: Botany collection permit
When: Friday, February 11, 2022 09:00-09:30.
Where:

Please invite anyone else who needs to be involved

Microsoft Teams meeting

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B-10.1_Notice re revised study plan availability notification and request for comments

From:	Carissa Shoemaker
Cc:	Shannon.Luoma@KleinschmidtGroup.com; finlay.anderson@kleinschmidtgroup.com; Kelly.Larimer@KleinschmidtGroup.com; matthew.woodhall@sce.com; martin.ostendorf@sce.com; allison.rudalevige@psomas.com; steve.norton@psomas.com; bblood@psomas.com; Matthew.Harper@KleinschmidtGroup.com; Angela.Whelpley@KleinschmidtGroup.com; Karen.Klosowski@KleinschmidtGroup.com; heather@stillwatersci.com; LTryba@kearnswest.com; talpaugh@kearnswest.com; jmharty@kearnswest.com; acohen@stillwatersci.com; Audry Williams; Shelly Davis-King; lcompas@hrassoc.com
Bcc:	culture@bridgeportindiancolony.com; events@mammothmuseum.org; nayanake@comcast.net; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; paiute11@aol.com; ashley.blythehaverstock@usda.gov; t.braithwaite@bentonpaiutereservation.org; chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; d.gutierrez@bigpinepaiute.org; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; curator@monobasinhistory.org; kutzanuumu@yahoo.com; adam.barnett@usda.gov; justin_barrett@fws.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; James.Erdman@wildlife.ca.gov; jora@friendsoftheinyo.org; nora.gamino@usda.gov; Rwgoode911@hotmail.com; katie@accessfund.org; ed.hancock@waterboards.ca.gov; sheila.irons@usda.gov; Saeed.Jorat@ladwp.com; claire@monolake.org; tristan.leong@usda.gov; alyssa.marquez@wildlife.ca.gov; cmcdonald@northforkrancheria-nsn.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; easternsierraartist@gmail.com; megan.mullowney@usda.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; greg@monolake.org; monique.sanchez@usda.gov; cshutes@calsport.org; nathan.sill@usda.gov; parker.thaler@Waterboards.ca.gov; eric.tillemans@ladwp.com; thomas.torres@usda.gov; Jameisha.Washington@usda.gov; Richard.McNeill@usda.gov; Rajaa.Hassan@waterboards.ca.gov
Subject:	Lee Vining Revised Study Plans ready for review
Date:	Tuesday, February 22, 2022 10:52:00 AM
Attachments:	image001.png

Hello Lee Vining Technical Working Group members,

The Lee Vining Revised Technical Study Plans were filed with FERC on Friday February 18, 2022. The Study Plan document is available on the Lee Vining Relicensing website and can also be found on the Project's FERC docket online (at this link). SCE greatly appreciates your review and comment on these plans. You now have 30 days to review; SCE would like your comments by March 21. On March 28, SCE is holding a virtual Study Plan meeting to discuss the pertinent comments received. If you haven't received an invitation to that meeting please let us know.

Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

B-10.1_Notice re revised study plan availability notification and request for comments

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Ethan Muhlestein

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Friday, March 4, 2022 11:18 AM
To: Carissa Shoemaker
Subject: FW: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

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Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Ron W. Goode <rwgoode911@hotmail.com>
Sent: Tuesday, March 1, 2022 2:07 PM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; culture@bridgeportindiancolony.com; events@mammothmuseum.org; nayanake@comcast.net; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; paiute11@aol.com; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org; Chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; d.gutierrez@bigpinepaiute.org; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; Iav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; curator@monobasinhistory.org; kutzanuumu@yahoo.com; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov; jora@friendsoftheinyo.org; Gamino, Nora -FS <nora.gamino@usda.gov>; katie@accessfund.org; ed.hancock@waterboards.ca.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com; claire@monolake.org; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov; cmcdonald@northforkrancheria-nsn.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; easternsierraartist@gmail.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; greg@monolake.org; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov; eric.tillemans@ladwp.com; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Rajaa.Hassan@waterboards.ca.gov
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com; martin.ostendorf@sce.com; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba

<LTryba@kearnswest.com>; talpaugh@kearnswest.com; jmharty@kearnswest.com
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

There seems to be a number of unfinished or unaddressed issues in terms of cultural data, historic, archaeological and ethnographical. You mentioned using an ethnobotanical report from the San Joaquin River. Is that my ethnobotanical report of cultural plants or a botanical study done by the botantist. My report will be helpful as a model, but the tribes on the eastern side need to have lots of input.

This is the same for Lee Vining, Rush and Bishop relicenses. I'm familiar with Utility time-lines and putting that on FERC but these studies need to be right now or as tribes we will work with FERC to ensure these studies are in proper order. Meaning do it right now or that time-line goes out the door as tribes and stakeholders we do not have to concur with the HPMP. I and several other stakeholders Intervened on SCE Big Creek 4 relicensing and the Long Range Operating Rules got stretched out for 18 years. I don't believe that is in anyone's best interest.
Ron

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, March 1, 2022 12:43 PM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; events@mammothmuseum.org <events@mammothmuseum.org>; nayanake@comcast.net <nayanake@comcast.net>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; paiute11@aol.com <paiute11@aol.com>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; Chair@lppsr.org <Chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>; sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com <thpo@fortindependence.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu <lav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; kutzanuumu@yahoo.com <kutzanuumu@yahoo.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com <rwgoode911@hotmail.com>; katie@accessfund.org <katie@accessfund.org>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; claire@monolake.org <claire@monolake.org>; Leong, Tristan -FS

<tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org <bartshe@monolake.org>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; greg@monolake.org <greg@monolake.org>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org <cshutes@calsport.org>; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Rajaa.Hassan@waterboards.ca.gov <Rajaa.Hassan@waterboards.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Finlay

What are you looking for with this round of review?

I see you responses to my comments, do you want a further response to that?

What if a comment did not receive a response from SCE?

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Tuesday, February 22, 2022 10:17
To: culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; events@mammothmuseum.org <events@mammothmuseum.org>; nayanake@comcast.net <nayanake@comcast.net>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; paiute11@aol.com <paiute11@aol.com>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; Chair@lppsr.org <Chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>; sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com <thpo@fortindependence.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu <lav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; kutzanuumu@yahoo.com <kutzanuumu@yahoo.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com <rwgoode911@hotmail.com>; katie@accessfund.org <katie@accessfund.org>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; claire@monolake.org <claire@monolake.org>; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org <bartshe@monolake.org>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; greg@monolake.org <greg@monolake.org>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org <cshutes@calsport.org>; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Rajaa.Hassan@waterboards.ca.gov <Rajaa.Hassan@waterboards.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen

Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>
Subject: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

[External Email]
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Hello Lee Vining Technical Working Group members,

The Lee Vining Revised Technical Study Plans were filed with FERC on Friday February 18, 2022. The Study Plan document is available on the Lee Vining Relicensing website and can also be found on the Project's FERC docket online (at this link). SCE greatly appreciates your review and comment on these plans. You now have 30 days to review; SCE would like your comments by March 21. On March 28, SCE is holding a virtual Study Plan meeting to discuss the pertinent comments received. If you haven't received an invitation to that meeting and you would like to attend please let us know.

Thank you!

Finlay Anderson
Sr. Regulatory Advisor
Kleinschmidt
O: 971.345.0517 C: 503.329.3586
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We provide practical **solutions** *for renewable energy, water and environmental projects!*

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From: Shannon Luoma
To: Carissa Shoemaker
Subject: FW: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]
Date: Thursday, March 3, 2022 11:49:57 AM
Attachments: image002.png
image003.jpg

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Hey! Can you help me track this down?

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Thursday, March 3, 2022 10:24 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Shannon
Thank you for the response, I know a few people weren't sure about what was expected.
I couldn't find a response to one of my comments, maybe I missed it.
My comment
Page 4/15 of the Botany study plan, 4.0 EXTENT OF STUDY AREA AND STUDY SITES
Should include subsurface facilities if there is a recreational use or an ongoing ecological impact (e.g. change in vegetation, erosion, landform, hydrologic process).
There are 52 climbs accessed from the Rhinedollar penstock and Pinus albicaulis/whitebark pine a INF species on conservation concern occur along the penstock, this needs to be surveyed for special status and invasive plants.
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>

Sent: Wednesday, March 2, 2022 09:09
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; events@mammothmuseum.org <events@mammothmuseum.org>; nayanake@comcast.net <nayanake@comcast.net>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; paiute11@aol.com <paiute11@aol.com>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; Chair@lppsr.org <Chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>; sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com <thpo@fortindependence.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu <lav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; kutzanuumu@yahoo.com <kutzanuumu@yahoo.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com <rwgoode911@hotmail.com>; katie@accessfund.org <katie@accessfund.org>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; claire@monolake.org <claire@monolake.org>; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org

<bartshe@monolake.org>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; greg@monolake.org <greg@monolake.org>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org <cshutes@calsport.org>; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Rajaa.Hassan@waterboards.ca.gov <Rajaa.Hassan@waterboards.ca.gov>

Cc: Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>

Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Richard -

Thanks for the great question! As Lee Vining is following the Traditional Licensing Process (TLP), there is nothing formally required on your end at this time. The formal FERC TLP process relating to study plans concluded on January 18 at the end of the comment period. However, SCE is providing additional opportunities to collaborate. SCE and the Relicensing Team have provided this revised technical study plan (RTSP) for your review and comment. Resource leads did take stakeholder/agency comments into consideration when revising these plans though some comments provided were more editorial in nature or addressed the PAD content rather than the study plan itself. If there is a comment that was not addressed that pertains to your study, please flag it for us as we may have missed it (or misunderstood it). We are holding a study plan meeting on March 28 (please let us know if you do not have the invite), and intend to review each study plan and any additional suggestions you may have between now and then. Our goal is to have final study plans complete shortly after the meeting so we can get into the field with first year studies this spring/summer.

If you have specific questions on the RTSP or our response to comments, we're more than happy to set up a call prior to the study plan meeting to discuss.

Let me know if you have other questions, thanks!

Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, March 1, 2022 11:43 AM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>;

culture@bridgeportindiancolony.com; events@mammothmuseum.org; nayanake@comcast.net; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; paiute11@aol.com; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org; Chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; d.gutierrez@bigpinepaiute.org; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; curator@monobasinhistory.org; kutzanuumu@yahoo.com; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov; jora@friendsoftheinyo.org; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com; katie@accessfund.org; ed.hancock@waterboards.ca.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com; claire@monolake.org; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov; cmcdonald@northforkrancheria-nsn.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; easternsierraartist@gmail.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; greg@monolake.org; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov; eric.tillemans@ladwp.com; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Rajaa.Hassan@waterboards.ca.gov

Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com; martin.ostendorf@sce.com; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com; jmharty@kearnswest.com

Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Finlay
What are you looking for with this round of review?
I see you responses to my comments, do you want a further response to that?
What if a comment did not receive a response from SCE?
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Tuesday, February 22, 2022 10:17
To: culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; events@mammothmuseum.org <events@mammothmuseum.org>; nayanake@comcast.net <nayanake@comcast.net>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; paiute11@aol.com <paiute11@aol.com>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; Chair@lppsr.org <Chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>; sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com <thpo@fortindependence.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu

<Iav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; kutzanuumu@yahoo.com <kutzanuumu@yahoo.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com <rwgoode911@hotmail.com>; katie@accessfund.org <katie@accessfund.org>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; claire@monolake.org <claire@monolake.org>; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org <bartshe@monolake.org>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; greg@monolake.org <greg@monolake.org>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org <cshutes@calsport.org>; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Rajaa.Hassan@waterboards.ca.gov <Rajaa.Hassan@waterboards.ca.gov>

Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>

Subject: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

[External Email]
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Hello Lee Vining Technical Working Group members,

The Lee Vining Revised Technical Study Plans were filed with FERC on Friday February 18, 2022. The Study Plan document is available on the Lee Vining Relicensing website and can also be found on the

Project's FERC docket online (at this link). SCE greatly appreciates your review and comment on these plans. You now have 30 days to review; SCE would like your comments by March 21. On March 28, SCE is holding a virtual Study Plan meeting to discuss the pertinent comments received. If you haven't received an invitation to that meeting and you would like to attend please let us know. Thank you!

Finlay Anderson
Sr. Regulatory Advisor

O: 971.345.0517 C: 503.329.3586
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B-10.4_Coordination re revised Botanical study plan meeting

From:	McNeill, Richard - FS, BISHOP, CA
To:	Shannon Luoma; Irons, Sheila -FS; Sanchez, Monique - FS
Cc:	Carissa Shoemaker; Finlay Anderson
Subject:	Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]
Date:	Friday, March 11, 2022 10:53:28 AM
Attachments:	image006.png image008.png image009.png image010.png image011.png image012.png image013.jpg Outlook-Forest Ser.png

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HI Shannon

I think 4:30 on Wednesday will work for us.

I will send a calendar invite.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Thursday, March 10, 2022 16:11
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>

Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Okay, thanks for the update on schedule, Rick! We're available next week as follows:
Monday: 2:30-5
Tuesday: 3-5
Wednesday 4:30-5
I just want to check in and see if we can get your initial thoughts on the revisions to the study plans and also ask a bit more about the survey request near Rhinedollar penstock/climbing area.
Thanks!

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Wednesday, March 9, 2022 1:55 PM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Shannon
Next week I am in training, so I am available before 0830 or after 1400.
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Wednesday, March 9, 2022 12:03
To: Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson

<finlay.anderson@kleinschmidtgroup.com>
Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi! Unfortunately the Kleinschmidt team is not available in the morning of the 11th.
What is your availability Monday afternoon (3/14) or Wednesday morning (3/16)?

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Irons, Sheila -FS <sheila.irons@usda.gov>
Sent: Wednesday, March 9, 2022 12:01 PM
To: Sanchez, Monique - FS <monique.sanchez@usda.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

That should work for me

Sheila Irons
Forest Lands Officer
Forest Service
Inyo National Forest
c: 760-965-9609
sheila.irons@usda.gov
351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us
Caring for the land and serving people

From: Sanchez, Monique - FS <monique.sanchez@usda.gov>
Sent: Tuesday, March 8, 2022 5:07 PM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

I am available on the 11th starting at 10, lets meet then.

Monique Sanchez
Hydropower Coordinator

Forest Service
Pacific Southwest Region
Public Services

c: 530-604-2971
monique.sanchez@usda.gov

1980 Old Mission Drive,
Solvang, CA 93463
www.fs.fed.us

Caring for the land and serving people

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, March 8, 2022 5:04 PM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Shannon
I apologize, I thought I answered this email last week.
I am available (all PST)
3/9 0700-1200
3/10 1300-1700
3/11 0700-1200
If none those times work, let me know and we can look farther out.
rick

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Friday, March 4, 2022 2:33:57 PM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Rick! This comment actually wasn't included in the version we received from the Forest Service. I've passed it along to Allison and we'll have something back to you asap. Also, I'd love to check in with you regarding the revised study plans in general. What's your schedule look like the next two weeks?
Thanks, have a great weekend!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Thursday, March 3, 2022 10:24 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Shannon
Thank you for the response, I know a few people weren't sure about what was expected.
I couldn't find a response to one of my comments, maybe I missed it.
My comment
Page 4/15 of the Botany study plan, 4.0 EXTENT OF STUDY AREA AND STUDY SITES
Should include subsurface facilities if there is a recreational use or an ongoing ecological impact (e.g. change in vegetation, erosion, landform, hydrologic process).

There are 52 climbs accessed from the Rhinedollar penstock and Pinus albicaulis/whitebark pine a INF species on conservation concern occur along the penstock, this needs to be surveyed for special status and invasive plants.
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Wednesday, March 2, 2022 09:09
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; events@mammothmuseum.org <events@mammothmuseum.org>; nayanake@comcast.net <nayanake@comcast.net>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; paiute11@aol.com <paiute11@aol.com>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; Chair@lppsr.org <Chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>; sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com

<thpo@fortindependence.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu <lav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; kutzanuumu@yahoo.com <kutzanuumu@yahoo.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com <rwgoode911@hotmail.com>; katie@accessfund.org <katie@accessfund.org>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; claire@monolake.org <claire@monolake.org>; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org <bartshe@monolake.org>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; greg@monolake.org <greg@monolake.org>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org <cshutes@calsport.org>; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Rajaa.Hassan@waterboards.ca.gov <Rajaa.Hassan@waterboards.ca.gov>

Cc: Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>

Subject: RE: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Richard -

Thanks for the great question! As Lee Vining is following the Traditional Licensing Process (TLP), there is nothing formally required on your end at this time. The formal FERC TLP process relating to study plans concluded on January 18 at the end of the comment period. However, SCE is providing

additional opportunities to collaborate. SCE and the Relicensing Team have provided this revised technical study plan (RTSP) for your review and comment. Resource leads did take stakeholder/agency comments into consideration when revising these plans though some comments provided were more editorial in nature or addressed the PAD content rather than the study plan itself. If there is a comment that was not addressed that pertains to your study, please flag it for us as we may have missed it (or misunderstood it). We are holding a study plan meeting on March 28 (please let us know if you do not have the invite), and intend to review each study plan and any additional suggestions you may have between now and then. Our goal is to have final study plans complete shortly after the meeting so we can get into the field with first year studies this spring/summer.

If you have specific questions on the RTSP or our response to comments, we're more than happy to set up a call prior to the study plan meeting to discuss.

Let me know if you have other questions, thanks!

Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, March 1, 2022 11:43 AM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; culture@bridgeportindiancolony.com; events@mammothmuseum.org; nayanake@comcast.net; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; paiute11@aol.com; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org; Chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; d.gutierrez@bigpinepaiute.org; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; curator@monobasinhistory.org; kutzanuumu@yahoo.com; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov; jora@friendsoftheinyo.org; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com; katie@accessfund.org; ed.hancock@waterboards.ca.gov; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com; claire@monolake.org; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov; cmcdonald@northforkrancheria-nsn.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; easternsierraartist@gmail.com; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com;

greg@monolake.org; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov; eric.tillemans@ladwp.com; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; Rajaa.Hassan@waterboards.ca.gov
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com; martin.ostendorf@sce.com; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com; jmharty@kearnswest.com
Subject: Re: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

Hi Finlay
What are you looking for with this round of review?
I see you responses to my comments, do you want a further response to that?
What if a comment did not receive a response from SCE?
rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Sent: Tuesday, February 22, 2022 10:17
To: culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; events@mammothmuseum.org <events@mammothmuseum.org>; nayanake@comcast.net <nayanake@comcast.net>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; paiute11@aol.com <paiute11@aol.com>; Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; Chair@lppsr.org <Chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>;

sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com <thpo@fortindependence.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu <lav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; curator@monobasinhistory.org <curator@monobasinhistory.org>; kutzanuumu@yahoo.com <kutzanuumu@yahoo.com>; Barnett, Adam -FS <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; Ellsworth, Todd -FS <todd.ellsworth@usda.gov>; Engelhardt, Blake -FS <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; Gamino, Nora -FS <nora.gamino@usda.gov>; rwgoode911@hotmail.com <rwgoode911@hotmail.com>; katie@accessfund.org <katie@accessfund.org>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; claire@monolake.org <claire@monolake.org>; Leong, Tristan -FS <tristan.leong@usda.gov>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org <bartshe@monolake.org>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; Mullowney, Megan -FS <megan.mullowney@usda.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; greg@monolake.org <greg@monolake.org>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; cshutes@calsport.org <cshutes@calsport.org>; Sill, Nathan -FS <nathan.sill@usda.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; Torres, Thomas - FS, MAMMOTH LAKES, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, LEE VINING, CA <Jameisha.Washington@usda.gov>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Rajaa.Hassan@waterboards.ca.gov <Rajaa.Hassan@waterboards.ca.gov>

Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Kelly Larimer <Kelly.Larimer@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Steve Norton <steve.norton@psomas.com>; Brad Blood <bblood@psomas.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Karen Klosowski <Karen.Klosowski@Kleinschmidtgroup.com>; Heather Bowen Neff <heather@stillwatersci.com>; Adam Cohen <acohen@stillwatersci.com>; Lindsay Tryba <LTryba@kearnswest.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>

Subject: [External Email]Lee Vining Revised Study Plan [sent on behalf of Southern California Edison]

[External Email]
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Hello Lee Vining Technical Working Group members,

The Lee Vining Revised Technical Study Plans were filed with FERC on Friday February 18, 2022. The Study Plan document is available on the Lee Vining Relicensing website and can also be found on the Project's FERC docket online (at this link). SCE greatly appreciates your review and comment on these plans. You now have 30 days to review; SCE would like your comments by March 21. On March 28, SCE is holding a virtual Study Plan meeting to discuss the pertinent comments received. If you haven't received an invitation to that meeting and you would like to attend please let us know.

Thank you!

Finlay Anderson
Sr. Regulatory Advisor

O: 971.345.0517 C: 503.329.3586
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From:	Finlay Anderson
To:	Shannon Luoma; Carissa Shoemaker; Heather Bowen Neff; Bret Hoffman; Isha Deo
Subject:	FW: Hydro-optimization data collection question
Date:	Friday, March 4, 2022 4:19:30 PM
Attachments:	image001.jpg image002.jpg

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

FYI

From: North, Jill@Waterboards <Jill.North@waterboards.ca.gov>
Sent: Monday, February 28, 2022 4:00 PM
To: Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Cc: Matthew Woodhall <matthew.woodhall@sce.com>; Wayne Allen <Wayne.Allen@sce.com>
Subject: Hydro-optimization data collection question

Hi Finlay,

I've been reviewing your revised study plans for Lee Vining and am pleased to see many of our recommendations incorporated into that plan. I have a couple of clarifying questions that I would like to ask regarding data collection during hydro-optimization.

For Water Quality studies, I see that you are agreeing to collect turbidity data at 30 minute intervals. I am unclear if flow monitoring and ramping rate data will be collected and reported as part of the studies. If so, at what intervals will this data be collected? Are you able to direct me to where I may find this information? I have been unable to locate it myself.

For AQ-5 Operations Model, I understand that there are some challenges and you will be modeling past hydro-optimization data if possible. What will be the time-step of the model?

Thank you for your time and enjoy the rest of this week

Jill North
Environmental Scientist
Water Quality Certification Unit
Division of Water Rights, State Water Board

ONE PERSON CAN MAKE A DIFFERENCE, AND EVERYONE SHOULD TRY- JOHN F. KENNEDY

B-12_Notice re revised study plan meeting agenda (attached)

From: Carissa Shoemaker

Bcc: Jessica Strickland; Chris Shutes; michael.wiese@usda.gov; culture@bridgeportindiancolony.com; nayanake@comcast.net; kutzanuumu@yahoo.com; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; jbethel@northforkrancheria-nsn.gov; paiute11@aol.com; t.braithwaite@bentonpaiutereservation.org; nativearchdoc@yahoo.com; chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; Rwgoode911@hotmail.com; d.gutierrez@bigpinepaiute.org; env@bridgeportindiancolony.com; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; cmcdonald@northforkrancheria-nsn.gov; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; andrea@mewuk.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; jocelynsheltraw@gmail.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; Iav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; events@mammothmuseum.org; frontierpacktrain@gmail.com; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; triplepointh2o@gmail.com; jonathan.aquayo@psomas.com; victor.aguirreorozco@usda.gov; wayne.allen@sce.com; talpaugh@kearnswest.com; holly@inyo-monowater.org; dawn.alvarez@usda.gov; Philipana@aol.com; markbagley02@gmail.com; Rose.Banks@wildlife.ca.gov; adam.barnett@usda.gov; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Jacqueline.beidl@usda.gov; bbell@co.tuolumne.ca.us; ethan@stillwaterscl.com; hydroesq@schat.net; lbergeron@pcta.org; bblood@psomas.com; ashley.blythehaverstock@usda.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; burger@stillwaterscl.com; bburman@usbr.gov; seth.carr@sce.com; acohen@stillwaterscl.com; rcollins@caltrout.org; lcompas@hrassoc.com; lisa@monolake.org; shellydk@frontiernet.net; robbie@monolake.org; matt.driscoll@sierranevada.ca.gov; Lauren@stillwaterscl.com; gardenofegan@suddenlink.net; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; James.Erdman@wildlife.ca.gov; stephanie.fincher@sce.com; jora@friendsoftheinyo.org; nora.gamino@usda.gov; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; pgunsolley@gmail.com; ed.hancock@waterboards.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; jmharty@kearnswest.com; jenny@sierranevadaalliance.org; bryan.hatchell@colorado.edu; ghaverst@blm.gov; kelly.henderson@sce.com; Michael.Hross@KleinschmidtGroup.com; sheila.irons@usda.gov; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; lilian_jonas@contractor.nps.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com; jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon.Kulik@KleinschmidtGroup.com; claire@monolake.org; tristan.leong@usda.gov; russ@stillwaterscl.com; info@rockcreekpackstation.com; alyssa.marquez@wildlife.ca.gov; pmcfarland395@gmail.com; Richard.McNeill@usda.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; hmiller@hrassoc.com; david.moore@sce.com; Erin.Moore@usda.gov; Patricia.Moyer@Wildlife.ca.gov; easternsierraartist@gmail.com; megan.mullowney@usda.gov; heather@stillwaterscl.com; samantha.nelson@sce.com; Jill.north@waterboards.ca.gov; steve.norton@psomas.com; Krista@stillwaterscl.com; martin.ostendorf@sce.com; Fatima.Oswald@Kleinschmidtgroup.com; steve.parmenter@wildlife.ca.gov; Charles.partridge@sce.com; Mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; marshmistress@msn.com; greg@monolake.org; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; calvin.rossi@sce.com; allison.rudalevige@psomas.com; monique.sanchez@usda.gov; jstarost@blm.gov; kary.schlick@usda.gov; wendy@friendsoftheinyo.org; cshutes@calsport.org; nathan.sill@usda.gov; barb@farwestern.com; esommerauer@stillwaterscl.com; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; daniel.sussman@waterboards.ca.gov; parker.thaler@Waterboards.ca.gov; shawna_theisen@fws.gov; lthurston@stillwaterscl.com; eric.tillemans@ladwp.com; thomas.torres@usda.gov; LTryba@kearnswest.com; nicolas.von@sce.com; curator@monobasinhistory.org; Jameisha.Washington@usda.gov; jennifer.watts@waterboards.ca.gov; johnwentworth@mltpa.org; eric@friendsoftheriver.org; vince.white@sce.com; Scott@stillwaterscl.com; Audry.Williams@sce.com; Brandy.Wood@Wildlife.ca.gov; daniel.yarborough@usda.gov; Andrew.Yoder@kleinschmidtgroup.com; finlay.anderson@kleinschmidtgroup.com; Shannon.Luoma@KleinschmidtGroup.com; matthew.woodhall@sce.com; Kelly.Larimer@KleinschmidtGroup.com; beth.lawson@wildlife.ca.gov; Philip.Meyer@Waterboards.ca.gov

Subject: Lee Vining Study Plan Meeting Agenda

Date: Thursday, March 17, 2022 11:00:00 AM

Attachments: image001.png
Lee Vining SP Meeting Agenda_20220328.pdf

Hello Lee Vining Relicensing participants,

Please see the attached agenda for the Revised Technical Study Plan meeting on March 28.
Let me know if you have any questions.

Thanks
See you then!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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Lee Vining Hydroelectric Project Relicensing

Revised Technical Study Plan Stakeholder Meeting

March 28, 2022, 1:00 PM – 4:00 PM PDT via Microsoft Teams

Objectives

- Review changes made to Study Plans since filing with FERC (Feb 2022)
- Review comments received since February filing
- Discuss Final Study Plans and implementation

Time	Agenda Topic/Subtopic	Lead
1:00	**Welcome & Introductions**	
	- Safety moment - Introductions	Matthew Woodhall
1:10	**Relicensing Schedule Overview**	
	- Review where we are in the relicensing process - Review purpose of study plans	Shannon Luoma
1:20	**Fish, Aquatics, and Hydrology Study Plans Discussion**	
	- Stream and Reservoir Water Quality Study (WQ-1) - Reservoir Fish Population Study (AQ-1) - Stream Fish Populations Study (AQ-2) - Aquatic Habitat Mapping and Sediment Characterization (AQ-3) - Aquatic Invasive Plants Survey (AQ-4) - Operations and Hydrology Model (AQ-5) - Lower Lee Vining Creek Channel Morphology (AQ-6)	Heather Neff, Adam Cohen, Finlay Anderson
1:55	**Terrestrial and Botanical Study Plans Discussion**	
	- General Botanical Resources Survey (TERR-1) - General Wildlife Resources Survey (TERR-2)	Allison Rudalevige, Steve Norton
2:25	**5-minute break**	
2:30	**Cultural and Tribal Study Plans Discussion**	
	- Cultural Resources (CUL-1) - Tribal Resources (TRI-1)	Audry Williams, Shelly Davis-King, Lynn Compas

3:00	**Recreation and Land Use Study Plans Discussion** - Recreation Use Assessment (REC-1) - Facilities Condition Assessment (REC-2) - Project Lands and Roads Assessment (LAND-1) - Aesthetics Resource Assessment (LAND-2)	Angela Whelpley, Karen Klosowski
3:35	**Schedule and Next Steps** - Upcoming important dates and events - Other action items	Carissa Shoemaker
3:45	**Final Q&A**	
4:00	**Adjourn**	

Materials Available on Relicensing Website

- Preliminary Application Document, filed August 12, 2021
  - Includes Draft Study Plans
- Revised Technical Study Plans, filed February 18, 2022
- Site Visit materials
  - Project overview maps
  - Site Visit Booklet
  - Agenda
  - Site Visit Photos
- Process Plan and Schedule
- USFWS IPaC Report (April 2020)
- Project Flyover Video
- FERC Environmental Assessment
- Current FERC License (1997)
- Select Orders Amending the 1997 License
- Technical Working Group (TWG) materials
  - Meeting Agenda
  - Meeting Summaries
  - PowerPoint Presentations
  - TWG Charter Document
- October 2020 Public Meeting materials
- November 2021 Joint Agency and Public Meeting materials

CALIFORNIA Water Boards

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GOVERNOR

JARED BLUMENFELD
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

March 17, 2022

Mr. Wayne Allen
Southern California Edison
1515 Walnut Grove Avenue
Rosemead, CA 91770
Wayne.Allen@sce.com

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426
Via e-filing

Revised Technical Study Plan
Lee Vining Hydroelectric Project
Federal Energy Regulatory Commission Project No. 1388
Mono County
Lee Vining Creek, Glacier Creek, Saddlebag Lake, Tioga Lake, and Ellery Lake

Dear Mr. Allen and Secretary Bose:

Southern California Edison (SCE) owns and operates the Lee Vining Hydroelectric Project (Project), also referred to as Federal Energy Regulatory Commission (FERC) Project No. 1388. On August 12, 2021, SCE filed its Pre-Application Document (PAD) with FERC for relicensing of the Project. On January 14, 2022, State Water Board staff submitted comments on the Project's PAD and requested additional studies. On February 18, 2022, SCE electronically filed their Revised Technical Study Plan based on comments received from stakeholders.

State Water Board staff supports and appreciates SCE's process of engaging stakeholders in early relicensing activities and their continued effort to work collaboratively with State Water Board staff and other relicensing participants to develop and refine the Technical Study Plan. Working collaboratively with all relicensing participants, where possible, often allows for expedited resolution of issues.

State Water Board staff hereby submits the enclosed comments on the Revised Technical Study Plan. The comments are provided in the following attachment: *Attachment A: Comments on Revised Technical Study Plan for Lee Vining Hydroelectric Project.*

If you have questions regarding this letter, please contact Jill North, Project Manager, by email at Jill.North@waterboards.ca.gov. Written correspondence should be directed to:

Wayne Allen
Secretary Bose

March 17, 2022

State Water Resources Control Board
Division of Water Rights – Water Quality Certification Program
Attn: Jill North
P.O. Box 2000
Sacramento, CA 95812-2000

Sincerely,

Parker Thaler

FOR: Jill North – Environmental Scientist
Water Quality Certification Program
Division of Water Rights

Attachments: Attachment A: Comments on Revised Technical Study Plan for Lee Vining Hydroelectric Project

ec:

Matthew Woodhall
Project Lead
Southern California Edison
matthew.woodhall@sce.com

Sandra Jacobson
California Trout
Sierra Headwaters Projects
sjacobson@caltrout.org

Chad Mellison
Fisheries Biologist
United States Fish and Wildlife Service
chad_mellison@FWS.gov

Tristan Leong
Hydroelectric Coordinator
United States Forest Service
tristan.leong@usda.gov

Todd Ellsworth
Hydrologist
United States Forest Service
Todd.ellsworth@usda.gov

Mono Lake Ranger District
PO Box 429
Lee Vining, CA 93541

Dawn Alvarez
USFS
Regional Office – FERC Program lead
351 Pacu Ln, Suite 200,
Bishop, CA 93514
dawn.alvarez@usda.gov

California Trout
Southern California Program Manager
1810 14th St, Suite 201
Santa Monica, CA 90404

Greg Reis
Mono Lake Committee
Information and Restoration Specialist
PO Box 161
San Geronimo, CA 94963
greg@monolake.org

Alyssa Marquez
Environmental Scientist
California Department of Fish & Wildlife
alyssa.marquez@wildlife.ca.gov

Wayne Allen
Secretary Bose

March 17, 2022

Beth Lawson
Senior Hydraulic Engineer
California Department of Fish & Wildlife
beth.lawson@wildlife.ca.gov

Bartshe Miller
Mono Lake Committee
bartshe@monolake.org

Hillary Behr
Eastern Sierra Audubon Society
President
P.O. Box 624
Bishop, CA 93515
president@esaudubon.org

Sierra Business Council
10183 Truckee Airport Rd #202
Truckee, CA 96161

Chris Shutes
California Sportfishing Protection Alliance
1248 East Oak Avenue, #D
Woodland, CA 95776
cshutes@calsport.org

Finlay Anderson
Senior Regulatory Advisor
Kleinschmidt
finlay.anderson@kleinschmidtgroup.com

Sierra Club, Toiyabe Chapter
2101 Webster St, Suite 1300
Oakland, CA 94612
chair@toiyabe.sierraclub.org

ATTACHMENT A

COMMENTS ON REVISED TECHNICAL STUDY PLAN FOR LEE VINING HYDROELECTRIC PROJECT

State Water Resources Control Board (State Water Board) staff are providing the following comments on Southern California Edison's (SCE) Revised Technical Study Plans for relicensing the Lee Vining Hydroelectric Project (Project):

1. Information collected through the implementation of study plans in the Federal Energy Regulatory Commission (FERC) relicensing process will be used by FERC to develop license conditions and fulfill its obligations under the National Environmental Policy Act and by other agencies that must take permitting actions during relicensing proceedings. Study plan information will assist the State Water Board in developing California Environmental Quality Act compliance documents and water quality certification conditions to ensure compliance with the Clean Water Act and appropriate requirements of state law.

2. WQ-1 Stream and Reservoir Water Quality Technical Study Plan:

   Data Collection Timeframe: State Water Board staff appreciates SCE's proposal to include a second year of water quality data if the following water year type differs from the first. State Water Board staff are looking forward to working with SCE to determine the adequacy of the one year of data collected and the potential need for additional data collection.

3. AQ-5 Operations Model Technical Study Plan:

   Hydro-Resource Optimization Monitoring: SCE is proposing to determine the frequency, magnitude, duration, and seasonality of intraday releases from the Poole Powerhouse in response to resource optimization needs. As optimization operations may be short lived, please provide detail on what model time-step is necessary to provide useful levels of detail to project operations.

From:	Marquez, Alyssa@Wildlife
To:	Carissa Shoemaker
Cc:	Erdman, James@Wildlife; Moyer, Patricia (Trisha)@Wildlife; Wood, Brandy@Wildlife; Matthew Woodhall; finlay.anderson@kleinschmidtgroup.com; Steve Norton
Subject:	Lee Vining Revised Study Plans - Yosemite Toad
Date:	Friday, March 18, 2022 3:37:12 PM
Attachments:	YOTO Revised Study Plan_CDFW Comments_3.18.2022.docx

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Carissa,
Jim Erdman and I have reviewed the TERR-2 Study proposal for the sections pertaining to Yosemite Toad (YOTO) and we have made several changes that we have document in track changes (see attached). Can you please forward this document to anybody else who should have a copy? Jim and I will both be participating in the March 28th Revised Study Plan meeting and will be available to discuss the proposed changes. If we need more time outside of the scheduled Revised Study Plan Meeting to discuss, we can be available for a follow-up meeting with SCE and other interested TWG members. Below is a summary of our changes to the revised YOTO study plan.

- **Study Goals and Objectives**: we clarified YOTO Study Goals and Objectives, specifically including our goal of identifying if Project operations are impacting YOTO at various life stages
- **Extent of Study Area and Study Sites**: we included all the locations that we believe should be surveyed to determine Project effects (maps included) on YOTO and we anticipate further discussion with SCE to determine what is feasible to survey with the available staff and time
- **YOTO Surveys**
    - **Desktop Analysis**: we included further clarification on what sources should be sued for the desktop analysis and what the product should be
    - **Documentation of Reservoir Levels and Outflow**: we included an additional section that describes documenting reservoir levels and outflow measurements prior to and during YOTO surveys to help identify Project effects
    - **VES**: we provided further guidance on when and how to conduct the VES surveys; the timing of the surveys is very important to ensure documentation of all YOTO life stages
    - **Survey During Operation Changes**: we included an additional section that describes a set of YOTO surveys that are specifically timed with operation changes, specifically changes of reservoir levels or stream discharge; this will require coordination with SCE operations staff to identify when reservoir levels or stream discharge change, so we can plan surveys accordingly; we do not anticipate needing to survey during every operational change but want to be able to identify key changes in operations that could impact YOTO
    - **Operations Model**: ensuring we use the Operations Model to help determine Project effects
- **YOTO Habitat-Recreation Interaction Surveys**: we included the original language from section 6.3 of the preliminary study proposal, as we believe this language addresses recreation impacts on YOTO

Thank you and have a great weekend,
Alyssa Marquez
Environmental Scientist, Inland Deserts Region 6

California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

1.0 POTENTIAL RESOURCE ISSUE

Special-status wildlife species that could be affected by Lee Vining Hydroelectric Project (Project) Operation and Maintenance (O&M) activities include:

- Yosemite toad (*Anaxyrus canorus)*
- Riparian bird species habitat

2.0 PROJECT NEXUS AND HOW THE RESULTS WILL BE USED

Data on the wildlife species present or with a high potential to be present within areas proposed for Project O&M activities in the Federal Energy Regulatory Commission (FERC) Project Boundary are needed to appropriately determine the existing conditions associated with terrestrial biological resources. If special-status wildlife or U.S. Forest Service Species of Conservation Concern are present, the data will be examined to determine the potential effects of the Project on wildlife in the context of the most recent *Land Management Plan for the Inyo National Forest* (USFS, 2019), the federal and state Endangered Species Acts, and the National Environmental Policy Act.

3.0 STUDY GOALS AND OBJECTIVES

The goal of this study is to develop the additional information necessary to supplement the existing information to address the identified issues. The study objectives are:

General Wildlife Surveys

- Build a compendium of common; special-status; and rare, threatened, and endangered wildlife species occurring within Project areas that may be affected by proposed O&M activities.

Riparian Birds

- Identify rare, threatened, and endangered riparian birds in the area during general wildlife surveys.

Yosemite Toad

- Determine persistence of known Yosemite toad populations within the Project Area.
- Conduct focused amphibian surveys to document location, life stages and characterize habitat within the Project area
- Determine potential effects and/or interactions between dispersed recreational use and terrestrial wildlife species of interest, including the Yosemite toad.
- Identify if Project operations (e.g., reservoir levels and flow releases) are impacting Yosemite toad at various life stages
- Develop sufficient data for informal and formal consultation needs for U.S. Fish and Wildlife Service (USFWS) with respect to the Yosemite toad.

Willow Flycatcher

- Assess willow flycatcher nesting habitat downstream of the Project between Poole Powerhouse and the reservoir at the Los Angeles Department of Water and Power (LADWP) Diversion Dam using vegetation classification as the primary tool, to include review of aerial photography and ground-truthing

4.0 EXTENT OF STUDY AREA AND STUDY SITES

The terrestrial wildlife study area is shown on Figure 4-1. It is comprised of the following Southern California Edison (SCE) O&M areas, including a 200-foot buffer:

- Saddlebag Dam and associated infrastructure
- Tioga Dam and SCE access road to Tioga Dam
- Rhinedollar Dam
- Poole Powerhouse and associated facilities, including garages, storage building, and tail race

The Yosemite toad study area consists of Yosemite toad locations known in the Project Area and likely suitable habitat areas (Figure 4-2), specifically:

- The Yosemite toad Visual Encounter Surveys (VES) include:
  - **Saddlebag Lake** (see attachment 1)
    - VES perimeter of Saddlebag Lake
    - VES all inlets of Saddlebag Lake for at least 200-meters
    - VES NW inlet of Saddlebag Lake to edge of Greenstone Lake (CNDDB identified area)
    - VES SE outlet of Saddlebag Lake to coverall habitat, including the~~The~~ wet meadow southeast of Saddlebag Lake (CNDDB identified area)
    - VES entire outlet~~s~~ of Saddlebag Lake to the edge of Ellery Lake ~~(entirely to Ellery Lake)~~
  - ~~o~~ **Tioga Lake** (attachment 2 & 3)~~The California Natural Diversity Database (CNDDB) identified area at the northwest end of Saddlebag Lake~~
  - o
    - VES perimeter of Tioga Lake
    - VES all inlets of Tioga Lake for at least 200-meters
    - VES entire south inlet area to Tioga Lake, including the meadow area to the Yosemite National Park boundary and the 12 CDFW identified sites at head of the inlet meadow~~The two inlets on the southern end of Tioga Lake, it's inlets (at least 200 meters upstream)~~

- ~~and~~ VES outlet (entirety to Lee Vining Creek)
- **CDFW Comment**: CDFW requests that VES surveys for YOTO are conducted at 12 intermittent ponds south of Tioga Lake (see Attachment 2). CNDDB identifies that YOTO are often present in these ponds and it is likely *the* source population for the Tioga Lake south inlet populations (see Attachment 3); and although we know YOTO are present, it is currently unknown how frequently YOTO use these ponds, Tioga Lake's south inlets, including the Glacier Canyon inlet. In addition, as we continue to experience climate change and more consecutive years of dry conditions, the YOTO may start relying more heavily on the perennial waters of Tioga's south inlets. **Project Nexus:** The 12 intermittent ponds are hydrologically interconnected with Tioga Lake (i.e., are within the same watershed, drain to Tioga inlet and some may become one waterbody in a big snow year). In order to determine if changes in YOTO populations at Tioga Lake are a result of Project operations or from outside sources (e.g., changes in YOTO populations at the source population), we need to concurrently monitor YOTO populations, via VES surveys, at the YOTO source population.

o **Ellery Lake** (attachment 2)
  - VES perimeter of Ellery Lake
  - VES all inlets of Ellery Lake for 200-meters

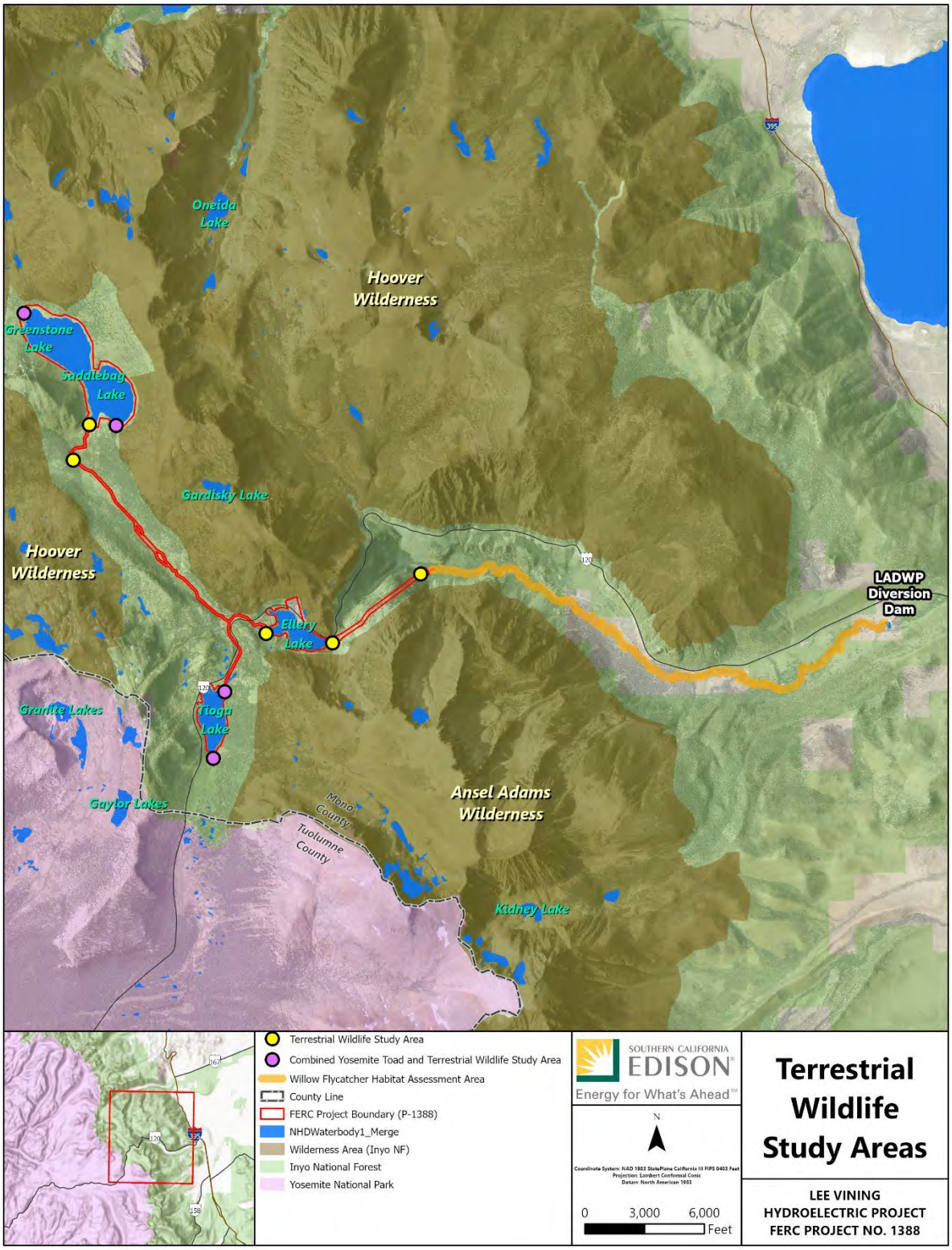
~~Additional areas of potentially suitable wet meadow habitat as determined through updated literature reviews and reviews of aerial photographs and recent aerial and infrared imagery collected for the 2021 vegetation surveys.~~

o Additional areas of potentially suitable wet meadow habitat as determined through updated literature reviews and reviews of aerial photographs and recent aerial and infrared imagery collected for the 2021 vegetation surveys.

- The Yosemite toad habitat-recreation interaction surveys include
  - Areas where Yosemite toad were identified during VES and all areas of potential impact (e.g., creek crossings)

Prior to finalizing the study area boundaries, a desktop review will be conducted to identify areas that may contain suitable habitat for special-status wildlife and may be either hydrologically influenced by proposed license activities or subject to proposed license related O&M activities. SCE will also continue discussions with agency staff (U.S. Forest Service and California Department of Fish and Wildlife) to identify any precise areas of concern for further incorporation into the study areas.

The willow flycatcher habitat assessment area consists of the portion of Lee Vining Creek downstream of Poole Powerhouse to the reservoir at the LADWP Diversion Dam (Figure 4-1).


Oneida Lake
Hoover Wilderness
Greenstone Lake
Saddlebag Lake
Garaisky Lake
Hoover Wilderness
LADWP Diversion Dam
Ellery Lake
Granite Lakes
Tioga Lake
Gaylor Lakes
Mono County
Tuolumne County
Ansel Adams Wilderness
Kidney Lake
Terrestrial Wildlife Study Area
Combined Yosemite Toad and Terrestrial Wildlife Study Area
Willow Flycatcher Habitat Assessment Area
County Line
FERC Project Boundary (P-1388)
NHDWaterbody1_Merge
Wilderness Area (Inyo NF)
Inyo National Forest
Yosemite National Park
SOUTHERN CALIFORNIA EDISON
Energy for What's Ahead
N
0 3,000 6,000
Feet
Terrestrial Wildlife Study Areas
LEE VINING HYDROELECTRIC PROJECT
FERC PROJECT NO. 1388

6.2. YOSEMITE TOAD SURVEYS

Desktop Analysis

Prior to conducting the field survey, a desktop analysis will be conducted to:

1. ~~the following sources will be reviewed to~~ identify potential expansions of the Yosemite toad study area;
2. Prepare preliminary maps of areas with known or suitable Yosemite toad breeding/rearing habitat in the study area where focused VES should be conducted;
3. Develop a Geographic Information System (GIS) map of existing and potential Yosemite toad habitat and overlay information on Project facilities and Operations and Maintenance (O&M) to identify areas of potential impact;

The following sources will be reviewed during the desktop analysis~~, per a comparison of attributes of known Yosemite toad breeding locations to potential O&M affected portions of the Project Area~~:

- Aerial and infrared imagery collected in 2021 for vegetation surveys conducted for existing license requirements. These images will be provided to the Technical Working Group with the finalized Study Proposal
    - **CDFW Comment**: please specify how these aerial and infrared images will be used
- GIS sources including the California Natural Diversity Database (CNDDB) and resourced by CDFW will be utilized to identify known Yosemite toad breeding locations
- Aerial satellite imagery to identify potential habitat areas that may be affected by O & M and season timing of availability

Documentation of Reservoir Levels and Outflow

Daily reservoir water level measurements (elevation in feet) and outflow measurements (cfs) at each lake will be recorded one month prior to and daily throughout the entire survey period (~3-4 months) to provide for analysis of Project operations on Yosemite toad populations. This data will be provided in any technical reports or progress reports.

Visual Encounter Surveys (VES)

Focused surveys for the Yosemite toad will be conducted to determine the extent of the species in the Yosemite toad study area. Yosemite toad habitat areas identified during the desktop analysis and in consultation with the Technical Working Group, will be used to further determine locations for focused surveys around each of the Project reservoirs. Two years of surveys will be conducted to sample multiple variations of annual rainfall and air temperatures. Three survey visits will be conducted each year during the Yosemite toad breeding season ~~(June 1 through September 30),~~ with each visit spaced

at least ~~3 weeks apart~~*(Preferred survey timing two weeks apart once egg masses or larvae have been detected; Example : 6/1-Recon-determine open water/survey schedule; 6/15; 6/30; 7/15), and the first visit conducted ~~approximately 1 month~~immediately after snow melt sufficient to develop breeding habitat, such as wet meadow (A reconnoiter trip/site photo by SCE or other party prior to biological survey will help determine exact survey times). Because weather and seasonal conditions vary at high altitudes, the timing of surveys will be adjusted to cover the toad's activity period, based on SCE or other party reconnoiter visit/site photos. An additional (fourth) survey visit may also be conducted pending weather conditions and observations from the preceding three visits. The surveys will include diurnal searches following the Fellers and Freel (modified by Knapp and CDFW) diurnal amphibian protocol or a similar protocol approved by the Technical Working Group to determine the presence of eggs, tadpoles, and adults. During each survey the surveyors will record the reservoir elevation or the current discharge (may need to coordinate with SCE Operations folks to acquire this data). During the surveys, areas of previously identified breeding habitat will be examined for the presence of all life-stages (eggs, tadpoles, subadults, and adults). The Biologist will visually scan all lake and stream shoreline and littoral areas and aquatic habitats and, if necessary, enter the water for further inspection. Where toads are found, the location of each population will be mapped, including taking GPS coordinates, site/area photos, and specimen photographs. Surveys will take place between 0900 and 1700 during "good" weather conditions ~~during suitable weather conditions~~ (i.e., air temperatures at least 50 degrees Fahrenheit, wind speeds not to exceed 15 miles per hour, clear or partly clear skies and not under overcast conditions, dense fog or during heavy rain). The Biologist will use the CDFW High Mountain Lakes – Amphibian and Reptile visual Encounter sheet (**Attachment 4**) or a similar datasheet approved by the Technical Working Group. Incidental sightings of Yosemite toad observed during the implementation of other technical studies will be recorded.

Survey During Operation Changes

To document the impacts of Project operations on Yosemite toad, additional reconnoiter surveys that are timed with changes in Project operations, specifically changes in reservoir elevations or changes in stream discharge, need to be conducted at known occupied sites. The goal of these surveys are to:

- Document how changes in reservoir levels or stream discharge impact Yosemite toad egg masses or the availability of Yosemite toad breeding habitat

The surveys will require close coordination with the SCE Operations team to determine when Projects operations could result in reservoir or stream discharge changes. Surveys should be conducted at sites where Yosemite toad have been identified during that years VES survey. The technical working group members will be consulted to prioritize locations for the Operational Changes Surveys.

Operations Model

Utilize the Operations model to help determine what Project operations could impact Yosemite toad at all life stages.

~~Mapped topographic contours of Tioga Lake will be reviewed to determine if and when suitable breeding habitat at the lake inlets are typically inundated by Project operations. During the surveys at Saddlebag Lake, the Biologist will record all recreational pedestrian traffic observed in areas within and adjacent to the occupied Yosemite toad habitat. The Yosemite toad surveys at Saddlebag Lake will generally be scheduled during anticipated periods of high to moderate visitation to best sample pedestrian traffic. If feasible, visual observations will be supplemented with trail cameras.~~

6.3. YOSEMITE TOAD HABITAT-RECREATION INTERACTION SURVEYS

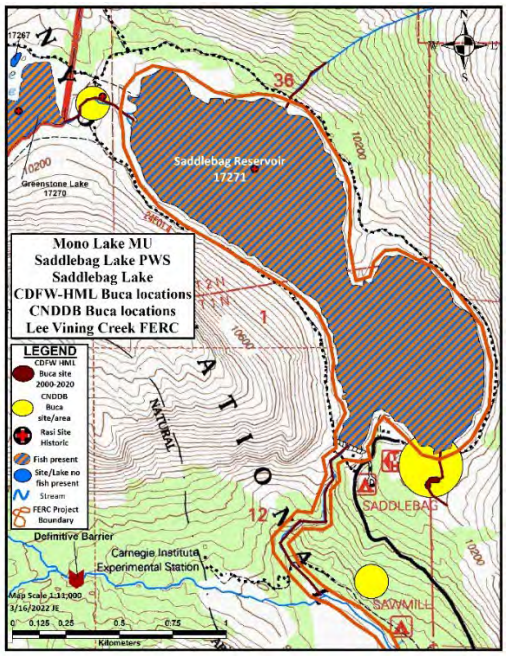
Pedestrian traffic associated with recreational use of areas (campgrounds, system trails and angler/user trails) within and adjacent to the occupied Yosemite toad habitat at Saddlebag Lake, Tioga Lake and Ellery Lake will be monitored in conjunction with the Yosemite toad surveys described in Section 6.2. Saddlebag Lake, Tioga, and Ellery Lakes water levels fluctuate throughout the recreational season as part of SCE's operations to ensure downstream water deliveries. These surveys ~~and the Yosemite toad surveys~~ (YOTO~~oto~~ surveys based on habitat and timing of breeding/hatching/metamorphosis) will be scheduled during anticipated periods of high-to-moderate visitation and different water levels. A biologist will visually track the abundance, path, and duration of recreational travel through and adjacent to the occupied habitat during both higher and lowered lake levels. The monitoring will be conducted discreetly to limit influence on the observed activity. Three 1-day monitoring visits will occur across multiple weekends coinciding with high-to-moderate visitation and the different lake levels.

- Consider impacts to YOTO when analyzing results from REC 1 – Recreation Use Assessment

CDFW Comment: CDFW recommends considering the use of trail cameras to document recreational impacts to YOTO. The trail cameras can be left out all season and could gather more data.

Attachment 1[1]

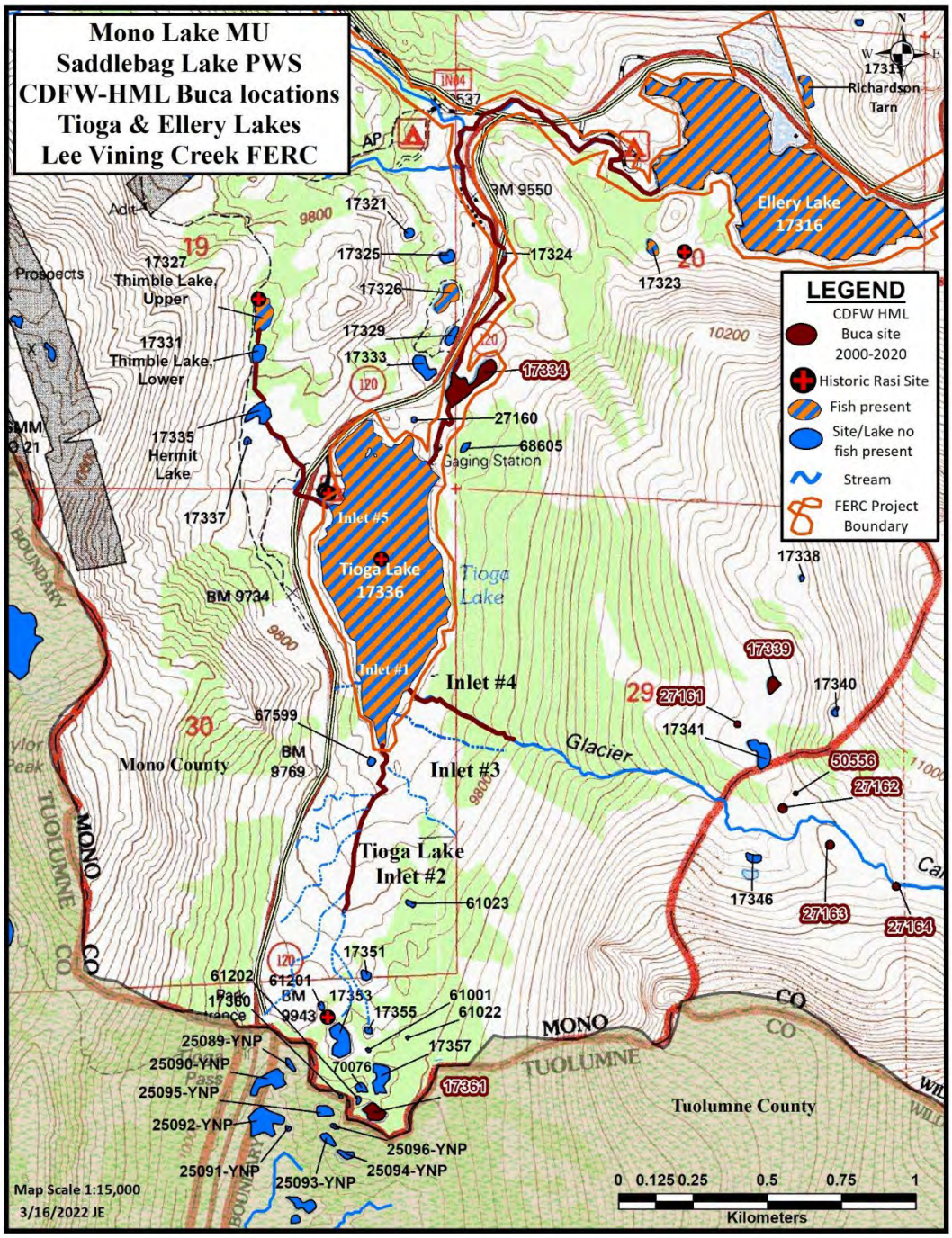
Lee Vining FERC Relicensing YOTO (*Buca*) study area at Saddlebag Lake.



[1] These layouts/maps display current CDFW Yosemite Toad presence/absence data, CNDDB Yosemite Toad presence/absence data and the Lee Vining Creek FERC relicensing project boundary area. They are intended to show current Yosemite Toad location information and "potential survey areas" that are needed to appropriately determine the existing conditions associated with terrestrial biological resources

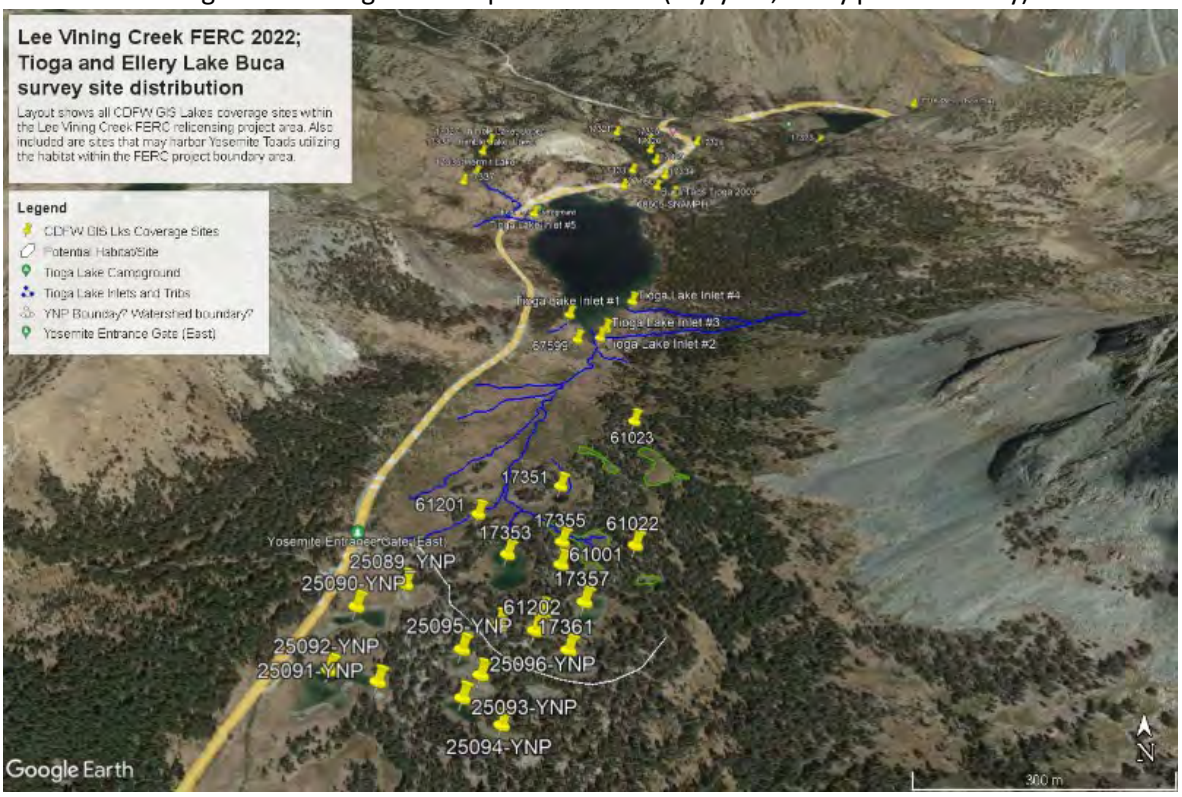
Attachment 2[2]

Lee Vining FERC Relicensing YOTO (*Buca*) study area at Tioga & Ellery Lakes

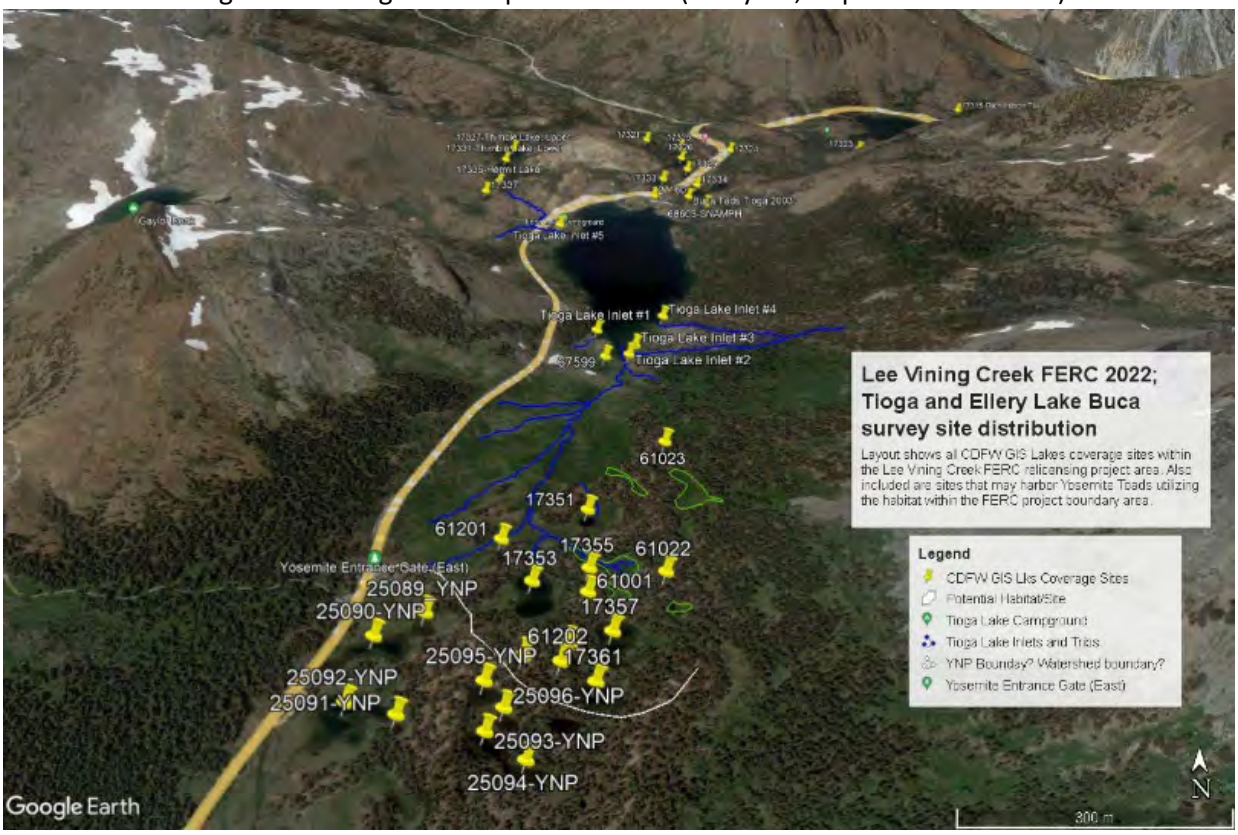


[2] These layouts/maps display current CDFW Yosemite Toad presence/absence data, CNDDB Yosemite Toad presence/absence data and the Lee Vining Creek FERC relicensing project boundary area. They are intended to show current Yosemite Toad location information and "potential survey areas" that are needed to appropriately determine the existing conditions associated with terrestrial biological resources

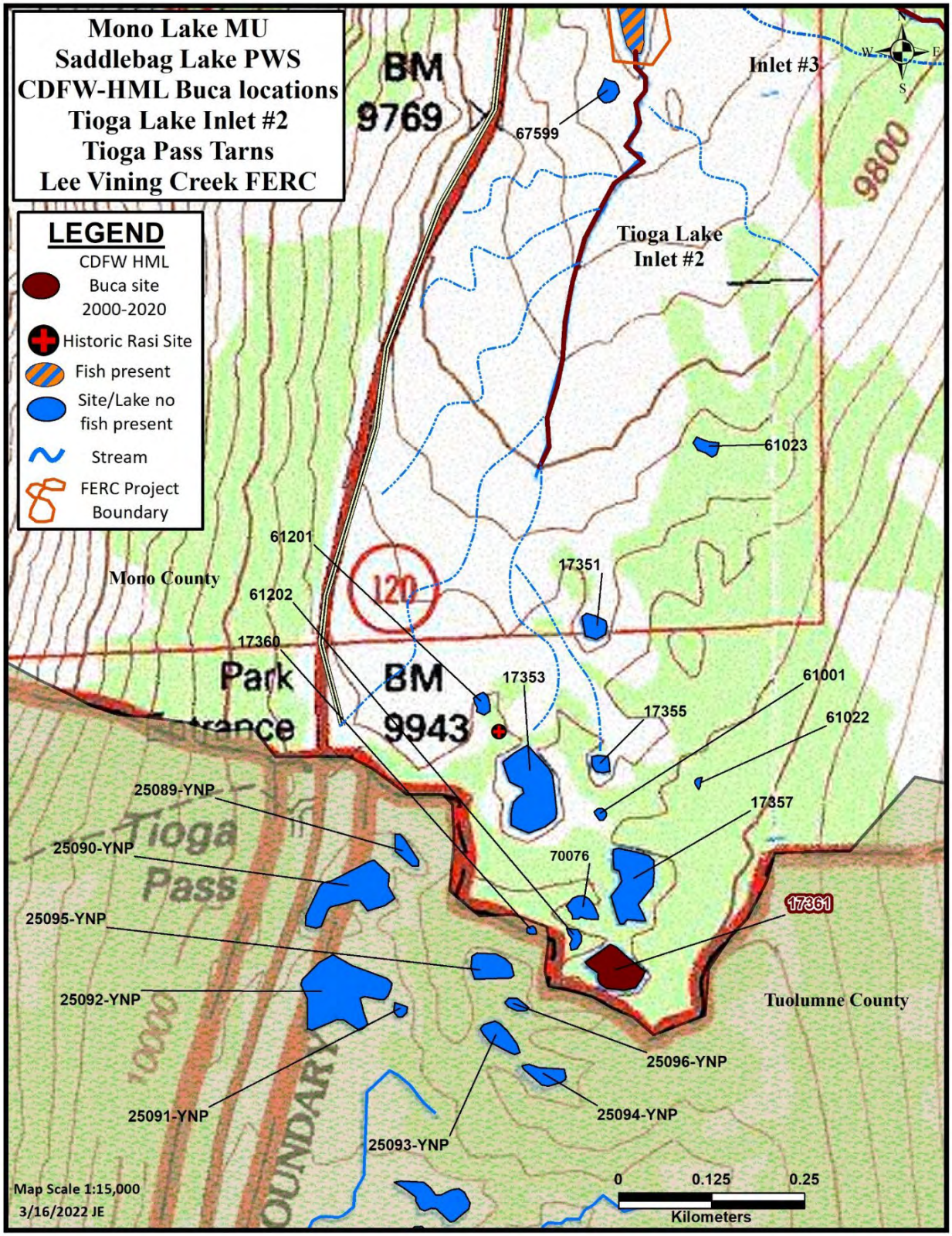
Google Earth Image from September 2013 (dry year, many ponds are dry)



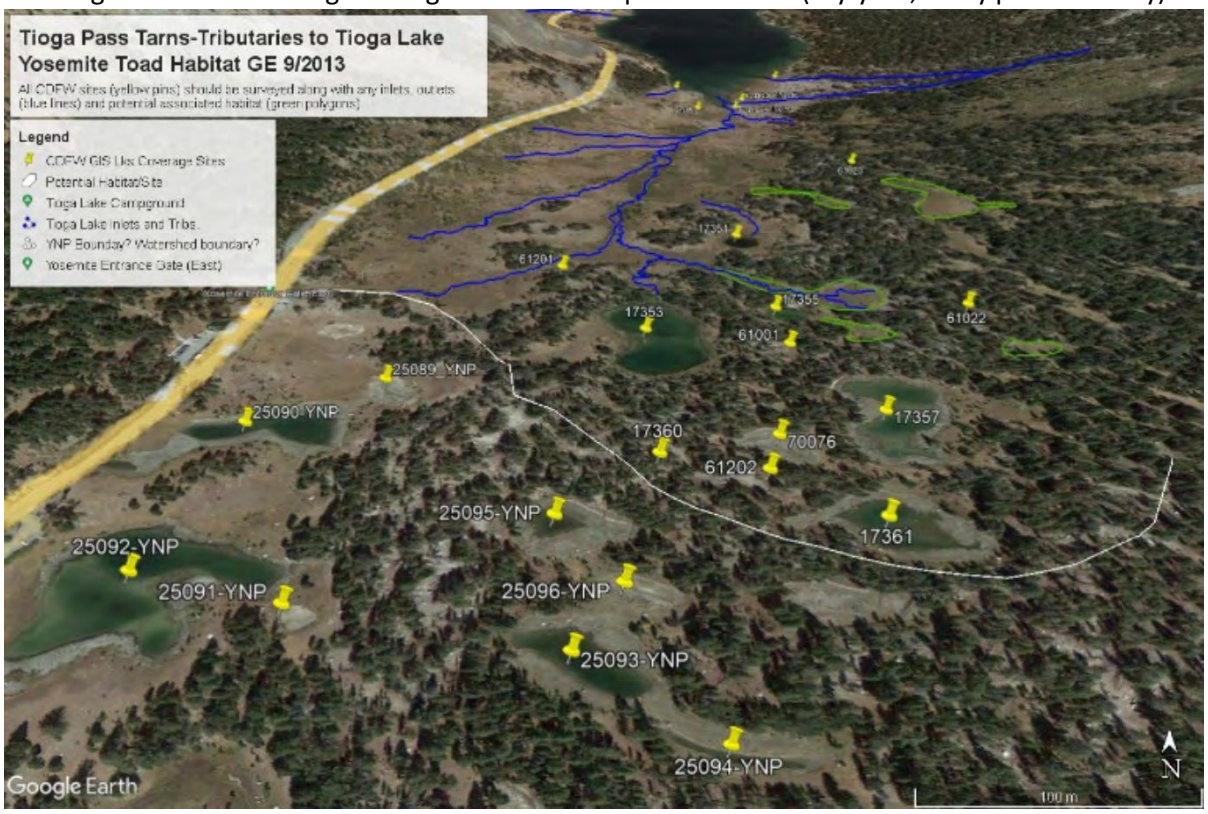
Google Earth Image from September 2019 (wet year, all ponds have water)



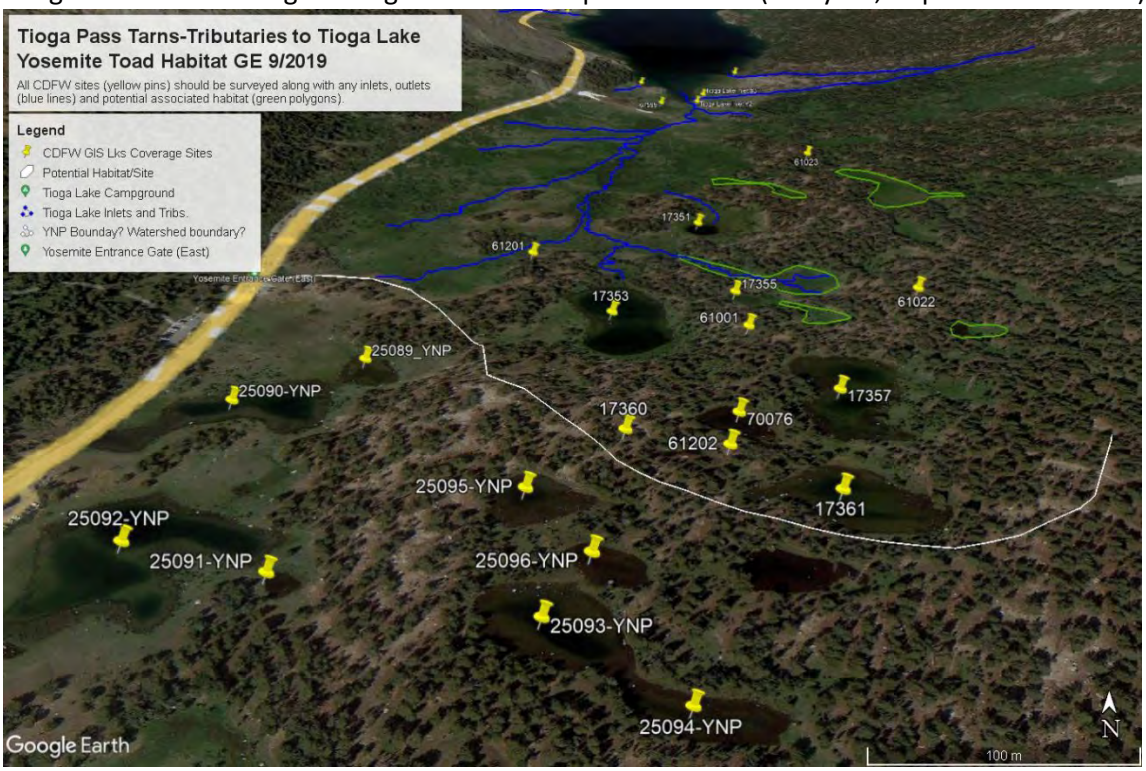
Zoom map of the 12 tarns/ponds at the head of Tioga Lake inlet #2 (Tioga Pass/Yosemite NP boundary)



Google Earth Zoom Image of Tioga Tarns from September 2013 (dry year, many ponds are dry)

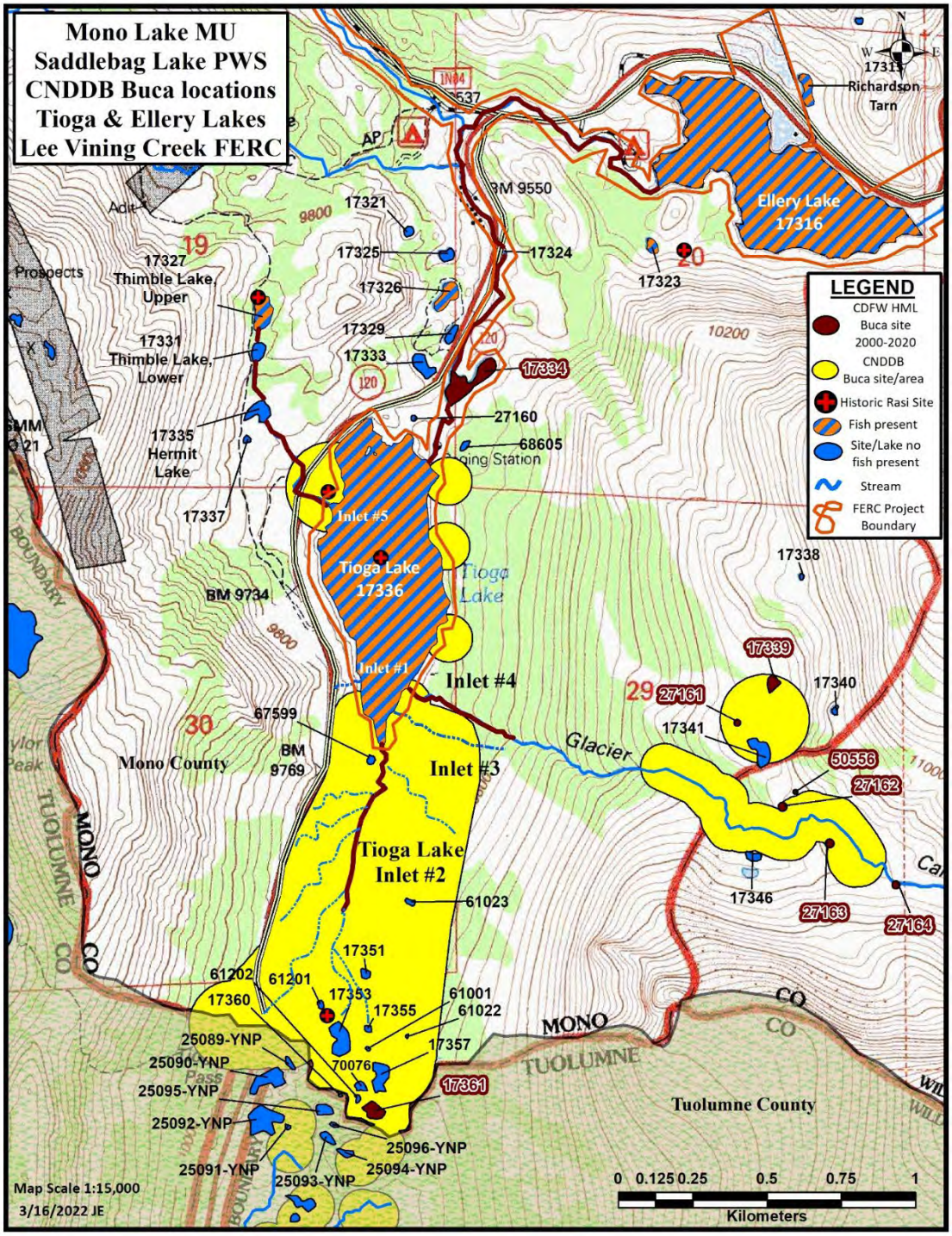


Google Earth Zoom Image of Tioga Tarns from September 2019 (wet year, all ponds have water)



Attachment 3 [3]

CNDDB GIS layout/map showing Yosemite Toad (*Buca*) locations and distribution



[3] These layouts/maps display current CDFW Yosemite Toad presence/absence data, CNDDB Yosemite Toad presence/absence data and the Lee Vining Creek FERC relicensing project boundary area. They are intended to show current Yosemite Toad location information and "potential survey areas" that are needed to appropriately determine the existing conditions associated with terrestrial biological resources

Attachment 4

CDFW High Mountain Lakes - Amphibian and Reptile Visual Encounter Survey Data Sheet

Site ID:	Date:	SKY: Clear / Partly Cloudy / Mostly Cloudy / Over-cast / Rain / Snow / Smoke	WIND: Calm / Light / Moderate / Strong
Topo Name: (1:24,000)	County:	Elevation: m ft	If not surveyed, provide reason: Private Property / Frozen / Not Found / No Access
Surveyors:		Water Type: Lake / Unmapped pond / Marsh/ meadow / Spring seep	Stream (Skip to "STREAMS" on pg. 2)
Lake Name: (from map)	East UTM:	North UTM:	UTM Zone:
Color: Clear / Stained Turbidity: Clear / Cloudy	Water (.5 m from shore, Temp 10cm deep): @ C or F	Air (1 m above Temp water): @ C or F	Seasonality: Perennial / Ephemeral Currently Dry? Yes / No
Survey START time:	Survey END time:	Total survey duration (min):	HERPS SEEN? YES / NO FISH SEEN? YES / NO

*FOR LAKES/PONDS/MEADOWS: ALSO SURVEY FIRST 200 m OF INLETS AND OUTLETS. RECORD DATA SEPARATELY IN THE "STREAMS" SECTION ON PG. 2

HERP SPECIES	# adults	# subadults	# metamorphs	# larvae	# egg m.	#swabs	Survey Method
Calling? Y N							Visual Trapped / Aural Hand Collected / Amp Net Incidental
Calling? Y N							Visual Trapped / Aural Hand Collected / Amp Net Incidental
Calling? Y N							Visual Trapped / Aural Hand Collected / Amp Net Incidental
Calling? Y N							Visual Trapped / Aural Hand Collected / Amp Net Incidental
Calling? Y N							Visual Trapped / Aural Hand Collected / Amp Net Incidental

FISH SPECIES (circle species seen, if known): **BK** (brook trout), **BN** (brown trout), **CT** (cutthroat trout), **GT** (golden trout), **RT** (rainbow trout) **HYBRID** (e.g., GT x RT), **OTHER** (e.g., minnows)

Amphibians: S. Long-toed Salamander (**AMMA**); Yosemite Toad (**ANCA**, frmly BUCA); Sierran Treefrog (**HYSI**, frmly PSRE or HYRE); Sierra Nevada Yellow-legged Frog (**RASI**)
Amph. less common in HML: CA Toad (**ANBO**, frmly BUBO); Bullfrog (**RACT**); Cascades Frog (**RACA**); CA Red-legged Frog (**RADR**); Sierra Newt (**TASI**, frmly TATO)
Reptiles: Sierra Gartersnake (**THCO**); Mountain Gartersnake (**THEL**); Valley Gartersnake (**THSI**); Western Pond Turtle (**EMMA**, frmly CLMA)

PHOTOS	Photo Number	Camera	Time	Date (yyyy/mm/dd)	UTM E	UTM N	Comments
Overview							
Herps							
Other							

SITE SKETCH:

NOTES:

PLEASE Return to: Isaac Chellman, California Department of Fish and Wildlife, (916) 358-4038; 1701 Nimbus Rd., Rancho Cordova, CA 95670

Field review_____ Copied_____ Entered_____ Proofed_____

STREAM

Inlet Outlet (circle one) #_____	**Stream Type:** Perennial Ephemeral			**Stream Currently Dry?** Y N			**Intermittent?** Y N		
Start UTM E:	UTM N:	**End** UTM E:	UTM N:				**Color:** Clear Stained NA		
							Turbidity: Clear Cloudy NA		
Start Time:	**End Time:**	**Duration (min):**	**Water Temp:**	**Air Temp:**			***BARRIERS (fill out info below)***		
Fish present? Y N	**Barrier 1)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Herps present? Y N	**Barrier 2)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Spawning evidence? Spawning / Redds / Fry / None	**Barrier 3)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						

Inlet Outlet (circle one) #_____	**Stream Type:** Perennial Ephemeral			**Stream Currently Dry?** Y N			**Intermittent?** Y N		
Start UTM E:	UTM N:	**End** UTM E:	UTM N:				**Color:** Clear Stained NA		
							Turbidity: Clear Cloudy NA		
Start Time:	**End Time:**	**Duration (min):**	**Water Temp:**	**Air Temp:**			***BARRIERS (fill out info below)***		
Fish present? Y N	**Barrier 1)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Herps present? Y N	**Barrier 2)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Spawning evidence? Spawning / Redds / Fry / None	**Barrier 3)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						

Inlet Outlet (circle one) #_____	**Stream Type:** Perennial Ephemeral			**Stream Currently Dry?** Y N			**Intermittent?** Y N		
Start UTM E:	UTM N:	**End** UTM E:	UTM N:				**Color:** Clear Stained NA		
							Turbidity: Clear Cloudy NA		
Start Time:	**End Time:**	**Duration (min):**	**Water Temp:**	**Air Temp:**			***BARRIERS (fill out info below)***		
Fish present? Y N	**Barrier 1)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Herps present? Y N	**Barrier 2)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Spawning evidence? Spawning / Redds / Fry / None	**Barrier 3)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						

Inlet Outlet (circle one) #_____	**Stream Type:** Perennial Ephemeral			**Stream Currently Dry?** Y N			**Intermittent?** Y N		
Start UTM E:	UTM N:	**End** UTM E:	UTM N:				**Color:** Clear Stained NA		
							Turbidity: Clear Cloudy NA		
Start Time:	**End Time:**	**Duration (min):**	**Water Temp:**	**Air Temp:**			***BARRIERS (fill out info below)***		
Fish present? Y N	**Barrier 1)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Herps present? Y N	**Barrier 2)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						
Spawning evidence? Spawning / Redds / Fry / None	**Barrier 3)** Photo #'s:		**UTM E:**		**UTM N:**				
			Description:						

HERP SPECIES	**In/Outlet #**	**# adults**	**#subadults**	**#metamorphs**	**larvae**	**# egg m.**	**#swabs**	**Survey Method**
	(circle one) #							Visual Trapped
	IN							Aural Hand Collected
Calling? Y N	OUT							Amp Net Incidental
	(circle one) #							Visual Trapped
	IN							Aural Hand Collected
Calling? Y N	OUT							Amp Net Incidental
	(circle one) #							Visual Trapped
	IN							Aural Hand Collected
Calling? Y N	OUT							Amp Net Incidental
	(circle one) #							Visual Trapped
	IN							Aural Hand Collected
Calling? Y N	OUT							Amp Net Incidental
	(circle one) #							Visual Trapped
	IN							Aural Hand Collected
Calling? Y N	OUT							Amp Net Incidental

FISH SPECIES (circle species seen, if known): **BK** (brook trout), **BN** (brown trout), **CT** (cutthroat trout), **GT** (golden trout), **RT** (rainbow trout) **HYBRID** (e.g., GT x RT), **OTHER** (e.g., minnows)

Amphibians: S. Long-toed Salamander (**AMMA**); Yosemite Toad (**ANCA**, frmly BUCA); Sierran Treefrog (**HYSI**, frmly PSRE or HYRE); Sierra Nevada Yellow-legged Frog (**RASI**)

Amph. less common in HML: CA Toad (**ANBO**, frmly BUBO); Bullfrog (**RACT**); Cascades Frog (**RACA**); CA Red-legged Frog (**RADR**); Sierra Newt (**TASI**, frmly TATO)

Reptiles: Sierra Gartersnake (**THCO**); Mountain Gartersnake (**THEL**); Valley Gartersnake (**THSI**); Western Pond Turtle (**EMMA**, frmly CLMA)

PLEASE Return to: Isaac Chellman, California Department of Fish and Wildlife, (916) 358-4038; 1701 Nimbus Rd., Rancho Cordova, CA 95670

Field review_____ Copied_____ Entered_____ Proofed_____

From:	Carissa Shoemaker
To:	Marquez, Alyssa@Wildlife
Cc:	Erdman, James@Wildlife; Moyer, Patricia (Trisha)@Wildlife; Wood, Brandy@Wildlife; Matthew Woodhall; finlay.anderson@kleinschmidtgroup.com; Steve Norton; Shannon.Luoma@KleinschmidtGroup.com
Subject:	RE: Lee Vining Revised Study Plans - Yosemite Toad
Date:	Friday, March 18, 2022 10:10:00 PM

Thank you for this, Alyssa.

See you on the 28th.

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Friday, March 18, 2022 3:36 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>; Wood, Brandy@Wildlife <Brandy.Wood@Wildlife.ca.gov>; Matthew Woodhall <Matthew.Woodhall@sce.com>; finlay.anderson@kleinschmidtgroup.com; Steve Norton <steve.norton@psomas.com>
Subject: Lee Vining Revised Study Plans - Yosemite Toad

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Carissa,

Jim Erdman and I have reviewed the TERR-2 Study proposal for the sections pertaining to Yosemite Toad (YOTO) and we have made several changes that we have document in track changes (see attached). Can you please forward this document to anybody else who should have a copy? Jim and I will both be participating in the March 28th Revised Study Plan meeting and will be available to discuss the proposed changes. If we need more time outside of the scheduled Revised Study Plan Meeting to discuss, we can be available for a follow-up meeting with SCE and other interested TWG members. Below is a summary of our changes to the revised YOTO study plan.

- **Study Goals and Objectives**: we clarified YOTO Study Goals and Objectives, specifically including our goal of identifying if Project operations are impacting YOTO at various life stages
- **Extent of Study Area and Study Sites**: we included all the locations that we believe should be surveyed to determine Project effects (maps included) on YOTO and we anticipate further discussion with SCE to determine what is feasible to survey with the available staff and time
- **YOTO Surveys**
    - **Desktop Analysis**: we included further clarification on what sources should be sued for

the desktop analysis and what the product should be
    - **Documentation of Reservoir Levels and Outflow**: we included an additional section that describes documenting reservoir levels and outflow measurements prior to and during YOTO surveys to help identify Project effects
    - **VES**: we provided further guidance on when and how to conduct the VES surveys; the timing of the surveys is very important to ensure documentation of all YOTO life stages
    - **Survey During Operation Changes**: we included an additional section that describes a set of YOTO surveys that are specifically timed with operation changes, specifically changes of reservoir levels or stream discharge; this will require coordination with SCE operations staff to identify when reservoir levels or stream discharge change, so we can plan surveys accordingly; we do not anticipate needing to survey during every operational change but want to be able to identify key changes in operations that could impact YOTO
    - **Operations Model**: ensuring we use the Operations Model to help determine Project effects
- **YOTO Habitat-Recreation Interaction Surveys**: we included the original language from section 6.3 of the preliminary study proposal, as we believe this language addresses recreation impacts on YOTO

Thank you and have a great weekend,

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

Carissa Shoemaker

Subject: Lee Vining Wildlife Study Plan Discussions

Start: Thu 3/24/2022 3:30 PM
End: Thu 3/24/2022 4:30 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Tentatively accepted

Organizer: Steve Norton
Required Attendees: James.Erdman@wildlife.ca.gov; alyssa.marquez@wildlife.ca.gov; shannon.luoma@kleinschmidtgroup.com; Brad Blood; finlay.anderson@kleinschmidtgroup.com
Optional Attendees: Carissa.Shoemaker@erm.com; Jonathan Aguayo

Categories: Meeting/Training

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Jim and Alyssa,
Thanks again for being open to meeting!

I added a couple of Kleinschmidt staff to the invite who might join if they are available.

Let me know if any timing conflicts come up.
Talk to you Thursday!
-Steve

Microsoft Teams meeting

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Lee Vining FERC Hydroelectric Relicensing Revised Study Proposal Comments

FERC Project No. 1388

March 25, 2022

Below are CDFW's comments on the Revised Technical Study Plan. The associated study plan, subsection and page are included for reference.

WQ-1 Stream and Reservoir Water Quality

4.3 Fish Tissue Mercury Sampling Sites (Page 20)

> **CDFW Comment**: Mercury sampling should focus on brown trout or brook trout. More than 95% of rainbow trout captured in the Eastern Sierra are planted from CDFW hatcheries.

5.0 Existing Information

…..Although hypolimnetic and outlet stream ammonium and orthophosphate were occasionally elevated in late summer and spring, which correlated with prolonged reservoir stratification and reduced Do.

> **CDFW Comment**: This could potentially impact the noxious invasive algae Didymo in stream reaches downstream. The impact of reservoir stratification and nutrient concentration on Didymo should be investigated. CDFW suggests monitoring either hypolimnetic nutrients or discharge in reaches above Didymo populations.

6.1.5 Fish Tissue Sampling (Page 24)

Fish sample collection will occur by boat using gill netting and electrofishing during Study AQ-1 Reservoir Fish Population fieldwork, at the sites specified in Section 4.3 above. Target species include all expected to be present in Project reservoirs, which include brown trout (Salmo trutta), rainbow trout (Oncorhynchus mykiss), and brook trout (Salvelinus fontinalis).

> **CDFW Comment**: Rainbow trout are hatchery-origin and could potentially be excluded in favor of increased wild fish sampling.

AQ-1 Reservoir Fish Population

6.1 Reservoir Fish Surveys (Page 36)

Procedures may include, but not be limited to, freezing or soaking with a commercial 409 cleaner all field gear (including waders, boots, wetsuits) to kill New Zealand mud snail, spraying equipment with a bleach and water solution to prevent spread of

quagga/zebra mussel, and inspecting all field equipment (including boats) after each use.

CDFW Comment: This will be conditioned in your Scientific Collecting Permit

At each sample location, scale samples will be collected from up to 20 fish of each game species (e.g., trout) across a variety of sizes at a variety of locations to assess age and growth relationships.

CDFW Comment: Otoliths should be pulled from gill-netted fish. Scales are not accurate in high elevation lakes

6.1.1 Gill Nets (Page 36)

One variable-mesh "adult" gill net (1- to 4-inch mesh, 80 to 125 feet long) and one variable-mesh "juvenile" gill net (less than 1-inch mesh, 30 feet long) will be deployed at each of three locations within each reservoir, occupying nearshore and deepwater habitats.

CDFW Comment: CDFW recommends the 125-foot gill net.

6.2 Analysis (Page 37)

Length-frequency histograms will be developed for each trout species observed or captured and used to estimate size and age-class distribution. Breaks and modalities within the histograms will be evaluated and compared to the subsample of aged scales…

CDFW comment: CDFW recommends that otoliths instead of scales are used

AQ-2 Stream Fish Population

Table 5-1. Average Abundance, Density, and Biomass Estimates for Naturally Reproducing Trout (Brown and Brook) in Lee Vining Creek Between Saddlebag Dam and the Confluence of Slate Creek, 1999–2016 (Page 44)

CDFW Comment: Brown and brook trout should be separated. There are some notable ecological differences.

AQ-3 Aquatic Habitat Mapping and Sediment Characterization

CDFW Comment: To protect wildlife resources and inform future licensing conditions, it is necessary to understand the habitat-flow relationship in the FERC Project area; however, AQ-3 does not propose to conduct surveys to document the current flow-habitat relationship within the Project area. AQ-3 is currently designed with the view that the limiting factor for trout is available spawning habitat, but CDFW does not agree with this viewpoint and believes an instream flow study is necessary to inform decision making. Additionally, the determination

of available spawning habitat should be supported by a proportional stock distribution analysis.

An instream flow analysis for brook and brown trout was conducted in 1992, but these data need to be updated and should not be the sole habitat-flow data utilized to inform license conditions 30 years later. Due to the underlying glacial geology and the steep gradient of the Lee Vining Creek system with the Project area, an Instream Flow Incremental Methodology (IFIM) may not be the best method to use. CDFW recommends using a Habitat Criteria Mapping Method or MesoHABSIM. The Demonstration Flow Analysis method uses direct observation of river habitat conditions at several flows and expert judgement to rank the alternative flows (Railsback et al. 2007[1]). This method has the benefit of being cheaper than a full IFIM or Physical Habitat Simulation System (PHABSIM) type study and it allows Technical Working Group (TWG) members to see the river at multiple flows. The downside is that we can't see the river at every flow. The MesoHABSIM is adapted for high-gradient streams and the procedure defines the habitat description, the biological model definition and the development of habitat rating curves and time series analysis (Vezza et al. 2014[2]).

3.0 Study Goals and Objectives (Page 53)

…..(2) characterizing spawnable gravel patches (i.e., coarse sediment) within Project affected stream reaches, and (3) determining potential habitat-related limiting factors for the trout population

CDFW Comment: Spawning limitation can be determined by stock distribution as well. It is unlikely that gravels are limiting.

5.0 Existing Information (Page 53)

CDFW Comment: IFIM is not an appropriate method for high gradient systems. We recommend that the habitat rating curves be revalidated using Habitat Criteria Mapping or mesoHabSIM.

The studies indicated that Lee Vining Creek between Saddlebag Dam and the confluence of Slate Creek is dominated by moderate-gradient riffles; …….(Page 54)

CDFW Comment: Are these riffles incising? What is the substrate in these riffles?

Table 6-1. Habitat Types Adapted from McCain et al. (1990), Armantrout (1998), Payne (1992), McMahon et al. (1996), and Hawkins et al. (1993) (Page 56)

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[1] Railsback, S. F., J. Kadvany, and W. J. Trusch (2007) Demonstration Flow Assessment: Procedures for Direct Observation Instream Flow Studies. *Environmental Science*.

[2] Vezza, P., P. Parasiewicz, M. Spairani, and C. Comoglio. 2014. Habitat Modeling in High-Gradient Streams: The Mesoscale Approach And Application

CDFW Comment: This is a good 'stage 0' survey, and should be considered the bare minimum

6.2 Spawning Gravel Mapping (Page 58)

CDFW Comment: CDFW does not believe that spawning is limiting based on length-frequency distribution.

AQ-4 Invasive Aquatic Plants

6.1 Survey Methods (Page 66)

Voucher specimens will be collected to confirm identification of any species not identifiable in the field.

CDFW Comment: All anecdotal observations of Didymo should be recorded as well. This method is appropriate for a course survey, but in this case a more targeted method is appropriate.

AQ-5 Operations Model

CDFW Comment: The operations model should be capable of releasing different bypass flows in different months and different water year types. The February 2022 Revised Study Plan states that: *A current set of rules describing how these constraints are incorporated for high, low, and mean water years will form the basic architecture for flow routing decisions produced by the Model.* In order to have flexibility for making various flow recommendations that will both benefit the aquatic ecosystems as well as be practical for the Project, we recommend that the water year types bins be a variable input for which year type breakdowns can be adjusted after review of the hydrology and consideration of various bypass release requirements. For example – it may be necessary later to include a critically dry year type instead of just "high, low, and mean." The model should be built with flexibility to adjust those year type bins as well as including at least four-year types.

The model should additionally be constructed to allow for release of different bypass flows in different months. To prepare the model with as much flexibility as possible, we recommend building the model with at least monthly variation in bypass flow requirements for each release node.

Along with the operations modeling, unimpaired hydrology should be developed at multiple points in the system. Unimpaired hydrology is used when considering the results of other resource studies and aquatic populations in the watershed. Unimpaired hydrology will be used to compare to historic operations as well as proposed operational scenarios when developing resource management measures.

The operations model should include a module or post processing tool that allows all relicensing participants and FERC to understand clearly the financial impact (both gross generation and revenue) of new bypass requirements, ramping rate changes, pulse flow requirements on project finances. In future discussions of protection, mitigation and enhancement (PM&E) measures, all relicensing participants should have the ability to understand how any proposed PM&E measures are balanced with project generation impacts. Without this tool, SCE can say "yes" or "no" to PM&E measures, but FERC and RPs have no ability to understand why those decisions were made and where there is negotiating space and potential tradeoffs to be made around each of those potential measures.

AQ-6 Lower Lee Vining Creek Channel Morphology

6.2 Responsive Study Site Characterization

Mapping of all alluvial sediment deposits within the bankfull channel boundaries (mapping may also occur on low-lying floodplains where applicable). (Page 84)

CDFW Comment: This should also include any colluvial deposits that are in the channel as well. A lot of sediment loading in the Sierra can be episodic.

Bulk sampling of alluvial sediment deposits. A minimum of three samples will be collected at each study site. Samples will be sieved in the field at 1/2 Φ_1 class intervals (i.e., 16, 22, 32, 45, 64, 90, 128 mm), down to 11 mm, and the fraction smaller than 11 mm will undergo laboratory particle-size analysis (Bunte and Abt, 2001). (Page 85)

CDFW Comment: Don't just focus on alluvial sediment, colluvial material can be important in these systems as well

6.3 Calculation of Bed Mobility and Sediment Transport

*All marked rocks will be resurveyed at least once. Results of these observations will be used to calibrate τ*r at each study site (Page 86)*

CDFW Comment: CDFW recommends inserting pit tags into the rocks rather than painting them- painted rocks can be buried and lost in large flow events, but PIT tags can be remotely detected.

The sediment transport equation of Parker (1990) is based on field data from Oak Creek, Oregon, regarded as one of the best sediment transport data sets available for gravel-bedded rivers . (Page 86)

CDFW Comment: Consider using an alternative sediment transport model. The proposed model was developed on gravel-bedded rivers with different dynamics

TERR-1 General Botanical Resources Survey

1.0 Potential Resource Issues (Page 93)

> **CDFW Comment:** Loss or degradation of riparian vegetation is also a potential resource issue.

5.0 Existing Information

Information on vegetation communities data, including riparian conditions monitored as part of the current license, is provided by the previously conducted field surveys and license-required monitoring studies (Psomas, 2010, 2013; Read, 2012, 2017).(Page 98)

> **CDFW Comment:** The riparian community data should be analyzed in greater detail. At the least this should include a list of all species, guild-specific diversity, species evenness and a similarity analysis (e.g. perMANOVA or ANOSIM) to test for differences over the course of the license. An indicator species analysis should be performed on any reaches where a significant shift occurred.

> **CDFW Comment:** All botanical reports for the Lee Vining Creek FERC Project should be made available for download on the relicensing website.

6.0 Study Approach (Page 98)

> **CDFW Comment:** CDFW recommends including the development of a GIS map that includes the vegetation alliances overlayed with information on Project facilities, Project-affected stream reaches and Project reservoirs.

> **CDFW Comment:** CDFW recommends that an overview of the life history requirements of the dominant woody riparian species and associated riparian vegetation processes along stream corridors similar to Lee Vining Creek is included. This includes seed initiation (e.g., dispersal, germination, and initial seed/root growth); microsite characteristics necessary for germination (e.g., water table depth, substrate); establishment (survival and growth until maturity); and maturation (e.g., age of maturity, rooting depth, and tree height).

> **CDFW Comment:** We need to be able to characterize the relationship between the riparian vegetation and flow conditions. We need to understand how frequently the riparian species across the floodplain are becoming inundated in the current flow regime, and what the depth and the width of inundation is. The CDFW proposed instream flow study (see AQ-3 comments) should be associated with riparian vegetation surveys to understand the stage-discharge relationship.

> **CDFW Comment:** Historical, existing, proposed and unimpaired hydrology should be used to analyze recession rates in spring/early summer when riparian seeds are releasing and germinating. We also need to be able to assess how the

flood recurrence intervals and timing impact riparian vegetation during the different hydrologic situations.

6.1.3 Desktop Characterization

A desktop characterization study will be performed on selected portion(s) of the riparian corridor using historic aerial imagery and infrared imagery flown as part of the previous license requirements. (Page 99)

CDFW Comment*:* How will these portions of the riparian corridor be selected? To the extent possible they should incorporate areas where instream flow and or habitat mapping occurs.

The aerial imagery will be used to map riparian community extent and a Normalized Difference Vegetation Index (NDVI) will be obtained from the existing infrared photography. (Page 99)

CDFW Comment: The methods for conducting the NDVI analysis need to be specified here. SCE should ensure that the images they plan to use for this analysis have the correct bands to perform the analysis.

Due to issues with the resolution of earlier infrared imagery, only infrared imagery from 2016 and 2021 will be analyzed; this provides information on the riparian corridor before and after hydro-resource optimization. (Page 99)

CDFW Comment: Please clarify hydro-resource optimization

CDFW Comment: Has SCE looked into acquiring infrared imagery from other sources? There are several free sources where satellite Imagery can be downloaded from but the resolution may not be sufficient (e.g., USGS Earth Explorer, Sentinel Open Access Hub, NASA Earthdata Search, NOAA Data Access Viewer).

6.3 Reporting (Page 102)

Draft Results will be prepared documenting:

- *Any Relevant information collected during site visits*

CDFW Comment: What will this entail? At the least this should include a list of all species, guild-specific diversity, species evenness and a similarity analysis (e.g. perMANOVA or ANOSIM) to test for differences over the course of the license. An indicator species analysis should be performed on any reaches where a significant shift occurred.

TERR-2 General Wildlife Resources Survey

6.3 Willow Flycatcher Habitat Assessment (Page 126)

CDFW Comment: What protocol will be used for this survey?

REC-1 Recreation Use Assessment

4.0 Extent of Study Area and Study sites

Table 4-1 Study Sites (Page 138)

> **CDFW Comment:** Ellery and Tioga day use area should be included as Creel locations.

6.2 Creel Surveys (2023)

For each study site, sampling days and times will be randomly generated to provide a representative sample of weekday, non-peak weekend, and peak weekend days as well as morning and afternoon/evening use. (Page 143)

> **CDFW Comment:** Random sampling dates should be stratified into weekend/weekday/holiday blocks. The current proposed sampling effort is too low. A minimum of 10 days/month should be sampled, although this varies based on use.

Table 4-1. Studies or Study Elements not Adopted

Proposed Study Topic	Entity and Date	Basis for Request	SCE Response	CDFW Comment (3/25/2022)
Peak Flow Study	Mono Lake Committee (2/22/2021)	LADWP diverts water below the Project; A 2013 Settlement Agreement between the LADWP and the SWRCB implementing a court ordered restoration effort clarifies the use of the natural hydrograph downstream of the LADWP diversion to restore functional and self-sustaining stream systems with healthy riparian ecosystem components. This study is intended to determine if Project operations and facilities are able to deliver peak flows that may aid in restoration of habitat.	SCE notes that it is not party to the agreement referenced by the Mono Lake Committee; however, the Operations Model that is being developed to look at Project hydrology and operations constraints should provide Stakeholders with information about the potential for the Project to provide peak flows. SCE has not adopted this as a study objective because there is no Project nexus between SCE operations and settlement Parties' ability to meet settlement agreement commitments downstream of the Project.	**Downstream water right constraints should be considered as boundary condition for the Operations model (e.g., Chandler decree in Bishop Creek)**
Non-point source contamination of Project waters at road pull-outs	February 25 Recreation TWG Meeting	Potential for non-point source from increased vehicle pull-outs around Project waters, specially from dirt areas around Saddlebag Lake at the Ellery pull-out and north end of Tioga Lake.	The California Department of Transportation owns and manages those pull-outs, which are outside of the FERC Project Boundary. SCE does not see a Project nexus as the bulk of this traffic and use is incidental to vehicles transiting to nearby Yosemite National Park.	**Are people accessing the Project reservoirs from these locations? If so, the Project is probably creating a recreation nuisance and there is a nexus.**
Riparian Monitoring and Community Health	California Department of Fish and Wildlife request	CDFW suggested that questions about riparian community assemblages might be appropriate and could be similar to those conducted at Bishop Creek	Sufficient data exists from ongoing Riparian Monitoring Evaluations conducted as part of the existing license—the most recent evaluation is being conducted during the summer of 2021. With regard to Bishop Creek, black cottonwood (Populus trichocarpa) is not present in Lee Vining Canyon and there are no data to suggest any impairment of riparian conditions	

Table 8.1 Consultation Summary - Response to comments (WQ-1 Stream and Reservoir Water Quality) (Page 26)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**
2	USFS	2/25/2021 Aquatic TWG	USFS suggested Licensee consider measurements of e. coli rather than fecal coliform if there isa nexus with the Project.	No recreation facilities are included in the Project license; therefore, bacteria monitoring was not included in the Study Plan due to lack of nexus	**Project includes reservoirs and concentrates recreations. Impacts from the public accessing Project recreation areas from roadside pullouts would have nexus to Project operations.**
8	USFS	1/14/2022 PAD Comment Period	Study should evaluate how much sediment Poole Powerhouse Road contributes to Lee Vining Creek. Use of this road past Big Bend CG is mainly by SCE. There is a clear nexus between use of this road by SCE and potential sediment	Poole Powerhouse Road is maintained by Mono County and is not a Project road; therefore, no nexus exists. However, WQ-1 will include continuous turbidity monitoring downstream of Poole Powerhouse	**Does the Project increase traffic along the road? Turbidity will only be a proxy for suspended sediment load and does not account for bedload. CDFW recommends a bed load**

			contribution to Lee Vining Creek		**mobilization study**

Table 8.1 Consultation Summary -Response to Comments (Page 39) (AQ-1 Reservoir Fish Population)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**
3	CDFW	5/24/2021	CDFW asked whether an otolith analysis would be included	This study includes scale analysis rather than otoliths, to approximate age of fish collected	**Scales are not accurate in high Sierra trout. We can provide supporting studies if needed**
6	CDFW	1/14/2022 PAD Comment Period	Fisheries monitoring should be focused on documenting the need for stocking and evaluating angler use	…… Additionally, the Licensee releases water that enhances angling opportunities	**This sentence doesn't make sense. The Project does not increase the amount of water**

				throughout the Project area.	**in the creeks, it actually removes it.**

Table 8.1 Consultation Summary -Response to Comments (Page 49) (AQ-2 Stream Fish Population)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**
3	CDFW	1/14/2022 Comments on Initial Study Request	Fisheries monitoring should be focused on documenting the need for stocking and evaluating angler use	……..Additionally, the Licensee releases water that enhances angling opportunities throughout the Project area.	**CDFW does not agree with this statement.**

Table 9.1 Consultation Summary -Response to Comments (Page 60) (AQ-3 Aquatic Habitat and Sediment Characterization)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**

3	MLC	2/22/2021 Aquatic TWG	Mono Lake Committee is interested in determining to what extent fine sediment is trapped in Project reservoirs.	SCE has no indication that fine sediment accumulates in Project reservoirs in substantive quantities……	**This dispute seems like it can be remedied easily with some on-the-ground-surveys. Synced fishing sonar devices can estimate this.** **At this point in the watershed you would expect to see a lot of courser materials in the sediment load.** **Sediment is unlikely to accumulate against the dam first, and you would expect to see something like a Gilbert Delta form near the stream mouth.** **If this is a concern, we should have a study that looks at bedload transport and annual sediment accumulation in the delta**

Table 7.1 Consultation Summary - Response to Comments (Page 77) (AQ-5 Operations Model)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**
3	CA Sports Fishing Assoc.	TWG Meeting (3/29/2021)	Have you considered the timestep of the model? CSPA recommends a daily model since that timestep will be important for many of the questions participants are interested in	A better understanding of management goals will help us understand what timestep is needed. SCE also needs to review existing data to determine the feasibility of providing daily timesteps	**Seasonal timesteps should be the default**

Table 8.1 Consultation Summary - Response to Comments (TERR-1 General Botanical Resources Survey) (Page 112)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**
19	CDFW	1/14/2022 PAD Comment Period	CDFW requests information (e.g., location [latitude, longitude], type, status) on the riparian monitoring infrastructure	Flow gauge and precipitation measurement station locations have been provided	**These should be collected and placed into a single repository**

			(e.g., stream flow discharge gauges, precipitation measurement stations, stream gauge and soil moisture electronic sensors)	in the riparian monitoring reports.	
25	CDFW	1/14/2022 PAD Comment Period	STUDY Plan Request Botanical Resources Surveys (Riparian Community) See Study Plan Request	……The location of a suitable site for NDVI analysis is also complicated by challenge of selecting a site under SCE influence that does not have additional variables (e.g., accretion flows, seeps, tributaries). The current riparian monitoring sites were selected to minimize those additional variables. However, the upstream sites have a conifer canopy that would make NDVI analysis infeasible. And the downstream site is	**Further discussion will be needed on this topic.**

				located very close to Slate Creek, which is a confounding variable. SCE is proposing a desktop characterization study of riparian areas downstream of Poole Powerhouse	

Table 8.1 Consultation Summary - Response to Comments (TERR-2 General Wildlife Resources Survey) (Page 127)

Comment No.	Entity	Date/Forum	Comment	SCE Response	**CDFW Comment 3/25/2022**
1	CDFW	April 7, 2021/Terrestrial and Botanical Resources TWG Meeting	Request to add focused point-count surveys for riparian birds to Study Plan	**Lack of Nexus**: The baseline environmental conditions would stay the same as no new activities are proposed. Detailed population studies or determining species' absence is not relevant**.**	**Project operations would impact riparian habitat. Baseline surveys are appropriate. Further discussion is needed on this topic.**

				Level of Effort: Not commensurate with resource question given no change in operations. **Methods**: Focal point counts do not inform questions around Project impacts and would require multiple years of study for non Project-related purposes.	
10	CDFW		Suitable nesting habitat for state listed as threatened willow flycatcher (Empidonax traillii) should be defined	Suitable nesting habitat for willow flycatcher will be defined in the final habitat assessment report	**This should be defined in advance. There are some publications about WIFL habitat in the Mono Basin that should be referenced. Mono Basin WIFL is the only documented population to use Wood's rose. HSC developed elsewhere will not work. McCreedy published about this around 2007.**

SOUTHERN CALIFORNIA EDISON
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Lee Vining, FERC Project No. 1388

WILDLIFE STUDY PLAN MEETING NOTES
MARCH 25, 2022; 3:30 PM – 4:30 PM PDT

**These meeting notes are documentation of general discussions from the meeting held on the above-noted date. These notes are not a verbatim account of proceedings, are not meeting minutes, and do not represent any final decisions or official documentation for the project or participating agencies.*

Attendees

Relicensing Team Members
Brad Blood, Psomas
Carissa Shoemaker, ERM
Finlay Anderson, Kleinschmidt
Jonathan Aguayo, Psomas
Shannon Luoma, Kleinschmidt
Steve Norton, Psomas

Agencies and Interested Stakeholders
Alyssa Marquez, CDFW
James "Jim" Erdman, CDFW

Recreation-Habitat interactions

- CDFW concerns:
  - Recreational crossings of inlet streams
    - Specifically on Tioga and Saddlebag.
  - Type of recreation
    - Specifically hiking or biking
  - Timing and frequency of use
    - Include early rec season (as early as May)
- Potential Study Solutions
  - Trail use counters to capture frequency and timing.
  - Motion cameras to capture type (biking or hiking)
  - Counters and cameras don't need to be at the crossings, but along the relevant trails

Study Areas

- Focus studies on SCE use areas (O&M) within the FERC boundary.
- Continue to assess additional areas incorporating CDFW institutional knowledge and desktop analysis in consultation with CDFW

Study Timing

- SCE staff to update license team (weekly or 2x/week) on road access to Saddlebag and on snow pack at Tioga Lake inlet
  - License team and CDFW to have frequent and regular updates with each other on timing
- Survey schedules to be flexible pending toad reproductive stage observed (egg masses, tadpoles, etc).
  - Survey between 2-3 weeks

- CDFW focus is on location of eggs and larvae stages: operations most likely to affect those life-stages rather than adults or metamorphs

Other Notes

- CDFW concerned about long-term climate change effects on YOTO with respect project lake levels.
- CDFW ideal impact avoidance measure of pedestrian bridges across inlets to Tioga and on northern inlet to Saddlebag.

B-18_Revised Study Plan meeting invitation

From: Carissa Shoemaker

To: Carissa Shoemaker; culture@bridgeportindiancolony.com; nayanake@comcast.net; kutzanuumu@yahoo.com; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; jbethel@northforkrancheria-nsn.gov; paiute11@aol.com; t.braithwaite@bentonpaiutereservation.org; nativearchdoc@yahoo.com; chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; Rwgoode911@hotmail.com; d.gutierrez@bigpinepaiute.org; env@bridgeportindiancolony.com; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; cmcdonald@northforkrancheria-nsn.gov; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; andrea@mewuk.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com; thpo@fortindependence.com; jocelynsheltraw@gmail.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; events@mammothmuseum.org; frontierpacktrain@gmail.com; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; triplepointh2o@gmail.com; jonathan.aguayo@psomas.com; victor.aguirreorozco@usda.gov; wayne.allen@sce.com; talpaugh@kearnswest.com; holly@inyo-monowater.org; dawn.alvarez@usda.gov; Philipana@aol.com; markbagley02@gmail.com; Rose.Banks@wildlife.ca.gov; adam.barnett@usda.gov; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Jacqueline.beidl@usda.gov; bbell@co.tuolumne.ca.us; ethan@stillwaterscl.com; hydroesq@schat.net; lbergeron@pcta.org; bblood@psomas.com; ashley.blythehaverstock@usda.gov; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; burger@stillwaterscl.com; bburman@usbr.gov; seth.carr@sce.com; acohen@stillwaterscl.com; rcollins@caltrout.org; lcompas@hrassoc.com; lisa@monolake.org; shellydk@frontiernet.net; robbie@monolake.org; matt.driscoll@sierranevada.ca.gov; Lauren@stillwaterscl.com; gardenofegan@suddenlink.net; todd.ellsworth@usda.gov; blake.engelhardt@usda.gov; James.Erdman@wildlife.ca.gov; stephanie.fincher@sce.com; jora@friendsoftheinyo.org; nora.gamino@usda.gov; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; pgunsolley@gmail.com; ed.hancock@waterboards.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; jmharty@kearnswest.com; jenny@sierranevadaalliance.org; bryan.hatchell@colorado.edu; ghaverst@blm.gov; kelly.henderson@sce.com; Michael.Hross@KleinschmidtGroup.com; sheila.irons@usda.gov; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; lilian_jonas@contractor.nps.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com; jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon.Kulik@KleinschmidtGroup.com; claire@monolake.org; tristan.leong@usda.gov; russ@stillwaterscl.com; info@rockcreekpackstation.com; alyssa.marquez@wildlife.ca.gov; pmcfarland395@gmail.com; Richard.McNeill@usda.gov; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; hmiller@hrassoc.com; david.moore@sce.com; Erin.Moore@usda.gov; Patricia.Moyer@Wildlife.ca.gov; easternsierraartist@gmail.com; megan.mullowney@usda.gov; heather@stillwaterscl.com; samantha.nelson@sce.com; Jill.north@waterboards.ca.gov; steve.norton@psomas.com; Krista@stillwaterscl.com; martin.ostendorf@sce.com; Fatima.Oswald@Kleinschmidtgroup.com; steve.parmenter@wildlife.ca.gov; Charles.partridge@sce.com; Mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; marshmistress@msn.com; greg@monolake.org; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; calvin.rossi@sce.com; allison.rudalevige@psomas.com; monique.sanchez@usda.gov; jstarost@blm.gov; kary.schlick@usda.gov; wendy@friendsoftheinyo.org; cshutes@calsport.org; nathan.sill@usda.gov; barb@farwestern.com; esommerauer@stillwaterscl.com; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; daniel.sussman@waterboards.ca.gov; parker.thaler@Waterboards.ca.gov; shawna_theisen@fws.gov; lthurston@stillwaterscl.com; eric.tillemans@ladwp.com; thomas.torres@usda.gov; LTryba@kearnswest.com; nicolas.von@sce.com; curator@monobasinhistory.org; Jameisha.Washington@usda.gov; jennifer.watts@waterboards.ca.gov; johnwentworth@mltpa.org; eric@friendsoftheriver.org; vince.white@sce.com; Scott@stillwaterscl.com; Audry.Williams@sce.com; Brandy.Wood@Wildlife.ca.gov; daniel.yarborough@usda.gov; Andrew.Yoder@kleinschmidtgroup.com; finlay.anderson@kleinschmidtgroup.com; Shannon.Luoma@KleinschmidtGroup.com; matthew.woodhall@sce.com; Kelly.Larimer@KleinschmidtGroup.com

Subject: Lee Vining Study Plan Meeting Invite

Start: Monday, March 28, 2022 1:00:00 PM

End: Monday, March 28, 2022 4:00:00 PM

Location: Microsoft Teams Meeting

Hello Lee Vining Relicensing participants,

Please join SCE and the relicensing team for our Study Plan Meeting on March 28, 2022 at 1pm PST to discuss Revised Study Plans.

Let me know if you have any questions

Thanks!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM

M 907 575 0294

Microsoft Teams meeting

Join on your computer or mobile app

Click here to join the meeting <https://teams.microsoft.com/l/meetup-join/19%3ameeting_NGQzOWE3NjEtYThiYS00NWMwLWEyYmQtZTE5ZmJmOTE4Yjgw%40thread.v2/0?context=%7b%22Tid%22%3a%22f2fe6bd3-9c4a-485b-ae69-e18820a88130%22%2c%22Oid%22%3a%22008911b3-c470-4526-a040-fc31729944f9%22%7d>

Join with a video conferencing device

195471110@teams.bjn.vc <mailto:195471110@teams.bjn.vc>

Video Conference ID: 123 564 092 7

Alternate VTC instructions <https://support.bluejeans.com/knowledge/vtc-dial-in-options-for-teams>

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Learn More <https://aka.ms/JoinTeamsMeeting> | Meeting options <https://teams.microsoft.com/meetingOptions/?organizerId=008911b3-c470-4526-a040-fc31729944f9&tenantId=f2fe6bd3-9c4a-485b-ae69-e18820a88130&threadId=19_meeting_NGQzOWE3NjEtYThiYS00NWMwLWEyYmQtZTE5ZmJmOTE4Yjgw@thread.v2&messageId=0&language=en-US>

Lee Vining Hydroelectric Project Relicensing

Revised Technical Study Plan Stakeholder Meeting

March 28, 2022, 1:00 PM – 4:00 PM PDT via Microsoft Teams

Objectives

- Review changes made to Study Plans since filing with FERC (Feb 2022)
- Review comments received since February filing
- Discuss Final Study Plans and implementation

Time	Agenda Topic/Subtopic	Lead
1:00	**Welcome & Introductions**	
	- Safety moment - Introductions	Matthew Woodhall
1:10	**Relicensing Schedule Overview**	
	- Review where we are in the relicensing process - Review purpose of study plans	Shannon Luoma
1:20	**Fish, Aquatics, and Hydrology Study Plans Discussion**	
	- Stream and Reservoir Water Quality Study (WQ-1) - Reservoir Fish Population Study (AQ-1) - Stream Fish Populations Study (AQ-2) - Aquatic Habitat Mapping and Sediment Characterization (AQ-3) - Aquatic Invasive Plants Survey (AQ-4) - Operations and Hydrology Model (AQ-5) - Lower Lee Vining Creek Channel Morphology (AQ-6)	Heather Neff, Adam Cohen, Finlay Anderson
1:55	**Terrestrial and Botanical Study Plans Discussion**	
	- General Botanical Resources Survey (TERR-1) - General Wildlife Resources Survey (TERR-2)	Allison Rudalevige, Steve Norton
2:25	**5-minute break**	
2:30	**Cultural and Tribal Study Plans Discussion**	
	- Cultural Resources (CUL-1) - Tribal Resources (TRI-1)	Audry Williams, Shelly Davis-King, Lynn Compas

3:00	**Recreation and Land Use Study Plans Discussion** - Recreation Use Assessment (REC-1) - Facilities Condition Assessment (REC-2) - Project Lands and Roads Assessment (LAND-1) - Aesthetics Resource Assessment (LAND-2)	Angela Whelpley, Karen Klosowski
3:35	**Schedule and Next Steps** - Upcoming important dates and events - Other action items	Carissa Shoemaker
3:45	**Final Q&A**	
4:00	**Adjourn**	

Materials Available on Relicensing Website

- Preliminary Application Document, filed August 12, 2021
  - Includes Draft Study Plans
- Revised Technical Study Plans, filed February 18, 2022
- Site Visit materials
  - Project overview maps
  - Site Visit Booklet
  - Agenda
  - Site Visit Photos
- Process Plan and Schedule
- USFWS IPaC Report (April 2020)
- Project Flyover Video
- FERC Environmental Assessment
- Current FERC License (1997)
- Select Orders Amending the 1997 License
- Technical Working Group (TWG) materials
  - Meeting Agenda
  - Meeting Summaries
  - PowerPoint Presentations
  - TWG Charter Document
- October 2020 Public Meeting materials
- November 2021 Joint Agency and Public Meeting materials

DRAFT MEETING NOTES*
LEE VINING, FERC PROJECT NO. 1388
REVISED TECHNICAL STUDY PLAN STAKEHOLDER MEETING
MARCH 28, 2022, 1:00PM - 4:00PM

**These meeting notes are documentation of general discussions from the meeting held on the above-noted date and focus on stakeholder questions and comments. These notes are not a verbatim account of proceedings and do not represent any final decisions or official documentation for the project or participating agencies.*

1.0 OBJECTIVES

- Review changes made to Study Plans since filing with FERC (Feb 2022)
- Review comments received since February filing
- Discuss Final Study Plans and implementation

2.0 ATTENDEES

Relicensing Team Members
Audry Williams, SCE
Martin Ostendorf, SCE
Matt Woodhall, SCE
Seth Carr, SCE
Nicolas von Gersdorff, SCE
Angela Whelpley, Kleinschmidt
Brandon Kulik, Kleinschmidt
Finlay Anderson, Kleinschmidt
Kelly Larimer, Kleinschmidt
Shannon Luoma, Kleinschmidt
Adam Cohen, Stillwater
Heather Bowen Neff, Stillwater
Allison Rudalevige, Psomas
Brad Blood, Psomas
Steve Norton, Psomas
Carissa Shoemaker, ERM
Edith Read, E Read and Associates, Inc.
Lynn Compas, HRA
Shelly Davis-King, Davis-King & Associates

Facilitation Team
Lindsay Tryba, KW

Technical Working Group Members & Interested Parties
Adam Barnett, USFS
Ashley Blythe Haverstock, USFS
Sheila Irons, USFS
Richard McNeill, USFS
Monique Sanchez, USFS
Nathan Sill, USFS
Thomas Torres, USFS
Jameisha Washington, USFS
Michael Wiese, USFS
Brandy Wood, CDFW
Alyssa Marquez, CDFW
Beth Lawson, CDFW
Nick Buckmaster, CDFW
James Erdman, CDFW
Chad Mellison, USFWS

Saeed Jorat, LADWP
Christina McDonald, North Fork Rancheria of Mono Indians of California
Raymond Andrews, Bishop Paiute Tribe
Bartshe Miller, MLC
Greg Reis, MLC
Chris Shutes, CSPA
Naomi Jensen, TEAM Engineering & Management, Inc.
Greg Foote, TEAM Engineering & Management, Inc.

3.0 COMPILED ACTION ITEMS

- **Chris Shutes** (CSPA) wants to be included in the next hydrology/operations meeting.
- **Relicensing Team** will schedule a separate meeting with CDFW to discuss CDFW's comments that were sent to SCE on 3/25.
- **Relicensing Team** will differentiate between the terms "alluvial" and "colluvial" in the Lower Lee Vining Creek Channel Morphology (AQ-6) study and in the DLA/FLA.
- **Relicensing Team** will consider including CDFW's request to include anecdotal *Didymo* surveys in the updated study plan.
- **Relicensing Team** will distribute a proposed schedule for the Yosemite Toad portion of the Wildlife study following the Relicensing Team's 3/29 internal Wildlife Study Plan meeting.
    - **Relicensing Team** will schedule another meeting (if needed) for all parties interested in the Yosemite Toad / Wildlife study plan and surveys.

4.0 WELCOME & INTRODUCTIONS

Finlay Anderson, Kleinschmidt, welcomed Technical Working Group (TWG) members to the meeting, introduced the Relicensing Team, and provided an overview of the agenda. Audry Williams, SCE, provided tribal land recognition. Matthew Woodhall, SCE, introduced the SCE Team and Shannon Luoma, Kleinschmidt, introduced the Consultant Team. The purpose of today's call is to review changes made to the Study Plans since filing with FERC, review comments received since the February filing, and discuss Final Study Plans and implementation.

5.0 RELICENSING SCHEDULE OVERVIEW

Finlay Anderson, Kleinschmidt, provided an overview of the Process Review and the Traditional Licensing Process (TLP). The agencies' involvement in the technical study plans typically ends with the FERC comment period, which occurs after the first stage of consultation. SCE chose to add additional steps to maintain collaboration with the TWG members, including: 2021 TWG meetings, complete study plan meetings, and after the first stage consultation, revised study plans and a Study Plan Meeting. Additionally, the Dispute Resolution Process exists if needed.

6.0 FISH, AQUATICS, AND HYDROLOGY STUDY PLANS DISCUSSION

Topic: Stream and Reservoir Water Quality Study (WQ-1). See slides for further details.

TWG member questions and comments are summarized below:

- Question (Q) (North Fork Rancheria of Mono Indians of California): If tissue mercury levels are elevated, then would you test Ellery Lake also?
    - Response (R) (Team): Ellery rarely, if ever, stratifies, which means that it is unlikely to methylate and bioaccumulate into fish. The data shows that Ellery does not have a problem with mercury.
- (Q) (CDFW): Are you seeing lower DO levels in the hypolimnion in the other reservoirs?
    - (R) (Team): There was some DO in limited circumstances, but it is not a major concern.
- (Q) (CDFW): Does the water temperature affect DO?
    - (R) (Team): If the reservoir is stratified for a long period of time, then dissolved oxygen has an opportunity for mercury to methylate. Stratification is not a concern for Ellery.
- (C) (CDFW): If sediment is removed from behind dams and added to the stream, would that move mercury into the stream? Perhaps you could test the sediment behind the dams to see if there is mercury.
    - (R) (Team): There is no reason to expect that there is mercury in the streams. The potential concern would be mercury accumulated in fish.
- (Q) (CDFW): Yes, it is very rare to find mercury at this altitude. Has it ever been documented at this altitude?
    - (R) (Team): It is possible. Some of the data in the PAD shows it, but it is limited and rare.

Topic: Reservoir Fish Population Study (AQ-1). See slides for further details.

TWG member questions and comments are summarized below:

- (C) (CDFW): CDFW included in a comment (on 3/25) about an inaccuracy in this study. CDFW can provide reference studies if needed.
    - (R) (Team): Thank you, the Relicensing Team is looking over the comments now. The comments were received on Friday (3/25), and the Team has not had a chance to review the comments before today's (3/28) meeting.

Topic: Stream Fish Populations Study (AQ-2). See slides for further details.

There were no questions or comments from TWG members.

Topic: Aquatic Habitat Mapping and Sediment Characterization (AQ-3). See slides for further details.

TWG member questions and comments are summarized below:

- (Q) (CDFW): Would it be helpful to schedule a separate meeting to discuss CDFW's comments?
    - (R) (Team): The Team is reviewing the comments sent on 3/25 and will follow up with any questions in the coming weeks.

Topic: Aquatic Invasive Plants Survey (AQ-4). See slides for further details.

There were no questions or comments from TWG members.

Topic: Lower Lee Vining Creek Channel Morphology (AQ-6). See slides for further details.

TWG member questions and comments are summarized below:

- (C) (CDFW): There was a suggestion to differentiate between the terms "alluvial" and "colluvial" in the PAD.
    - (R) (Team): SCE will difference between the terms alluvial and colluvial in the Lower Lee Vining Creek Channel Morphology (AQ-6) study and in the DLA/FLA.

Topic: Operations and Hydrology Model (AQ-5). See slides for further details.

TWG member questions and comments are summarized below:

- (Q) (CDFW): What is the channel morphology below the Poole powerhouse? Is it primarily bedrock or ground riffle?
    - (R) (Team): It is not a plunge-pool system; it is more of a riffle-run system.
- (Q) (CSPA): Will the model have reservoir levels in stage, storage, and spills?
    - (R) (Team): Yes.
- (Q) (CSPA): Is there a provision for unimpaired hydrology?
    - (R) (Team): The Relicensing Team is currently considering this request.
- (Q) (CSPA): Will there be a daily reported average value for flows in each of the major project streams reaches?
    - (R) (Team): Yes, in cfs. The model is predictive, and the initial study report will show how the model works, define input levels, and describe the expected reporting. TWGs can provide feedback on the updated model to ensure that the initial study reports will meet TWGs' needs. There will be a final study plan in April to address CDFW's comments.
- (Q) (CDFW): Could you include anecdotal *Didymo* surveys in the updated study plan?
    - (R) (Team): The Relicensing Team will consider including CDFW's request to include anecdotal *Didymo* surveys in the updated study plan.
- (Q) (CDFW): Feel free to set up a meeting with CDFW. We'd rather have a meeting to discuss this rather than to reply back and forth via email.
    - (R) (Team): Thank you. We want to continue this effective collaboration. Once we have a chance to review your comments, we will come up with a schedule to have conversations.

7.0 TERRESTRIAL AND BOTANICAL STUDY PLANS DISCUSSION

Topic: General Botanical Resources Survey (TERR-1). See slides for further details.

TWG member questions and comments are summarized below:

- (Q) (Bishop Paiute Tribe): Is there an invasive plant removal plan?
    - (R) (Team): SCE has a corporate vegetation management plan that is implemented on all SCE projects.

Topic: General Wildlife Resources Survey (TERR-2). See slides for further details.

TWG member questions and comments are summarized below:

- (Q) (CDFW): How many people do you have on your survey crew?

- (R) (Team): The survey crew includes two permanent surveyors and potentially additional assistance from partner agencies.

8.0 CULTURAL AND TRIBAL STUDY PLANS DISCUSSION

Topic: Cultural Resources (CUL-1). See slides for further details.

There were no questions or comments from TWG members.

Topic: Tribal Resources (TRI-1). See slides for further details.

There were no questions or comments from TWG members.

9.0 RECREATION AND LAND USE STUDY PLANS DISCUSSION

Topic: Recreation Use Assessment (REC-1). See slides for further details.

There were no questions or comments from TWG members.

Topic: Facilities Condition Assessment (REC-2). See slides for further details.

There were no questions or comments from TWG members.

Topic: Project Lands and Roads Assessment (LAND-1). See slides for further details.

TWG member questions and comments are summarized below:

- (Q) (CDFW): Regarding the Yosemite Toad / Wildlife study, can we convene another meeting for all interested in the study plan and surveys?
  - (R) (Team): The Team is meeting tomorrow (3/29) to discuss this. The Relicensing Team will distribute a proposed schedule for the Yosemite Toad study following the Relicensing Team's 3/29 internal Wildlife Study Plan meeting.
    - The Relicensing Team will schedule another meeting (if needed) for all parties interested in the Yosemite Toad / Wildlife study plan and surveys.

Topic: Aesthetics Resource Assessment (LAND-2). See slides for further details.

There were no questions or comments from TWG members.

10.0 SCHEDULE AND NEXT STEPS

The Relicensing Team provided a schedule of upcoming important dates and events.

11.0 FINAL Q&A

There were no further questions. The Relicensing Team adjourned the meeting.

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Energy for What's Ahead℠

Lee Vining Hydroelectric Project
FERC No. 1388

Welcome!

Using the chat, please write your name, organization, and your favorite spring activity

Revised Technical Study Plan Stakeholder Meeting
March 28, 2022

Welcome and Land Acknowledgment

SCE would like to take a moment and recognize that the Lee Vining Project is located on the Mono Lake Kutzadikaa Tribes' traditional lands which they have stewarded for generations.

Safety Moment

Welcome and Introductions: Lee Vining Relicensing Team

SCE Team

Consultant Team

Shannon Luoma
Project Manager

Finlay Anderson
Technical Advisor

Kelly Larimer
Project Director

Carissa Shoemaker
TWG Coordinator

Heather Neff
Aquatics Lead

Allison Rudalevige and **Steve Norton**
Terrestrial and Botanical Leads

Shelly Davis-King
Tribal Lead

Lynn Compas
Cultural Lead

Matt Harper and **Angela Whelpley**
Recreation and Land Use Leads

Study Plan Meeting Agenda

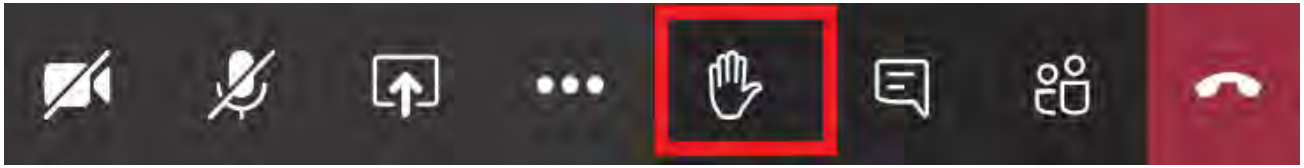
- Safety moment
- Welcome and Introductions
- Meeting objectives
- Review stakeholder comments on Study Plans
  - Aquatics
  - Terrestrial
  - Cultural and Tribal
  - Recreation and Land Use
- Schedule, next steps, action items
- Final questions

Meeting Objectives

- Review changes made as a result of comments received during FERC and Revised Study Plan comment periods
- Finalize Study Plans and shift to study implementation

Meeting Tips and Guidelines

- Please wait to be called on and then unmute your line
  - Introduce yourself (name and affiliation) prior to speaking
- Listen and respect each other
- Stay on topic



Process Review

- Traditional Licensing Process (TLP)
  - Agency involvement in study plans typically ends with FERC comment period (after first stage of consultation)
  - SCE has added additional steps to maintain collaboration
    - 2021 TWG meetings
    - Complete Study Plans in PAD
    - After first stage consultation:
      - Revised Study Plans
      - Study Plan Meeting
- Dispute Resolution Process Exists
  - 18 CFR 16.8(b)(6)

Relicensing Schedule to Date (FERC)

Date	Activity
Week of Feb 22, 2021	Water Resources, Terrestrial, Botanical, Cultural, Tribal, Recreation and Land Use TWG meetings
Week of March 29, 2021	Water Resources, Terrestrial, Botanical, Cultural, Tribal, Recreation and Land Use TWG meetings
Week May 24, 2021	Water Resources, Terrestrial, Botanical, Cultural, Tribal, Recreation and Land Use TWG meetings
August 12, 2021	SCE Files PAD, NOI and Draft Study Plans
November 16, 2021	Joint Agency and Stakeholder Meeting (JAM)
January 18, 2022 **(End First State Consultation)**	FERC deadline for PAD comments, Study Plan Comments and new Study Plan Requests
Additional Consultation Outside of FERC Process	
February 18, 2022	SCE Files Revised Technical Study Plans
March 21, 2022	End of RTSP Comment Period

Upcoming Relicensing Process Schedule

Date	Activity
March 28, 2022	Study Plan Meeting with Stakeholders *(outside TLP)*
April 18, 2022	SCE Issues Final Study Plans for Implementation *(outside TLP)*
Spring – Fall 2022	Conduct Year 1 field studies
Spring – Fall 2023	Conduct Year 2 field studies, as needed
January 2023	Interim Study Report meeting *(outside TLP)*
September 2024	SCE Files Draft License Application
January 2025	SCE Files Final License Application

Fish, Aquatics, and Hydrology – Study Plans

- Stream and Reservoir Water Quality
- Reservoir Fish Populations
- Stream Fish Populations
- Aquatic Habitat Mapping and Sediment Characterization
- Aquatic Invasive Plants
- Lower Lee Vining Creek Channel Morphology
- Operations Model

Stream and Reservoir Water Quality

- Study Goal: assess whether Project waters are consistent with Basin Plan water quality objectives
- Reservoir temperature profiling and bacterial sampling will occur at all three project reservoirs
- *In situ* water quality sampling will occur at all three Project reservoirs and from 7 sites in Lee Vining Creek, and two sites in Glacier Creek, including the inflows to each Project reservoir
- Fish tissue mercury sampling will occur at Saddlebag and Tioga lakes
- Turbidity monitoring of hydro-resource optimization events will occur at one site downstream of Poole Powerhouse

Stream and Reservoir Water Quality

- Changes since PAD
  - Continuous turbidity monitoring downstream of Poole Powerhouse
  - Fecal coliform will be sampled at Project reservoirs near campgrounds, 5 times within a 30-day period
  - Sampling will occur at reservoir inflows
  - A second year of *in situ* and reservoir profiles will be performed if the water year type in 2023 differs from 2022
  - Fish tissue mercury sampling will occur in Saddlebag and Tioga lakes, but not Ellery
  - Water column mercury and methylmercury was not adopted.

Stream and Reservoir Water Quality

- Schedule

Date	Activity
2022/2023 – Spring/Fall	Conduct water quality fieldwork
2022 – Summer/Fall	Conduct fish tissue mercury fieldwork (AQ-1 Reservoir Fish Population)
2022/2023 – Winter	Analyze data and prepare draft report
2023 – January	Interim Study Report and Meeting
2023 – March	Distribute draft report to Stakeholders
2023 – April/May	Stakeholder review and provide comments on draft report
2023 – Fall	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Reservoir Fish Populations

- Study Goal: assess fish population densities, age-class distribution, and condition within Project reservoirs
  - Saddlebag Lake, Ellery Lake, Tioga Lake
- Sampling conducted with gill netting and boat electrofishing
  - Sampling once in summer or fall using variable-mesh gill nets at three locations per reservoir
  - Fish total length, fork length, weight, general condition
  - Fish age approximated from scale samples from up to 20 fish of each species

Reservoir Fish Populations

- Changes since PAD
  - Study revised to include nighttime rather than daytime boat electrofishing
- Schedule

Date	Activity
2022 – Summer–Fall	Conduct field surveys
2022/2023 – Winter	Compile study results, conduct analyses, and prepare draft report
2023 – January	Interim Study Report and Meeting
2023 – March	Distribute draft report to Stakeholders
2023 – April/May	Stakeholder review and provide comments on draft report
2023 – Fall	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Stream Fish Populations

- No changes since PAD

- Schedule

Date	Activity
2022 – Summer/Fall	Conduct field surveys
2022/2023 – Winter	Compile study results and prepare draft report
2023 – January	Interim Study Report and Meeting
2023 – March	Distribute draft report to Stakeholders
2023 – April/May	Stakeholder review and provide comments on draft report
2023 – Fall	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Aquatic Habitat Mapping and Sediment Characterization

- No changes or comments since PAD

- Schedule

Date	Activity
2023 – Summer/Fall	Conduct field surveys
2023/2024 – Winter	Compile study results and prepare draft report
2024 – September	Distribute final report in Draft License Application

Aquatic Invasive Plants

- No changes or comments since PAD

- Schedule

Date	Activity
2023 – Spring	Refine study sites
2023 – Summer/Fall	Conduct field surveys
2024 – September	Distribute final report in Draft License Application

Lower Lee Vining Creek Channel Morphology

- No changes since PAD

- Schedule

Date	Activity
2022 – Spring	Historical photograph and data review
2022 – Summer/Fall	Conduct field surveys
2022/2023 – Winter	Compile study results and prepare draft report
2023 – January	Interim Study Report and Meeting
2023 – March	Distribute draft report to Stakeholders
2023 – April/May	Stakeholder review and provide comments on draft report
2023 – Fall	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Operations Model

Goals/Objectives

- Understand how Project operations interact with Lee Vining hydrology; use to make informed decisions regarding the implementation of and results from other relicensing studies.
  - Accurately model the systems inflows, outflows, and generation nodes.
  - Align model with needs of other relicensing studies and information needs.
  - Develop procedures to configure model for alternative operational scenarios and document results.

Operations Model

- Determine effective operating limits the Poole Powerhouse to accurately represent installed and dependable capacity for licensing documents.
- Determine the frequency, magnitude, duration, and seasonality of intraday releases from the Poole Powerhouse in response to resource optimization needs.
- Describe the stage/discharge relationship at discreet locations between the Poole Powerhouse and the Los Angeles Department of Water and Power (LADWP) diversion.

Operations Model

Comments Received

- SWRCB inquired about anticipated time-steps for examining hydro-optimization releases from Poole Powerhouse
  - Anticipated to look at historical data on 1-hour time-step to align with available SCADA information
- CDFW provided suggestions on 3-25 regarding model configuration
  - Review of suggestions ongoing but appear to align with discussions from Bishop Creek PME experience.

Operations Model

- Schedule

Date	Activity
2022 – April	Revised study plan adding details and addressing CDFW comments
2022 – Summer	Data review (hydrology and SCADA)
2022 – Summer	Data collection for HEC-RAS component (downstream of Poole PH) coincident with channel geomorphology study
2022/2023 – Winter	Operations model for daily operations
2023 – January	Interim Study Report and Meeting
2023 – March	Distribute draft report to Stakeholders
2023 – April/May	Stakeholder review and provide comments on draft report
2024 – September	Distribute final report in Draft License Application

Terrestrial, Botanical, Wetlands, and RTE Species – Study Plans

- Botanical Surveys at Project Facilities
  - RTE species surveys
  - Non-listed special status plant species
  - Invasive species surveys
  - Ground-truth existing USFS vegetation map
- Wildlife
  - General wildlife surveys
  - Yosemite toad surveys
  - Willow flycatcher habitat assessment

Botanical Survey

- Introduction
- Goals and Objectives
  - Document the presence of plant species listed by the federal and/or state ESAs or proposed for listing.
  - Document the presence of other special-status plants.
  - Ground-truth the existing USFS vegetation map, including identification of any sensitive natural communities.
  - Incorporate results of the riparian monitoring study undertaken as part of the existing license.
  - Perform a desktop characterization study of select riparian habitat area(s) to document potential changes resulting from hydro-resource optimization.
  - Document non-native, invasive plants.

Botanical Survey

- Changes since PAD
  - Botanical survey area extent will be developed as part of a desktop analysis to encompass areas that may be hydrologically influenced by proposed activities or that may be subject to proposed activities related to project O&M.
  - Added two Tioga Lake inlets and penstock dispersed use trail to botanical survey area.
  - Clarified botanical survey study methods.
  - Added a desktop characterization study to document general riparian conditions downstream of Poole Powerhouse.
  - Directly addressed relevant comments received in table at end of Study Plan.

Botanical Survey

- Schedule

Date	Activity
2022 – Spring	Select study sites Meeting with agencies and stakeholders Conduct desktop analysis
2022 – Spring/Fall	Conduct first season of field surveys
2022 – Nov/Dec	Compile study results
2023 – January	Interim Study Report and Meeting
2023 – Spring/Fall	Conduct second season of field surveys
2024 – March	Distribute draft report to Stakeholders
2024 – April/May	Stakeholder review and provide comments on draft report
2024 – September	Distribute final report in Draft License Application

Wildlife Survey

- Goals and Objectives
  - Build a species compendium of wildlife occurring within Project area.
  - Identify riparian birds during general wildlife surveys.
  - Identify YOTO breeding locations in areas subject to Project O&M.
  - Determine interactions between dispersed recreation and YOTO.
  - Develop sufficient data for informal and formal consultation needs for USFWS with respect to YOTO.
  - Assess willow flycatcher nesting habitat between the Poole Powerhouse and the reservoir at the LADWP Diversion Dam.

Wildlife Survey

- Changes since PAD
  - Added Tioga Lake inlets to YOTO survey area.
  - Increased YOTO focused surveys from 1 to 2 years.
  - Added review of mapped contours of Tioga/ Saddlebag Lakes to assess potential YOTO breeding habitat in the littoral zone.

Wildlife Survey

- Changes since PAD (cont.)
  - Added wildlife agency coordination for camera deployment locations (including INF and CDFW).
  - Stated that willow flycatcher habitat considered suitable will be explicitly identified in relevant reporting.
  - Clarified recreation-toad habitat study methods.
  - Directly addressed relevant comments received in table at end of Study Plan.

Wildlife Survey

- Schedule

Date	Activity
2022 – Spring	Select study sites Meeting with agencies and stakeholders Conduct desktop analysis
2022 – Spring/Fall	Conduct first season of field surveys
2022 – Nov/Dec	Compile study results
2023 – January	Interim Study Report and Meeting
2023 – Spring/Fall	Conduct second season of field surveys
2024 – Jan/Feb	Compile study results and prepare draft report
2024 – March	Distribute draft report to Stakeholders
2024 – April/May	Stakeholder review and provide comments on draft report
2023 – Fall	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Cultural and Tribal – Study Plans

- Cultural Resources Study
  - Background Research
  - Pedestrian Survey
  - Archaeological Site Recordation and Evaluations
  - Built Environment Recordation and Evaluations
- Tribal Resources study
  - Background Research
  - Field Investigation with Tribal representatives
  - Interviews with Tribal representatives
  - Documentation and evaluation of Tribal resources

No comments received and no changes made to either study plan

- Implementation will begin in 2022.

Recreation and Land Use Study Plans

- Recreation Use and Needs Assessment
- Recreation Facilities Condition Assessment
- Project Boundary, Lands, and Roads
- Visual Quality Assessment

Recreation Use and Needs Assessment

- Goals and Objectives

  Determine which INF recreation facilities or activities have a potential connection to the Project and thus would warrant inclusion in the broader studies proposed in the second study season

  For the study sites and activities identified:
  - Characterize existing recreation opportunities and visitation
  - Characterize existing visitor characteristics, needs, and preferences
  - Estimate current recreational fishing effort in Project creeks and reservoirs
  - Estimate future recreational demand and needs, including the need for additional recreation facility and access enhancements or enforcement actions
  - Assess consistency of current recreation opportunities with the Desired Conditions, Goals, Standards, and Guidelines described in the *Land Management Plan for the Inyo National Forest*

Recreation Use and Needs Assessment

- Changes since PAD
  - Added proposed user survey schedule/methodology for the 2022 study season
  - Updated proposed user survey schedule/methodology for the 2023 study season
  - Added spot count schedule and methodology

Recreation Use and Needs Assessment

- Schedule

Date	Activity
2022 – Spring/Summer	Conduct initial user surveys to determine primary reason for visit
2023 – January	Interim Study Report and Meeting
2023 – February	Consult with TWG to determine study sites and methods for 2023 field season
2023 – Spring/Summer/Winter	Conduct season two studies
2024 – March	Distribute draft report to TWG
2024 – April/May	TWG review and comments
2024 – September	Distribute final report in Draft License Application

Recreation Facilities Condition Assessment

- No changes since PAD

Date	Activity
2022 – Spring/Summer	Conduct initial user surveys under REC-1 to determine primary reason for visit; Conduct dispersed use assessment
2022 – Winter	Consult with TWG to determine study sites and methods for 2023 field season
2023 – Spring/Summer	Conduct facility condition assessment
2024 – Jan/Feb	Compile study results and prepare draft report
2024 – March	Distribute draft report to TWG
2024 – April/May	TWG review and comments
2024 – Summer	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Project Boundary, Lands, and Roads

- Identify whether additional Project lands may be needed for operation of the Project, including laydown and spoil areas, or whether current Project lands or facilities are no longer needed for Project operation
- Confirm existing land ownership and federal lands within the existing FERC Project Boundary are accurately represented
- Identify which roads or access trails are used for access to and maintenance of the Project, and identify existing agreements related to maintenance of those roads and access trails
- Inventory and assess the condition of those identified Project-related roads and access trails, including the potential need for improvements
- Identify for purposes of describing in the License Application all Project facilities and structures used for hydroelectric generation (e.g., buildings, roads, and spillways)

Project Boundary, Lands, and Roads

- Added new goal for the study
  - Identify for purposes of describing the License Application all Project facilities and structures used for hydroelectric generation (e.g., buildings, roads, and spillways)

Project Boundary, Lands, and Roads

- Schedule

Date	Activity
2022 – Spring/Summer	Conduct desktop analysis and interview SCE staff
2022 – Winter	Prepare initial findings
2023 – May	Compile study results and prepare draft report
2023 – June	Distribute draft report to TWG
2023 – June/July	TWG review and comments
2023 – Nov/Dec	Resolve comments and prepare final report
2024 – September	Distribute final report in Draft License Application

Visual Quality Assessment

Date	Activity
2022 – Summer–Fall	Conduct field surveys/compile existing information
2023–February	Consult with TWG as needed
2023	Compile study results and prepare draft report
2024–March	Distribute draft report to TWG
2024–April/May	TWG review and comments
2024–July/Aug	Resolve comments and prepare final report
2024–September	Distribute final report in Draft License Application

KOP = Key Observation Point; TWG = Technical Working Group

How to Stay Involved

www.sce.com/leevining

www.sce.com/regulatory/hydro-licensing

www.ferc.gov

carissa.shoemaker@erm.com

B-20_Coordination re times to discuss Yosemite toad study plan

From:	Erdman, James@Wildlife
To:	Steve Norton; Marquez, Alyssa@Wildlife
Cc:	Shannon Luoma; Carissa Shoemaker
Subject:	RE: Follow-up Meeting on Lee Vining Yosemite Toad Study Plan
Date:	Tuesday, March 29, 2022 2:55:58 PM
Attachments:	image001.png image002.png image003.png

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Thanks Steve. Talk to you tomorrow.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, March 29, 2022 1:50 PM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Follow-up Meeting on Lee Vining Yosemite Toad Study Plan

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Thanks Both.
I'll set up a meeting for tomorrow at 2:00.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Tuesday, March 29, 2022 1:35 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Steve Norton <steve.norton@psomas.com>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Follow-up Meeting on Lee Vining Yosemite Toad Study Plan
Hi Steve,
I'm available for a meeting from 1400-1500 tomorrow.
Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Tuesday, March 29, 2022 12:46 PM
To: Steve Norton <steve.norton@psomas.com>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Follow-up Meeting on Lee Vining Yosemite Toad Study Plan

Hi Steve,
I am available for a call on Wednesday (tomorrow) at either time listed (8-9 or 1400-1500).
I am not available on Thursday. It is a state holiday and our offices are closed.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, March 29, 2022 11:24 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Follow-up Meeting on Lee Vining Yosemite Toad Study Plan

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Hi Jim and Alyssa,
I'd like another phone call in hopes of buttoning up the Wildlife Study Plan before the survey season kicks off. Please note: the scope of this call would only include the Wildlife Study and not address comments on the other study plans (those will be scheduled separately and without me). Matt Woodhall (Edison) will also be on the call.
Let me know if you are available for an hour-long call this week during any of the times below.

Wednesday (March 30)
8:00-9:00 AM
2:00-3:00 PM

Thursday (March 31)
8:00-9:00 AM
1:00-3:00 PM

Thank you and hopefully we will talk soon.
-Steve

B-20_Coordination re times to discuss Yosemite toad study plan

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

B-21_Sharing project shapefiles

From:	Shannon Luoma
To:	Alyssa.Marquez@Wildlife.ca.gov
Cc:	Carissa Shoemaker
Subject:	Lee Vining FERC Project Shapefiles
Date:	Wednesday, March 30, 2022 9:09:16 AM
Attachments:	Project Boundary_P1388_20220330 .zip

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good morning, Alyssa!
Attached is the Lee Vining FERC Project Boundary that we used to put together that map. Let me know if you are looking for something else or have any questions.
Thanks!

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Tuesday, March 29, 2022 3:32 PM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: Lee Vining FERC Project Shapefiles
Hi Shannon,
I would like to make a request for the shapefiles of the Lee Vining FERC Project. Specifically, I would like access to the shapefiles that were used to make the attached map. Please let me know if this is something you can provide or if you need any more clarification.
Thanks,

Alyssa Marquez
Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

Carissa Shoemaker

Subject: Lee Vining Wildlife Study Plan Discussions

Start: Wed 3/30/2022 2:00 PM
End: Wed 3/30/2022 3:00 PM
Show Time As: Tentative

Recurrence: (none)

Meeting Status: Tentatively accepted

Organizer: Steve Norton
Required Attendees Brad Blood; Alyssa.Marquez@Wildlife.ca.gov; James.Erdman@wildlife.ca.gov; Shannon.Luoma@Kleinschmidtgroup.com; Carissa.Shoemaker@erm.com; Matthew.Woodhall@sce.com; finlay.anderson@kleinschmidtgroup.com; Martin.Ostendorf@sce.com

Categories: Meeting/Training

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

This meeting is to continue planning for the 2022 field season and to finalize any remaining edits to the Wildlife Study Plan for the Lee Vining Relicensing Project.

Please note: the scope of this call only includes the Wildlife Study and will not address comments on the other study plans.

Talk to you all tomorrow,
-Steve Norton

Microsoft Teams meeting

Join on your computer or mobile app
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Or call in (audio only)
+1 951-344-4988,,66089334# United States, Riverside
Phone Conference ID: 660 893 34#
Find a local number | Reset PIN

Learn More | Meeting options

B-23.1_Email to CDFW re wildlife study plan meeting

From:	Steve Norton
To:	Erdman, James@Wildlife; Marquez, Alyssa@Wildlife
Cc:	Matthew Woodhall; Brad Blood; Shannon Luoma; Carissa Shoemaker; Finlay Anderson
Subject:	3/30/22 Wildlife Study Plan Meeting Minutes
Date:	Wednesday, March 30, 2022 6:48:06 PM
Attachments:	image003.png image004.png image005.png Wildlife Study Plan Meeting Minutes_033022.pdf

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Jim and Alyssa,

Attached is a brief summary of the topics we discussed at the meeting.

Let me know if you have any edits or additions.

Thanks again for meeting with us.

-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Lee Vining Wildlife Study Plan Agenda and Minutes

March 30, 2022

1) Quick introduction
    a. Alyssa Marquez
    b. Jim Erdman
    c. Matt Woodhall
    d. Steve Norton
    e. Brad Blood
    f. Finlay Anderson
    g. Carissa Shoemaker
    h. Shannon Luoma

2) Meeting Goal
    a. Finalize Wildlife Study Plan
    b. If time: Continue planning for 2022 field season

3) Recent Study Plan Updates
    a. Updated rec study components
        i. Data of interest:
            1. Timing of recreationalists use relative to YOTO breeding season
                a. May (post-snowmelt)
            2. Determine type of recreational transit: foot or bicycle
    b. Updated YOTO survey methods, notably:
        i. removed June 1-Sept 30.
        ii. replaced with: start after snow melt. Will include communication with SCE operations staff to assist in determining appropriate survey start date.
        iii. Determined to use inlets to Tioga Lake as indicator location of snow melt
        iv. Psomas to provide SCE Ops with criteria for Tioga Lake inlet check (Photo sites, etc.).
        v. Will use CDFW high mnt datasheet or similar to collect relevant data
        vi. GPS location, habitat photo, and (where relevant) life-stage photo, will be collected at each YOTO observation site.
        vii. Will record lake elevations during each visit.
    c. Expanded Study Area
        i. Now includes inlets at Tioga Lake.
        ii. Include flexibility to expand survey area where relevant.
        iii. Previously included areas include:
            1. area downstream of Tioga Dam.

2. north and south inlets at Saddlebag.
3. known population south of Saddlebag.

iv. Include focused habitat assessment in 2022 of presumptive wet-meadows along Lee Vining Creek (generally located upstream of Sawmill Campground). Locations determined based on Google Earth aerial photography but need ground truthing. Areas will be evaluated as suitable habitat based on the presence of USFWS-defined Primary Constituent Elements.

v. 2023 YOTO survey efforts will be determined based on the results of 2022 survey results and other related licensing efforts.

d. Review of mapped contours of Tioga littoral zone.

4) General project information
   a. Lake elevations at Tioga and Ellery are mandated to be kept within a narrow range (generally speaking: near full capacity) for most of the recreational year.
   b. Saddlebag daily release amount established at the beginning of each year (generally in April) then generally remains unchanged until the Fall.
5) Action Items
   a. License team to communicate with SCE operations staff to schedule at minimum a weekly photograph of the snowpack/melt at the southern inlet to Tioga Lake. Photo will be sent to License team to determine when toad surveys must start. Psomas to email to CDFW and USFWS.
   b. CDFW to send approximate points of focused habitat assessment along Lee Vining Creek to be conducted by License Team in 2022 field season.

Lee Vining Wildlife Study Plan Agenda and Minutes

March 30, 2022

1) Quick introduction
    a. Alyssa Marquez
    b. Jim Erdman
    c. Matt Woodhall
    d. Steve Norton
    e. Brad Blood
    f. Finlay Anderson
    g. Carissa Shoemaker
    h. Shannon Luoma

2) Meeting Goal
    a. Finalize Wildlife Study Plan
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3) Recent Study Plan Updates
    a. Updated rec study components
        i. Data of interest:
            1. Timing of recreationalists use relative to YOTO breeding season
                a. May (post-snowmelt)
            2. Determine type of recreational transit: foot or bicycle
    b. Updated YOTO survey methods, notably:
        i. removed June 1-Sept 30.
        ii. replaced with: start after snow melt. Will include communication with SCE operations staff to assist in determining appropriate survey start date.
        iii. Determined to use inlets to Tioga Lake as indicator location of snow melt
        iv. Psomas to provide SCE Ops with criteria for Tioga Lake inlet check (Photo sites, etc.).
        v. Will use CDFW high mnt datasheet or similar to collect relevant data
        vi. GPS location, habitat photo, and (where relevant) life-stage photo, will be collected at each YOTO observation site.
        vii. Will record lake elevations during each visit.
    c. Expanded Study Area
        i. Now includes inlets at Tioga Lake.
        ii. Include flexibility to expand survey area where relevant.
        iii. Previously included areas include:
            1. area downstream of Tioga Dam.

2. north and south inlets at Saddlebag.
3. known population south of Saddlebag.

iv. Include focused habitat assessment in 2022 of presumptive wet-meadows along Lee Vining Creek (generally located upstream of Sawmill Campground). Locations determined based on Google Earth aerial photography but need ground truthing. Areas will be evaluated as suitable habitat based on the presence of USFWS-defined Primary Constituent Elements.

v. 2023 YOTO survey efforts will be determined based on the results of 2022 survey results and other related licensing efforts.

d. Review of mapped contours of Tioga littoral zone.

4) General project information
   a. Lake elevations at Tioga and Ellery are mandated to be kept within a narrow range (generally speaking: near full capacity) for most of the recreational year.
   b. Saddlebag daily release amount established at the beginning of each year (generally in April) then generally remains unchanged until the Fall.
5) Action Items
   a. License team to communicate with SCE operations staff to schedule at minimum a weekly photograph of the snowpack/melt at the southern inlet to Tioga Lake. Photo will be sent to License team to determine when toad surveys must start. Psomas to email to CDFW and USFWS.
   b. CDFW to send approximate points of focused habitat assessment along Lee Vining Creek to be conducted by License Team in 2022 field season.

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Lee Vining, FERC Project No. 1388

WILDLIFE STUDY PLAN MEETING NOTES
MARCH 30, 2022; 2:00 PM – 3:00 PM PDT

**These meeting notes are documentation of general discussions from the meeting held on the above-noted date. These notes are not a verbatim account of proceedings, are not meeting minutes, and do not represent any final decisions or official documentation for the project or participating agencies.*

Attendees

Relicensing Team Members	Agencies and Interested Stakeholders
Brad Blood, Psomas	Alyssa Marquez, CDFW
Carissa Shoemaker, ERM	James "Jim" Erdman, CDFW
Finlay Anderson, Kleinschmidt	
Matthew Woodhall, SCE	
Shannon Luoma, Kleinschmidt	
Steve Norton, Psomas	

Meeting Goal

- Finalize Wildlife Study Plan
- If time: Continue planning for 2022 field season

Recent Study Plan Updates

- Updated rec study components
    - Data of interest:
        - Timing of recreationalists use relative to YOTO breeding season
            - May (post-snowmelt)
        - Determine type of recreational transit: foot or bicycle
- Updated YOTO survey methods, notably:
    - removed June 1-Sept 30.
    - replaced with: start after snow melt. Will include communication with SCE operations staff to assist in determining appropriate survey start date.
    - Determined to use inlets to Tioga Lake as indicator location of snow melt
    - Psomas to provide SCE Ops with criteria for Tioga Lake inlet check (Photo sites, etc.).
    - Will use CDFW high mnt datasheet or similar to collect relevant data
    - GPS location, habitat photo, and (where relevant) life-stage photo, will be collected at each YOTO observation site.
    - Will record lake elevations during each visit.
- Expanded Study Area
    - Now includes inlets at Tioga Lake.
    - Include flexibility to expand survey area where relevant.
    - Previously included areas include:
        - area downstream of Tioga Dam.

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        - north and south inlets at Saddlebag.
        - known population south of Saddlebag.
    - Include focused habitat assessment in 2022 of presumptive wet-meadows along Lee Vining Creek (generally located upstream of Sawmill Campground). Locations determined based on Google Earth aerial photography but need ground truthing. Areas will be evaluated as suitable habitat based on the presence of USFWS-defined Primary Constituent Elements.
    - 2023 YOTO survey efforts will be determined based on the results of 2022 survey results and other related licensing efforts.
- Review of mapped contours of Tioga littoral zone.

General Project Information

- Lake elevations at Tioga and Ellery are mandated to be kept within a narrow range (generally speaking: near full capacity) for most of the recreational year.
- Saddlebag daily release amount established at the beginning of each year (generally in April) then generally remains unchanged until the Fall.

Action Items

- License team to communicate with SCE operations staff to schedule at minimum a weekly photograph of the snowpack/melt at the southern inlet to Tioga Lake. Photo will be sent to License team to determine when toad surveys must start. Psomas to email to CDFW and USFWS.
- CDFW to send approximate points of focused habitat assessment along Lee Vining Creek to be conducted by License Team in 2022 field season.

B-24_Comments on Revised Technical Study Plan

From:	Shannon Luoma
To:	Carissa Shoemaker
Subject:	FW: [External Email]Lee Vining Study Plan Meeting Invite
Date:	Thursday, April 14, 2022 4:23:53 PM
Attachments:	image003.png Outlook-Forest Ser.png

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Thursday, March 31, 2022 8:53 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Allison Rudalevige <allison.rudalevige@psomas.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Edith Read <marshmistress@msn.com>; Brad Blood <bblood@psomas.com>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>; Patricia.Moyer@Wildlife.ca.gov
Subject: Re: [External Email]Lee Vining Study Plan Meeting Invite

Hi Alison and Shannon

Per Alison's email, when the methods and sites are more refined, please send it to me.

My initial comments

In the RTSP, 6.1.3 (page 99/260) it states that only 2016 and 2021 will be analyzed.

This seems problematic because 2016 had about average precipitation, but followed four years of below average precip and 2021 was below average (see image below).

How will "healthy" vegetation be indicated if the only data is from these years and consists of only two data points?

Please do your best to use the data from 1999-2001, 2006, 2011, 2016 and 2021.

If that isn't possible, I'm not sure how useful this will be and we might need to explore other options.

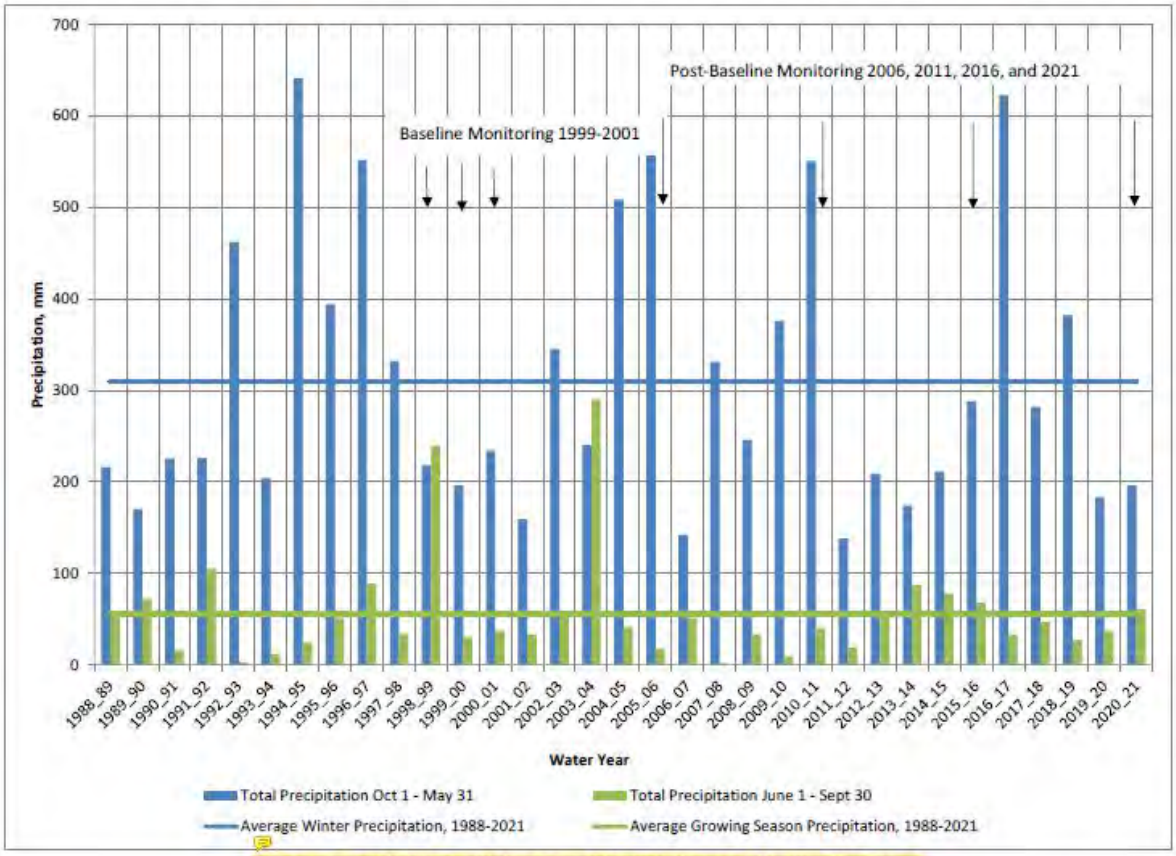

Figure 3. Precipitation in Water Year 2020-2021 Compared to Previous Years

How will the riparian communities be delineated in these images?

Will you ground truth the remote sensing data to ensure it is the correct vegetation type?

In the monitoring report for the current license, this technique is used where there are existing vegetation transects.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Wednesday, March 30, 2022 14:57
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Allison Rudalevige <allison.rudalevige@psomas.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Edith Read <marshmistress@msn.com>; Brad Blood <bblood@psomas.com>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: RE: [External Email]Lee Vining Study Plan Meeting Invite

Hi Rick – The language Allison provided below was included in the Revised Technical Study Plans (RTSP) distributed in February.

When we last spoke, USFS was waiting to provide comments on the riparian RTSP until you received the 2021 monitoring report. I understand you were sent that report and all of the date a week or so ago. Should we expect further comments? As mentioned on the meeting on Monday, we are working on finalizing these plans and moving into implementation, so the sooner we can hear from you the better.
Thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, March 29, 2022 7:28 AM
To: Allison Rudalevige <allison.rudalevige@psomas.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Cc: Edith Read <marshmistress@msn.com>; Brad Blood <bblood@psomas.com>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>
Subject: Re: [External Email]Lee Vining Study Plan Meeting Invite

Thank you Alison.

Please send me the information as you finalize it.

I hope that we will have a review period to discuss this once you have a final protocol, since it wasn't part of the original study plan.

Also when communicating with the INF concerning Lee Vining FERC, please include Monique Sanchez and Sheila Irons.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Allison Rudalevige <allison.rudalevige@psomas.com>
Sent: Monday, March 28, 2022 14:57
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Cc: marshmistress@msn.com <marshmistress@msn.com>; Brad Blood <bblood@psomas.com>
Subject: RE: [External Email]Lee Vining Study Plan Meeting Invite

Hi Richard-
Since CDFW and USFS requested additional riparian studies, we are proposing a desktop characterization study of select riparian habitat area(s) to document potential changes resulting from hydro-resource optimization. The new text has been added as Section 6.1.3. I've copied it below. We are in the process of refining this text to provide details on methods and site selection.

A desktop characterization study will be performed on selected portion(s) of the riparian corridor using historic aerial imagery and infrared imagery flown as part of the previous license requirements. The aerial imagery will be used to map riparian community extent and a Normalized Difference Vegetation Index (NDVI) will be obtained from the existing infrared photography. NDVI quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). A high NDVI value indicates "healthy" vegetation because it reflects more near-infrared and green light compared to other wavelengths and absorbs more red and blue light. Due to issues with the resolution of earlier infrared imagery, only infrared imagery from 2016 and 2021 will be analyzed; this provides information on the riparian corridor before and after hydro-resource optimization. To document changes in the riparian corridor, the study would need to determine what vegetation communities (or individual species) correspond to a particular infrared wavelength. Since the historic aerial and infrared imagery was not ground-truthed, the analysis will be limited to riparian shrub extent.

Allison D. Rudalevige

PSOMAS 75 1946-2021

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

-----Original Appointment-----
From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov> **On Behalf Of** Carissa Shoemaker
Sent: Monday, March 28, 2022 2:51 PM
To: Allison Rudalevige; Sanchez, Monique - FS; Irons, Sheila -FS; Shannon Luoma; Finlay Anderson; Wiese, Michael - FS, Bishop, CA; Matthew Woodhall; culture@bridgeportindiancolony.com; nayanake@comcast.net; kutzanuumu@yahoo.com; kathybncrft@yahoo.com; monty.bengochia@bishoppaiute.org; jbethel@northforkrancheria-nsn.gov; paiute11@aol.com; t.braithwaite@bentonpaiutereservation.org; nativearchdoc@yahoo.com; Chair@lppsr.org; ssmiwuknation@gmail.com; sandra47roy@gmail.com; darrel.cruz@washoetribe.us; businesscommittee@fortindependence.com; tilford.denver@bishoppaiute.org; durhamdthvlly@aol.com; thpo@timbisha.com; efink@nfr-nsn.gov; secretary@southernsierramiwuknation.org; rfuller@mewuk.com; george@timbisha.com; chair@bridgeportindiancolony.com; rwgoode911@hotmail.com; d.gutierrez@bigpinepaiute.org; env@bridgeportindiancolony.com; char54lange@gmail.com; c.levine@bigpinepaiute.org; s.manning@bigpinepaiute.org; cmcdonald@northforkrancheria-nsn.gov; steven.orihuela@bishoppaiute.org; jon@mewuk.com; lucy_basket4@yahoo.com; andrea@mewuk.com; claymiwumati@gmail.com; shanesaulque@hotmail.com; falconkeeper22@gmail.com;

thpo@fortindependence.com; jocelynsheltraw@gmail.com; serrell.smokey@washoetribe.us; l.stewart@bigpinepaiute.org; jjthompson@timbisha.com; dtonenna@gmail.com; chairman@wrpt.org; lav1@humboldt.edu; BryAnna.Vaughan@bishoppaiute.org; events@mammothmuseum.org; frontierpacktrain@gmail.com; ferccaseadmin@sce.com; FOMLR@bodiefoundation.org; info@friendsoftheinyo.org; comdev@mono.ca.gov; info@monolake.org; saddlebaglake@gmail.com; chair@toiyabe.sierraclub.org; calweb@tnc.org; tiogalodge@gmail.com; tiogapassresortllc@gmail.com; triplepointh2o@gmail.com; Jonathan Aguayo; Aguirre orozco, Victor - FS; wayne.allen@sce.com; talpaugh@kearnswest.com; holly@inyo-monowater.org; Alvarez, Dawn -FS; Philipana@aol.com; markbagley02@gmail.com; Rose.Banks@wildlife.ca.gov; Barnett, Adam -FS; justin_barrett@fws.gov; Heather_Beeler@fws.gov; president@esaudubon.org; Beidl, Jacqueline -FS; bbell@co.tuolumne.ca.us; ethan@stillwatersci.com; hydroesq@schat.net; Lizbergeron; Brad Blood; Blythe Haverstock, Ashley - FS; stephen_bowes@nps.gov; Nick.Buckmaster@wildlife.ca.gov; sb@snowhydrology.com; burger@stillwatersci.com; bburman@usbr.gov; seth.carr@sce.com; acohen@stillwatersci.com; rcollins@caltrout.org; lcompas@hrassoc.com; lisa@monolake.org; shellydk@frontiernet.net; robbie@monolake.org; Matt Driscoll; Lauren@stillwatersci.com; gardenofegan@suddenlink.net; Ellsworth, Todd -FS; Engelhardt, Blake -FS; James.Erdman@wildlife.ca.gov; stephanie.fincher@sce.com; jora@friendsoftheinyo.org; Gamino, Nora -FS; katie@accessfund.org; nate@esavalanche.org; office@esavalanche.org; pgunsolley@gmail.com; ed.hancock@waterboards.ca.gov; Matthew.Harper@Kleinschmidtgroup.com; jmharty@kearnswest.com; Jenny Hatch; bryan.hatchell@colorado.edu; ghaverst@blm.gov; kelly.henderson@sce.com; Michael.Hross@KleinschmidtGroup.com; SJacobson@caltrout.org; naomi@teambishop.com; conservation@bristleconecnps.org; lilian_jonas@contractor.nps.gov; Saeed.Jorat@ladwp.com; nosmog@yahoo.com; jkrclr@gmail.com; Karen.Klosowski@Kleinschmidtgroup.com; jonklusmire@yahoo.com; cknight@caltrout.org; Tyler.Kreider@KleinschmidtGroup.com; Brandon.Kulik@KleinschmidtGroup.com; claire@monolake.org; Leong, Tristan -FS; russ@stillwatersci.com; info@rockcreekpackstation.com; alyssa.marquez@wildlife.ca.gov; pmcfarland395@gmail.com; McNeill, Richard - FS, BISHOP, CA; geoff@monolake.org; Chad_Mellison@fws.gov; bartshe@monolake.org; hmiller@hrassoc.com; david.moore@sce.com; Moore, Erin - FS, BISHOP, CA; Patricia.Moyer@Wildlife.ca.gov; easternsierraartist@gmail.com; Mullowney, Megan -FS; heather@stillwatersci.com; samantha.nelson@sce.com; Jill.north@waterboards.ca.gov; Steve Norton; Krista@stillwatersci.com; martin.ostendorf@sce.com; Fatima.Oswald@Kleinschmidtgroup.com; steve.parmenter@wildlife.ca.gov; Charles.partridge@sce.com; Mparuolo@mono.ca.gov; Paul.Pau@ladwp.com; Adam.Perez@ladwp.com; lprimosc@blm.gov; kquinlan16@gmail.com; marshmistress@msn.com; greg@monolake.org; ARoesberry@caltrout.org; GRoff@caltrout.org; maryroper51@gmail.com; paulR4shopping@verizon.net; calvin.rossi@sce.com; jstarost@blm.gov; Schlick, Kary -FS; wendy@friendsoftheinyo.org; cshutes@calsport.org; Sill, Nathan -FS; barb@farwestern.com; esommerauer@stillwatersci.com; pstickells@gmail.com; jstrickland@tu.org; wsugimura@mono.ca.gov; daniel.sussman@waterboards.ca.gov; parker.thaler@Waterboards.ca.gov; shawna_theisen@fws.gov; lthurston@stillwatersci.com; eric.tillemans@ladwp.com; Torres, Thomas - FS, MAMMOTH LAKES, CA; LTryba@kearnswest.com; nicolas.von@sce.com; curator@monobasinhistory.org; Washington, Jameisha - FS, Lee Vining, CA; jennifer.watts@waterboards.ca.gov; johnwentworth@mltpa.org; eric@friendsoftheriver.org; vince.white@sce.com; Scott@stillwatersci.com; Audry.Williams@sce.com; Brandy.Wood@Wildlife.ca.gov; Yarborough, Daniel -FS; Andrew.Yoder@kleinschmidtgroup.com; Kelly.Larimer@KleinschmidtGroup.com; beth.lawson@wildlife.ca.gov; Philip.Meyer@Waterboards.ca.gov

Cc: Jessica Strickland; blancapaloma@msn.com; Wiese, Michael - FS, Bishop, CA; Hassan, Rajaa@Waterboards; Comm Dev

Subject: FW: [External Email]Lee Vining Study Plan Meeting Invite

When: Monday, March 28, 2022 1:00 PM-4:00 PM (UTC-08:00) Pacific Time (US & Canada).

Where: Microsoft Teams Meeting

Hi Allison

In the meeting today, you talked doing some riparian characterization that I couldn't find mentioned in the study plan. Did I miss it? Could you please explain what you will be doing in more detail or send me the methodology that you will be using.

Thank you

rick

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Wednesday, January 19, 2022 3:47:36 PM (UTC-08:00) Pacific Time (US & Canada)
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; culture@bridgeportindiancolony.com <culture@bridgeportindiancolony.com>; nayanake@comcast.net <nayanake@comcast.net>; kutzanuumu@yahoo.com

<kutzanuumu@yahoo.com>; kathybncrft@yahoo.com <kathybncrft@yahoo.com>; monty.bengochia@bishoppaiute.org <monty.bengochia@bishoppaiute.org>; jbethel@northforkrancheria-nsn.gov <jbethel@northforkrancheria-nsn.gov>; paiute11@aol.com <paiute11@aol.com>; t.braithwaite@bentonpaiutereservation.org <t.braithwaite@bentonpaiutereservation.org>; nativearchdoc@yahoo.com <nativearchdoc@yahoo.com>; chair@lppsr.org <chair@lppsr.org>; ssmiwuknation@gmail.com <ssmiwuknation@gmail.com>; sandra47roy@gmail.com <sandra47roy@gmail.com>; darrel.cruz@washoetribe.us <darrel.cruz@washoetribe.us>; businesscommittee@fortindependence.com <businesscommittee@fortindependence.com>; tilford.denver@bishoppaiute.org <tilford.denver@bishoppaiute.org>; durhamdthvlly@aol.com <durhamdthvlly@aol.com>; thpo@timbisha.com <thpo@timbisha.com>; efink@nfr-nsn.gov <efink@nfr-nsn.gov>; secretary@southernsierramiwuknation.org <secretary@southernsierramiwuknation.org>; rfuller@mewuk.com <rfuller@mewuk.com>; george@timbisha.com <george@timbisha.com>; chair@bridgeportindiancolony.com <chair@bridgeportindiancolony.com>; Rwgoode911@hotmail.com <Rwgoode911@hotmail.com>; d.gutierrez@bigpinepaiute.org <d.gutierrez@bigpinepaiute.org>; env@bridgeportindiancolony.com <env@bridgeportindiancolony.com>; char54lange@gmail.com <char54lange@gmail.com>; c.levine@bigpinepaiute.org <c.levine@bigpinepaiute.org>; s.manning@bigpinepaiute.org <s.manning@bigpinepaiute.org>; cmcdonald@northforkrancheria-nsn.gov <cmcdonald@northforkrancheria-nsn.gov>; steven.orihuela@bishoppaiute.org <steven.orihuela@bishoppaiute.org>; jon@mewuk.com <jon@mewuk.com>; lucy_basket4@yahoo.com <lucy_basket4@yahoo.com>; andrea@mewuk.com <andrea@mewuk.com>; claymiwumati@gmail.com <claymiwumati@gmail.com>; shanesaulque@hotmail.com <shanesaulque@hotmail.com>; falconkeeper22@gmail.com <falconkeeper22@gmail.com>; thpo@fortindependence.com <thpo@fortindependence.com>; jocelynsheltraw@gmail.com <jocelynsheltraw@gmail.com>; serrell.smokey@washoetribe.us <serrell.smokey@washoetribe.us>; l.stewart@bigpinepaiute.org <l.stewart@bigpinepaiute.org>; jjthompson@timbisha.com <jjthompson@timbisha.com>; dtonenna@gmail.com <dtonenna@gmail.com>; chairman@wrpt.org <chairman@wrpt.org>; lav1@humboldt.edu <lav1@humboldt.edu>; BryAnna.Vaughan@bishoppaiute.org <BryAnna.Vaughan@bishoppaiute.org>; events@mammothmuseum.org <events@mammothmuseum.org>; frontierpacktrain@gmail.com <frontierpacktrain@gmail.com>; ferccaseadmin@sce.com <ferccaseadmin@sce.com>; FOMLR@bodiefoundation.org <FOMLR@bodiefoundation.org>; info@friendsoftheinyo.org <info@friendsoftheinyo.org>; comdev@mono.ca.gov <comdev@mono.ca.gov>; info@monolake.org <info@monolake.org>; saddlebaglake@gmail.com <saddlebaglake@gmail.com>; chair@toiyabe.sierraclub.org <chair@toiyabe.sierraclub.org>; calweb@tnc.org <calweb@tnc.org>; tiogalodge@gmail.com <tiogalodge@gmail.com>; tiogapassresortllc@gmail.com <tiogapassresortllc@gmail.com>; triplepointh2o@gmail.com <triplepointh2o@gmail.com>; jonathan.aguayo@psomas.com <jonathan.aguayo@psomas.com>; victor.aguirreorozco@usda.gov <victor.aguirreorozco@usda.gov>; wayne.allen@sce.com <wayne.allen@sce.com>; talpaugh@kearnswest.com <talpaugh@kearnswest.com>; holly@inyo-monowater.org <holly@inyo-monowater.org>; dawn.alvarez@usda.gov <dawn.alvarez@usda.gov>; Philipana@aol.com <Philipana@aol.com>; markbagley02@gmail.com <markbagley02@gmail.com>; Rose.Banks@wildlife.ca.gov <Rose.Banks@wildlife.ca.gov>; adam.barnett@usda.gov <adam.barnett@usda.gov>; justin_barrett@fws.gov <justin_barrett@fws.gov>; Heather_Beeler@fws.gov <Heather_Beeler@fws.gov>; president@esaudubon.org <president@esaudubon.org>; Jacqueline.beidl@usda.gov <Jacqueline.beidl@usda.gov>; bbell@co.tuolumne.ca.us <bbell@co.tuolumne.ca.us>; ethan@stillwaterwsci.com <ethan@stillwaterwsci.com>; hydroesq@schat.net <hydroesq@schat.net>; lbergeron@pcta.org <lbergeron@pcta.org>; bblood@psomas.com <bblood@psomas.com>; ashley.blythehaverstock@usda.gov <ashley.blythehaverstock@usda.gov>; stephen_bowes@nps.gov <stephen_bowes@nps.gov>; Nick.Buckmaster@wildlife.ca.gov <Nick.Buckmaster@wildlife.ca.gov>; sb@snowhydrology.com <sb@snowhydrology.com>; burger@stillwaterwsci.com <burger@stillwaterwsci.com>; bburman@usbr.gov <bburman@usbr.gov>; seth.carr@sce.com <seth.carr@sce.com>; acohen@stillwaterwsci.com <acohen@stillwaterwsci.com>; rcollins@caltrout.org <rcollins@caltrout.org>; lcompas@hrassoc.com <lcompas@hrassoc.com>; lisa@monolake.org <lisa@monolake.org>; shellydk@frontiernet.net <shellydk@frontiernet.net>; robbie@monolake.org <robbie@monolake.org>; matt.driscoll@sierranevada.ca.gov <matt.driscoll@sierranevada.ca.gov>; Lauren@stillwaterwsci.com <Lauren@stillwaterwsci.com>; gardenofegan@suddenlink.net <gardenofegan@suddenlink.net>; todd.ellsworth@usda.gov <todd.ellsworth@usda.gov>; blake.engelhardt@usda.gov <blake.engelhardt@usda.gov>; James.Erdman@wildlife.ca.gov <James.Erdman@wildlife.ca.gov>; stephanie.fincher@sce.com <stephanie.fincher@sce.com>; jora@friendsoftheinyo.org <jora@friendsoftheinyo.org>; nora.gamino@usda.gov <nora.gamino@usda.gov>; katie@accessfund.org <katie@accessfund.org>; nate@esavalanche.org <nate@esavalanche.org>; office@esavalanche.org <office@esavalanche.org>; pgunsolley@gmail.com <pgunsolley@gmail.com>; ed.hancock@waterboards.ca.gov <ed.hancock@waterboards.ca.gov>; Matthew.Harper@Kleinschmidtgroup.com <Matthew.Harper@Kleinschmidtgroup.com>; jmharty@kearnswest.com <jmharty@kearnswest.com>; jenny@sierranevadaalliance.org <jenny@sierranevadaalliance.org>; bryan.hatchell@colorado.edu <bryan.hatchell@colorado.edu>; ghaverst@blm.gov <ghaverst@blm.gov>; kelly.henderson@sce.com <kelly.henderson@sce.com>; Michael.Hross@KleinschmidtGroup.com <Michael.Hross@KleinschmidtGroup.com>; sheila.irons@usda.gov <sheila.irons@usda.gov>; SJacobson@caltrout.org <SJacobson@caltrout.org>; naomi@teambishop.com <naomi@teambishop.com>; conservation@bristleconecnps.org <conservation@bristleconecnps.org>; lilian_jonas@contractor.nps.gov <lilian_jonas@contractor.nps.gov>; Saeed.Jorat@ladwp.com <Saeed.Jorat@ladwp.com>; nosmog@yahoo.com <nosmog@yahoo.com>; jkrclr@gmail.com <jkrclr@gmail.com>; Karen.Klosowski@Kleinschmidtgroup.com <Karen.Klosowski@Kleinschmidtgroup.com>; jonklusmire@yahoo.com <jonklusmire@yahoo.com>; cknight@caltrout.org <cknight@caltrout.org>; Tyler.Kreider@KleinschmidtGroup.com <Tyler.Kreider@KleinschmidtGroup.com>; Brandon.Kulik@KleinschmidtGroup.com <Brandon.Kulik@KleinschmidtGroup.com>; claire@monolake.org <claire@monolake.org>; tristan.leong@usda.gov <tristan.leong@usda.gov>; russ@stillwaterwsci.com <russ@stillwaterwsci.com>; info@rockcreekpackstation.com <info@rockcreekpackstation.com>; alyssa.marquez@wildlife.ca.gov <alyssa.marquez@wildlife.ca.gov>; pmcfarland395@gmail.com <pmcfarland395@gmail.com>; Richard.McNeill@usda.gov <Richard.McNeill@usda.gov>; geoff@monolake.org <geoff@monolake.org>; Chad_Mellison@fws.gov <Chad_Mellison@fws.gov>; bartshe@monolake.org <bartshe@monolake.org>; hmiller@hrassoc.com <hmiller@hrassoc.com>; david.moore@sce.com <david.moore@sce.com>; Erin.Moore@usda.gov <Erin.Moore@usda.gov>; Patricia.Moyer@Wildlife.ca.gov <Patricia.Moyer@Wildlife.ca.gov>; easternsierraartist@gmail.com <easternsierraartist@gmail.com>; megan.mullowney@usda.gov <megan.mullowney@usda.gov>; heather@stillwaterwsci.com <heather@stillwaterwsci.com>; samantha.nelson@sce.com <samantha.nelson@sce.com>; Jill.north@waterboards.ca.gov <Jill.north@waterboards.ca.gov>; steve.norton@psomas.com <steve.norton@psomas.com>; Krista@stillwaterwsci.com <Krista@stillwaterwsci.com>; martin.ostendorf@sce.com <martin.ostendorf@sce.com>; Fatima.Oswald@Kleinschmidtgroup.com <Fatima.Oswald@Kleinschmidtgroup.com>; steve.parmenter@wildlife.ca.gov <steve.parmenter@wildlife.ca.gov>; Charles.partridge@sce.com <Charles.partridge@sce.com>; Mparuolo@mono.ca.gov <Mparuolo@mono.ca.gov>; Paul.Pau@ladwp.com <Paul.Pau@ladwp.com>; Adam.Perez@ladwp.com <Adam.Perez@ladwp.com>; lprimosc@blm.gov <lprimosc@blm.gov>; kquinlan16@gmail.com <kquinlan16@gmail.com>;

marshmistress@msn.com <marshmistress@msn.com>; greg@monolake.org <greg@monolake.org>; AROesberry@caltrout.org <AROesberry@caltrout.org>; GRoff@caltrout.org <GRoff@caltrout.org>; maryroper51@gmail.com <maryroper51@gmail.com>; paulR4shopping@verizon.net <paulR4shopping@verizon.net>; calvin.rossi@sce.com <calvin.rossi@sce.com>; allison.rudalevige@psomas.com <allison.rudalevige@psomas.com>; monique.sanchez@usda.gov <monique.sanchez@usda.gov>; jstarost@blm.gov <jstarost@blm.gov>; kary.schlick@usda.gov <kary.schlick@usda.gov>; wendy@friendsoftheinyo.org <wendy@friendsoftheinyo.org>; cshutes@calsport.org <cshutes@calsport.org>; nathan.sill@usda.gov <nathan.sill@usda.gov>; barb@farwestern.com <barb@farwestern.com>; esommerauer@stillwatersci.com <esommerauer@stillwatersci.com>; pstickells@gmail.com <pstickells@gmail.com>; jstrickland@tu.org <jstrickland@tu.org>; wsugimura@mono.ca.gov <wsugimura@mono.ca.gov>; daniel.sussman@waterboards.ca.gov <daniel.sussman@waterboards.ca.gov>; parker.thaler@Waterboards.ca.gov <parker.thaler@Waterboards.ca.gov>; shawna_theisen@fws.gov <shawna_theisen@fws.gov>; lthurston@stillwatersci.com <lthurston@stillwatersci.com>; eric.tillemans@ladwp.com <eric.tillemans@ladwp.com>; thomas.torres@usda.gov <thomas.torres@usda.gov>; LTryba@kearnswest.com <LTryba@kearnswest.com>; nicolas.von@sce.com <nicolas.von@sce.com>; curator@monobasinhistory.org <curator@monobasinhistory.org>; Jameisha.Washington@usda.gov <Jameisha.Washington@usda.gov>; jennifer.watts@waterboards.ca.gov <jennifer.watts@waterboards.ca.gov>; johnwentworth@mltpa.org <johnwentworth@mltpa.org>; eric@friendsoftheriver.org <eric@friendsoftheriver.org>; vince.white@sce.com <vince.white@sce.com>; Scott@stillwatersci.com <Scott@stillwatersci.com>; Audry.Williams@sce.com <Audry.Williams@sce.com>; Brandy.Wood@Wildlife.ca.gov <Brandy.Wood@Wildlife.ca.gov>; daniel.yarborough@usda.gov <daniel.yarborough@usda.gov>; Andrew.Yoder@kleinschmidtgroup.com <Andrew.Yoder@kleinschmidtgroup.com>; finlay.anderson@kleinschmidtgroup.com <finlay.anderson@kleinschmidtgroup.com>; Shannon.Luoma@KleinschmidtGroup.com <Shannon.Luoma@KleinschmidtGroup.com>; matthew.woodhall@sce.com <matthew.woodhall@sce.com>; Kelly.Larimer@KleinschmidtGroup.com <Kelly.Larimer@KleinschmidtGroup.com>; beth.lawson@wildlife.ca.gov <beth.lawson@wildlife.ca.gov>; Philip.Meyer@Waterboards.ca.gov <Philip.Meyer@Waterboards.ca.gov>
Cc: Jessica Strickland <Jessica.Strickland@tu.org>; Chris Shutes <BlancaPaloma@msn.com>; michael.wiese@usda.gov <michael.wiese@usda.gov>; Hassan, Rajaa@Waterboards <Rajaa.Hassan@Waterboards.ca.gov>; Comm Dev <commdev@mono.ca.gov>
Subject: [External Email]Lee Vining Study Plan Meeting Invite
When: Monday, March 28, 2022 1:00 PM-4:00 PM.
Where: Microsoft Teams Meeting

[External Email]
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Hello Lee Vining Relicensing participants,

Please join SCE and the relicensing team for our Study Plan Meeting on March 28, 2022 at 1pm PST to discuss Revised Study Plans.

Let me know if you have any questions
Thanks!

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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M 907 575 0294

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From:	Carissa Shoemaker
To:	Marquez, Alyssa@Wildlife
Subject:	RE: Lee Vining study plan meeting availability
Date:	Tuesday, April 12, 2022 11:32:00 AM
Attachments:	image001.png

Ok thanks Alyssa, I'll check in with Nick next Monday and follow up.

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Tuesday, April 12, 2022 10:43 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Lee Vining study plan meeting availability

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Hi Carissa,

Nick will also need to attend the meeting. It looks like Nick is off most of this week, so I'd recommend sending a follow-up message to him next Monday. April 20 from 4-5 is still open for me.

Thanks,

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Tuesday, April 12, 2022 10:39 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: RE: Lee Vining study plan meeting availability

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Hi Alyssa, are these timeslots still open for you? I haven't heard back from Nick so I'll just schedule something when you and our leads are available.

- 4/13: 9-10, 3-5
- 4/20: 9-11, 4-5

Thanks

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

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M 907 575 0294

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Wednesday, April 6, 2022 9:08 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: RE: Lee Vining study plan meeting availability

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Hi Carissa,

My current availability:

- 4/11: open
- 4/13: 9-10, 3-5
- 4/20: 9-11, 4-5

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>

Sent: Tuesday, April 5, 2022 9:20 PM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: Lee Vining study plan meeting availability

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Hi Alyssa and Nick,

We'd like to set up another call with you to discuss your comments on the Lee Vining study plans. Could you provide a couple options of your availability for a meeting next week and the following (weeks of April 11 and April 18)? Also please let me know if any other CDFW staff would need to or want to join.

Thank you!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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From:	Steve Norton
To:	Erdman, James@Wildlife; Marquez, Alyssa@Wildlife
Cc:	Matthew Woodhall; Brad Blood; Shannon Luoma; Carissa Shoemaker; Finlay Anderson
Subject:	Re: 3/30/22 Wildlife Study Plan Meeting Minutes
Date:	Friday, April 15, 2022 1:14:20 PM
Attachments:	image001.png image002.png image003.png

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Thanks Jim!

Steve Norton
P S O M A S | Balancing the Natural and Built Environment

Senior Biologist/Project Manager/Associate
Resource Management
714.481.8037 (office/cell)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Friday, April 15, 2022 1:10:17 PM
To: Steve Norton <steve.norton@psomas.com>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Matthew Woodhall <Matthew.Woodhall@sce.com>; Brad Blood <bblood@psomas.com>; Shannon.Luoma@Kleinschmidtgroup.com <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa.Shoemaker@erm.com <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: RE: 3/30/22 Wildlife Study Plan Meeting Minutes

Hi Steve and all,
I heard last week from the folks at Beaver Sporting Goods in Lee Vining that Highway 120 was plowed and cleared to the Tioga Pass gate.
Highway is still closed a few miles past Lee Vining and I assume the Saddlebag Lake dirt road has yet to be cleared.
Weather has been unstable but looks to be warming up next week.
I will keep you posted on any further developments.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, March 30, 2022 6:48 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>

Cc: Matthew Woodhall <Matthew.Woodhall@sce.com>; Brad Blood <bblood@psomas.com>; Shannon.Luoma@Kleinschmidtgroup.com; Carissa.Shoemaker@erm.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>

Subject: 3/30/22 Wildlife Study Plan Meeting Minutes

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Hi Jim and Alyssa,

Attached is a brief summary of the topics we discussed at the meeting.

Let me know if you have any edits or additions.

Thanks again for meeting with us.

-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Heather Neff
To: Meyer, Philip@Waterboards
Cc: Shannon Luoma; Carissa Shoemaker
Subject: RE: Lee Vining Fish Tissue Mercury Question
Date: Friday, April 15, 2022 4:37:53 PM

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Thank you Phillip. Have a nice weekend!

Heather Neff
Senior Aquatic Ecologist, Stillwater Sciences
Office: 530-756-7550 ex. 322
Cell: 530-848-9289
heather@stillwatersci.com

From: Meyer, Philip@Waterboards <Philip.Meyer@Waterboards.ca.gov>
Sent: Thursday, April 14, 2022 8:32 AM
To: Heather Neff <heather@stillwatersci.com>
Cc: Shannon.Luoma@KleinschmidtGroup.com; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Re: Lee Vining Fish Tissue Mercury Question

Hello Heather,

Thank you for reaching out. The purpose of the fish tissue study is to sample fish that may be caught and consumed by the public. Rainbow trout should be kept in the study plan because the focus of the study is to ensure that the Project is protective of human health and is compliant with water quality standards. Please let me know if you have any additional questions.

Thank you,

Philip Meyer

Environmental Scientist

Water Quality Certification Program

State Water Resources Control Board

(916) 341-5369

Philip.Meyer@waterboards.ca.gov

From: Heather Neff <heather@stillwatersci.com>
Sent: Wednesday, April 13, 2022 11:55 AM
To: Meyer, Philip@Waterboards <Philip.Meyer@Waterboards.ca.gov>
Cc: Shannon.Luoma@KleinschmidtGroup.com <shannon.luoma@kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Lee Vining Fish Tissue Mercury Question

EXTERNAL:

Hi Phillip,

As a follow-up to my voicemail earlier this week, I am hoping to connect with you regarding a fish tissue mercury question that came up for the Lee Vining Hydroelectric Project Relicensing. A little context: SWRCB requested a fish tissue study targeting all species in Project reservoirs; SCE included fish tissue mercury sampling and analysis as a study element in their Revised Study WQ-1 *Stream and Reservoir Water Quality*. CDFW subsequently provided comments on the fish tissue mercury component and stated "Mercury sampling should focus on brown trout or brook trout. More than 95% of rainbow trout captured in the Eastern Sierra are planted from CDFW hatcheries" and "Rainbow trout are hatchery-origin and could potentially be excluded in favor of increased wild fish sampling." Existing information indicates that all Rainbow Trout in the Lee Vining Project Area are likely stocked, sterile (e.g., triploid) trout.

SCE is interested in whether SWRCB concurs that Rainbow Trout can be removed from the fish tissue mercury analysis of Study WQ-1 *Stream and Reservoir Water Quality*?

Feel free to call me directly to discuss.

Many thanks,

Heather

Heather Neff
Senior Aquatic Ecologist
Office: 530-756-7550 ex. 322
Cell: 530-848-9289
heather@stillwatersci.com
Stillwater Sciences
279 Cousteau Place #400, Davis, CA 95618
tel 530-756-7550
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From:	Shannon Luoma
To:	Buckmaster, Nick@Wildlife; Marquez, Alyssa@Wildlife; Lawson, Beth@Wildlife
Cc:	Carissa Shoemaker
Subject:	RE: Lee Vining study plan comments
Date:	Monday, April 25, 2022 8:28:23 AM
Attachments:	image001.jpg

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This is great, thanks Nick! Appreciate your quick turnaround.

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>
Sent: Monday, April 25, 2022 7:44 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Lee Vining study plan comments

Shannon,

I am in the field at the moment, but I would refer you to:

Zale, Alexander V., Donna L. Parrish, and Trent M. Sutton, eds. *Fisheries techniques*. Bethesda, Maryland: American Fisheries Society, 2012.

For information of how to stratify and conduct a creel survey- your consultants should have this information, but it is a good basic introduction to this approach

Re: otoliths- this is a very common fish aging technique. There are a couple of textbooks that discuss the validity of this method compared to scales, and I am happy to provide citations if needed. For information on bias regarding Sierra trout, start with:

Hall, D. L. "Age validation and aging methods for stunted brook trout." *Transactions of the American Fisheries Society* 120, no. 5 (1991): 644-649.

Thanks.

Nick Buckmaster
(760) 920-8391

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Saturday, April 23, 2022 10:30 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Lee Vining study plan comments

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Alyssa, Nick and Beth –

Apologies for the late in the day email at the end of the week. We're filing the final study plans for Lee Vining on Monday and wanted to send you a quick email about some of the comments you had on the revised plans. With people being less and less available it seemed unlikely we were going to have everyone on one call, so an email seemed like the best course of action. You'll see we're incorporating several of your comments, but a few we are not. Below is a brief summary of our

responses to select comments. Let me know if you have questions or want to discuss further. Thanks, have a great weekend!

Re Removing rainbow trout from the tissue studies: The State Water Board has asked that we keep them in to help quantify potential impacts to human health and water quality. So we'll continue to include rainbow trout in our fish surveys.

Re Otoliths: Scales are the most commonly used calcified structure for aging fish and have been used to valuate high-elevation fish populations throughout California, including previous surveys in Lee Vining Creek (Salamunovich 2017) and surveys of other streams in the Mono Basin (e.g., Bishop Creek). In the interest of obtaining age information for the current Lee Vining fish population, maintaining comparability of fish population structure to prior surveys, and having a minimal impact to the population, we intend to maintain the use of scales to approximate fish age. Additionally, we have been unable to locate studies involving otoliths and are interested in reviewing the data cited by CDFW, please send along those reports for review when you can.

Re flow studies: The request for a new flow study was submitted two months after the FERC comment period which ended in January, which followed nearly 6 months of TWG meetings in the first half of 2021. In Aquatics TWG meetings held in January, February, March, and May 2021, SCE developed and presented the study plan that has become *AQ-3 Aquatic Habitat Mapping and Sediment Characterization.* This study was developed in consultation with stakeholders, including the CDFW, who requested a qualitative habitat mapping study. Additionally, SCE believes that the current available data and existing studies provide sufficient information to identify potential impacts. However, SCE is intending to implement the channel morphology and the fish population studies this study year. Should those studies produce unexpected data or identify potential impacts not previously identified, SCE will consider an alternate flow study or adapting the AQ 3 study after discussions with the TWG.

Re operations model: SCE and FERC use the current baseline conditions (existing Project) to identify and analyze any potential effects. SCE does not agree that unimpaired hydrology, or pre-project conditions, present a useful basis of comparison and will therefore not develop unimpaired hydrology. Additionally, SCE considers generation and revenue to be internal considerations that should not drive discussions surrounding potential effects. This information will not be developed for any publicly available version of the operations model.

Re Creel Surveys: We intend to conduct creel surveys at the Tioga and Ellery campgrounds; can CDFW confirm that there are no other day use areas at those lakes you are referring to? Want to make sure we're talking about the same locations. Also, please provide more information on what you mean by stratified blocks.

Thanks, have a great weekend!

Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614
www.KleinschmidtGroup.com

B-29_Notice re final Technical Study Plans availability

From:	Matthew Woodhall
Cc:	Shannon Luoma; Finlay Anderson; Martin Ostendorf; Kelly.Larimer@KleinschmidtGroup.com; Carissa Shoemaker; allison.rudalevige@psomas.com; Brad Blood; steve.norton@psomas.com; marshmistress@msn.com; Shelly DavisKing; Audry Williams; lcompas@hrassoc.com; Matthew.Harper@Kleinschmidtgroup.com; Angela.Whelpley@KleinschmidtGroup.com; Heather Bowen Neff; Adam Cohen
Subject:	Lee Vining Final Technical Study Plans
Date:	Friday, May 6, 2022 1:10:01 PM
Attachments:	image001.png

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Hello Lee Vining Technical Working Group members,

The Lee Vining Final Technical Study Plans were filed with FERC on Monday April 25, 2022. The document is now available on the Lee Vining Relicensing website and can also be found on the Project's FERC docket (P-1388) online (at this link). SCE greatly appreciates your input in developing these plans. Several of the studies will be implemented this spring. We are looking forward to kicking off the fieldwork and sharing the study results with you when they are available.

As a general reminder, all stakeholders have the option to register and subscribe on FERC's public website to receive communication directly from FERC throughout the relicensing process. This will ensure timely receipt of all filings made by FERC, SCE, and stakeholders. Once registered, future communications related to this relicensing will arrive primarily via FERC communications, therefore, it is important that interested parties register on FERC's website https://www.ferc.gov/docs-filing/esubscription.asp.

Thanks,

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

B-30.1_Discussion re draft Recreation Nexus Survey (attached)

From:	Shannon Luoma
To:	Sanchez, Monique - FS
Cc:	Carissa Shoemaker
Subject:	Lee Vining Recreation Nexus Survey Questions
Date:	Tuesday, May 10, 2022 4:37:03 PM
Attachments:	image001.jpg REC1_2022 Survey Qs_May 2022.docx

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Hi Monique!

As you know, SCE is planning to implement the Recreation 1 Nexus Surveys this spring. These will be in-person surveys at various locations in the project area on randomly generated dates throughout the spring/summer. Results of these surveys will be used to help SCE and the USFS identify where we should focus the Recreation Use and Needs Surveys in 2023. Attached is a draft copy of the recreation nexus questions we're planning to ask and we'd like get a call set up for next week to get your input on them.

1. Does the FS agree that these questions will be useful in helping to identify project nexus?
    a. if not, what other question would you suggest?
2. We're hoping to get out for our first surveys in May, but Tioga Pass is not open yet and we're assuming the facilities owned by the Forest Service are also not yet ready. Do you have an idea what percentage of facilities will be open once the road opens and/or how long of a delay there might be?

Can you please send over a few dates/times that work for you and let me know who else from the FS should be included?

Thank you, hope you're well!

Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614
www.KleinschmidtGroup.com

[Describe the area and terminology (Lee Vining Canyon [Upper vs Lower], Inyo facilities, etc.). Include orientation map.]

1. What is the primary purpose of your trip to Lee Vining Canyon? (See map for reference)
    a. Passing through on my way to Yosemite National Park
    b. Passing through on my way to Eastern Sierras (Mono Lake, June Lake, Mammoth Lakes, Bishop, etc.)
    c. Recreate in the Upper Lee Vining Canyon (Saddlebag Lake, Lee Vining Creek, Tioga Lake, Glacier Creek, Ellery Lake, etc.)
    d. Recreate in the Lower Lee Vining Canyon (Campgrounds and Lee Vining Creek access below Poole Powerhouse)
2. Other than camping, which of the following developed, Inyo NF recreation sites and informal recreation areas do you plan to visit on this trip to the Lee Vining Canyon? (Select all that apply)

Upper Lee Vining Canyon		**Lower Lee Vining Canyon**	
☐	Saddlebag Lake Campground	☐	Fishing along Lee Vining Creek below Poole Powerhouse
☐	Saddlebag Lake Day Use Area	☐	Big Bend Campground
☐	Saddlebag Lake Trailhead (Saddlebag Lake Loop Trail)	☐	Aspen Grove Campground
☐	Sawmill Walk-In Campground	☐	Boulder Day Use Area
☐	Fishing along Lee Vining Creek below Saddlebag	☐	Moraine Campground
☐	Fishing along Glacier Creek below Tioga	☐	Lower Lee Vining Campground
☐	Carnegie Station Trailhead	☐	Cattleguard Campground
☐	Gardisky Lake Trailhead		
☐	Junction Campground		
☐	Bennettville Trailhead		
☐	Tioga Lake Overlook Info Site		
☐	Glacier Canyon Trailhead		
☐	Nunatak-Tioga Tarns Trailhead		
☐	Tioga Lake Campground		
☐	Nunatak Nature Trail	☐	Tioga Lodge
☐	Ellery Lake Campground	☐	N/A – I'm just here to camp
☐	Warren Fork Trailhead	☐	*Other (Please specify)*

3. Which activities have you, or will you participate in during your visit? (Select all that apply)

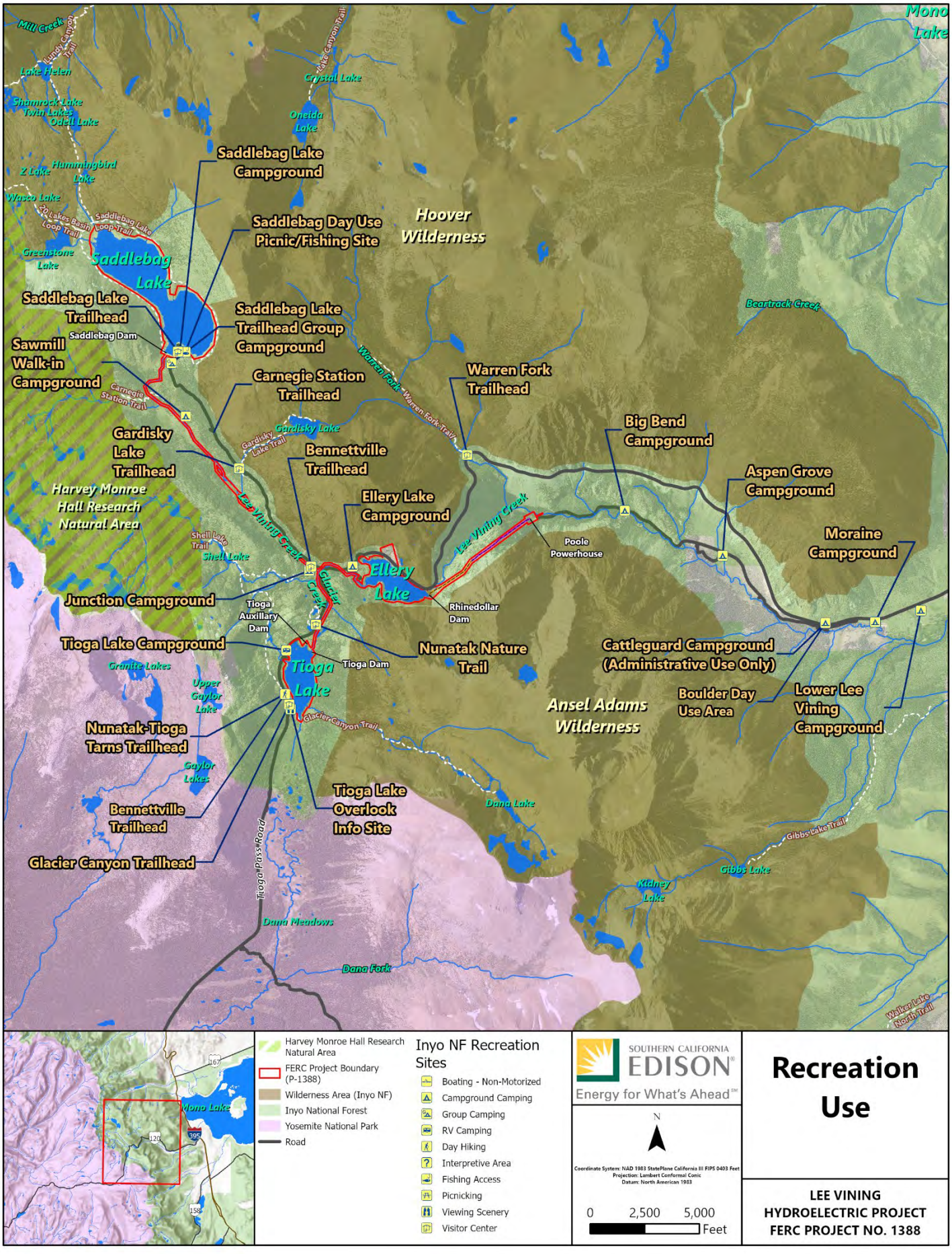
Participating? (Select all that apply)	***Activity***	***Primary (Select One)***
☐	*Camping (Developed Campground)*	☐
☐	*Fishing (creek)*	☐
☐	*Fishing (reservoir)*	☐
☐	*Hiking/Trail Use (Day Use)*	☐
☐	*Hiking/Trail Use/Overnight Camping (Wilderness)*	☐
☐	*Boating*	☐
☐	*Biking*	☐
☐	*Photography*	☐
☐	*Picnicking*	☐
☐	*Rock Climbing*	☐
☐	*Viewing Scenery*	☐
☐	*Scenic Driving*	☐

4. Are you staying overnight in the Lee Vining Canyon?
    a. No
        i. Why not?
            1. Passing through and staying at Yosemite National Park
            2. Passing through and staying in the Eastern Sierras
            3. Local day trip
            4. No reservations/campsites available in Lee Vining Canyon
    b. Yes
        i. Where are you staying?

Upper Lee Vining Canyon		**Lower Lee Vining Canyon**	
☐	Saddlebag Lake Campground	☐	Big Bend Campground
☐	Sawmill Walk-In Campground	☐	Aspen Grove Campground
☐	Junction Campground	☐	Moraine Campground
☐	Tioga Lake Campground	☐	Lower Lee Vining Campground
☐	Ellery Lake Campground	☐	Cattleguard Campground
☐	Overnight Hiking (Wilderness) *(Please indicate which trailhead you will be using)*		

5. Please provide more information on why you chose to stay at this location.
    a. This was my preferred location
    b. I preferred to stay elsewhere but was unable
        i. Where did you prefer to stay?
            1. Fill in the black
        ii. Why were you unable to stay at your preferred location?
            1. Fill in the blank
6. Anything else you'd like to share about why you're in the area and what your plans are?

B-30.1_Discussion re draft Recreation Nexus Survey (attached)



B-30.2_Discussion re draft Recreation Nexus Survey (attached)

From:	Shannon Luoma
To:	Barnett, Adam -FS; andrew.kennedy@usda.gov; Irons, Sheila -FS
Cc:	Sanchez, Monique - FS; Carissa Shoemaker
Subject:	Lee Vining Recreation Nexus Survey Questions
Date:	Thursday, May 12, 2022 7:31:28 AM
Attachments:	image001.jpg REC1_2022 Survey Qs_May 2022.docx

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Hello!

As most of you know, SCE is planning to implement the Rec 1 Nexus Surveys for Lee Vining this spring. These will be in-person surveys at various locations in the project area on randomly generated dates throughout the spring/summer. Results of these surveys will be used to help SCE and the USFS identify where we should focus the Recreation Use and Needs Surveys in 2023. Attached is a draft copy of the recreation nexus questions we're planning to ask and we'd like get a call set up for next week to get your input on them.

1. Does the FS agree that these questions will be useful in helping to identify project nexus?
    a. if not, what other question would you suggest?
2. We're hoping to get out for our first surveys in May, but Tioga Pass is not open yet and we're assuming the facilities owned by the Forest Service are also not yet ready. Do you have an idea what percentage of facilities will be open once the road opens and/or how long of a delay there might be?

Can you please send over a few dates/times that work for you all and include anyone I may have missed?

Thank you, hope you're all well!

Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614
www.KleinschmidtGroup.com

[Describe the area and terminology (Lee Vining Canyon [Upper vs Lower], Inyo facilities, etc.). Include orientation map.]

1. What is the primary purpose of your trip to Lee Vining Canyon? (See map for reference)
    a. Passing through on my way to Yosemite National Park
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2. Other than camping, which of the following developed, Inyo NF recreation sites and informal recreation areas do you plan to visit on this trip to the Lee Vining Canyon? (Select all that apply)

Upper Lee Vining Canyon		**Lower Lee Vining Canyon**	
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☐	Junction Campground		
☐	Bennettville Trailhead		
☐	Tioga Lake Overlook Info Site		
☐	Glacier Canyon Trailhead		
☐	Nunatak-Tioga Tarns Trailhead		
☐	Tioga Lake Campground		
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☐	*Fishing (creek)*	☐
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☐	*Hiking/Trail Use/Overnight Camping (Wilderness)*	☐
☐	*Boating*	☐
☐	*Biking*	☐
☐	*Photography*	☐
☐	*Picnicking*	☐
☐	*Rock Climbing*	☐
☐	*Viewing Scenery*	☐
☐	*Scenic Driving*	☐

4. Are you staying overnight in the Lee Vining Canyon?
    a. No
        i. Why not?
            1. Passing through and staying at Yosemite National Park
            2. Passing through and staying in the Eastern Sierras
            3. Local day trip
            4. No reservations/campsites available in Lee Vining Canyon
    b. Yes
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Upper Lee Vining Canyon		**Lower Lee Vining Canyon**	
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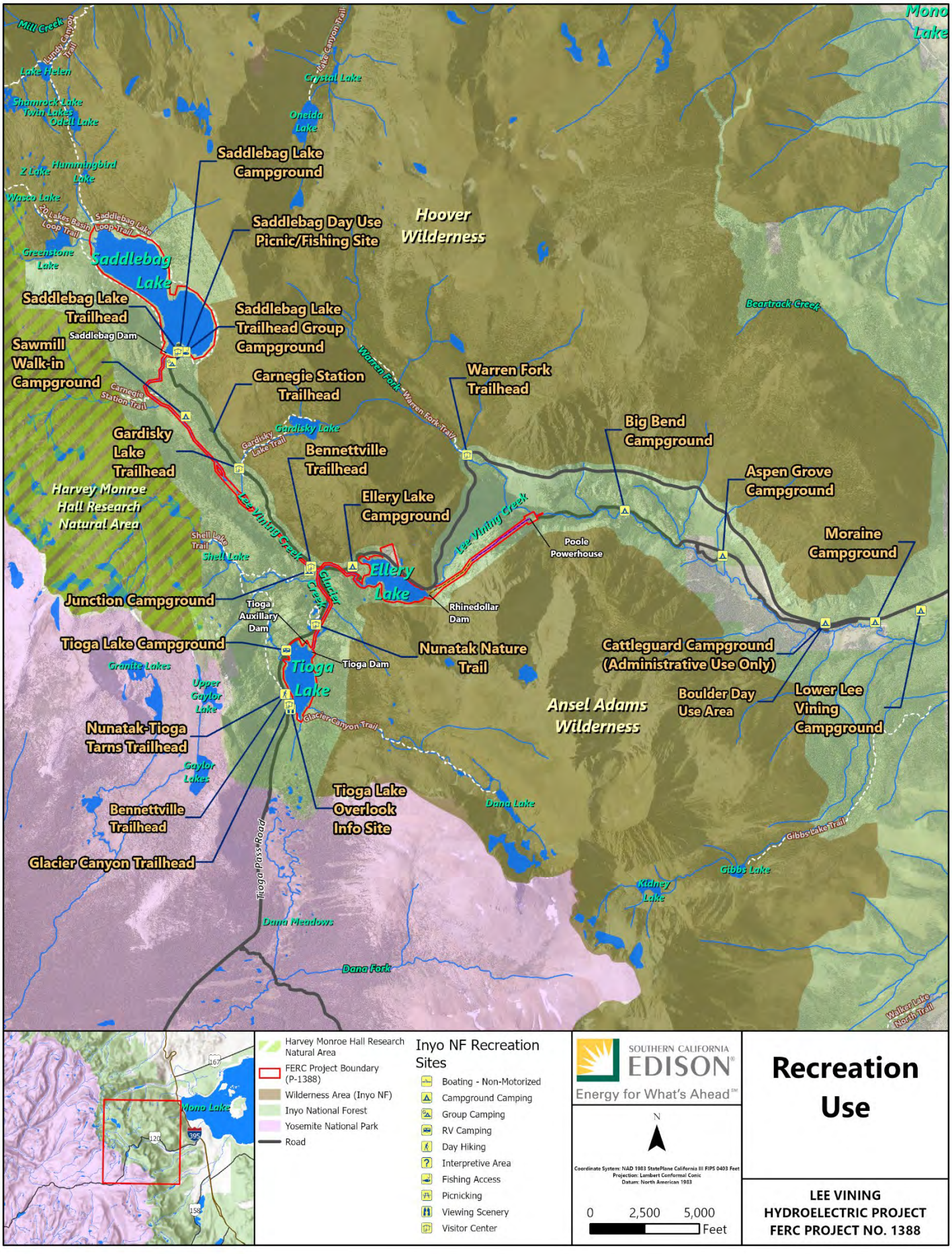
6. Anything else you'd like to share about why you're in the area and what your plans are?

B-30.2_Discussion re draft Recreation Nexus Survey (attached)



Carissa Shoemaker

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Friday, May 13, 2022 10:17 AM
To: Barnett, Adam -FS
Cc: Carissa Shoemaker
Subject: RE: [External Email]Lee Vining Recreation Nexus Survey Questions

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Thank you, Adam!
Let me know when you think the FS team will be able to make a call to discuss the survey questions.
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Barnett, Adam -FS <adam.barnett@usda.gov>
Sent: Friday, May 13, 2022 7:35 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: RE: [External Email]Lee Vining Recreation Nexus Survey Questions

Hi Shannon, these are the planned opening dates for the upper Lee Vining campgrounds. Adam

Inyo National Forest
Mono Lake District
2022 Minimum Operating Season Schedule

Location	Scheduled to Open
June Lake Loop	
Gull Lake	April 29
June Lake	April 29
Oh! Ridge (Field Sales Location)	April 29
Reversed Creek	May 06
Silver Lake	April 22
Aerie Crag	April 29
Lee Vining Canyon	
Big Bend	May 27
Ellery	May 27
Tioga Lake	June 3
Junction	June 3
Sawmill Walk-In	June 3
Saddlebag	June 10
Trailhead Group	June 24

Adam Barnett
Public Services Staff Officer
Forest Service
Inyo National Forest
p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov
351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

Caring for the land and serving people

B-30.3_Follow up to discussion re draft Recreation Nexus Survey

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Thursday, May 12, 2022 7:30 AM
To: Barnett, Adam -FS <adam.barnett@usda.gov>; Kennedy, Andrew -FS <andrew.kennedy@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>
Cc: Sanchez, Monique - FS <monique.sanchez@usda.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: [External Email]Lee Vining Recreation Nexus Survey Questions

[External Email]
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Hello!

As most of you know, SCE is planning to implement the Rec 1 Nexus Surveys for Lee Vining this spring. These will be in-person surveys at various locations in the project area on randomly generated dates throughout the spring/summer. Results of these surveys will be used to help SCE and the USFS identify where we should focus the Recreation Use and Needs Surveys in 2023. Attached is a draft copy of the recreation nexus questions we're planning to ask and we'd like get a call set up for next week to get your input on them.

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Can you please send over a few dates/times that work for you all and include anyone I may have missed?

Thank you, hope you're all well!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Kleinschmidt
Office: 425.528.1614
www.KleinschmidtGroup.com

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B-30.4_USFS edits to Recreation Nexus Survey questions

From: Barnett, Adam -FS
To: Shannon Luoma
Subject: RE: [External Email]RE: Lee Vining Recreation Nexus Survey Questions
Date: Tuesday, May 24, 2022 8:29:58 AM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.jpg

Hi Shannon,

I did have a couple edits for the survey instrument:

1. Remove Cattleguard CG from the survey because it is not open for public camping
2. Remove Cattleguard CG from the map (it is currently shown in the wrong location anyway)

Thanks,

Adam

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

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From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Tuesday, May 17, 2022 11:04 AM
To: Barnett, Adam -FS <adam.barnett@usda.gov>; Kennedy, Andrew -FS <andrew.kennedy@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>
Cc: Sanchez, Monique - FS <monique.sanchez@usda.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: [External Email]RE: Lee Vining Recreation Nexus Survey Questions

[External Email]
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Hello everyone!

Checking back in to see if you've been able to review the nexus questions (attached here for reference) and are ready to discuss these and the survey schedule. Please let me know when is good for you.
Thanks!

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Shannon Luoma
Sent: Thursday, May 12, 2022 7:30 AM
To: Barnett, Adam -FS <adam.barnett@usda.gov>; 'andrew.kennedy@usda.gov' <andrew.kennedy@usda.gov>; Irons, Sheila -FS <sheila.irons@usda.gov>
Cc: Sanchez, Monique - FS <monique.sanchez@usda.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: Lee Vining Recreation Nexus Survey Questions

Hello!

As most of you know, SCE is planning to implement the Rec 1 Nexus Surveys for Lee Vining this spring. These will be in-person surveys at various locations in the project area on randomly generated dates throughout the spring/summer. Results of these surveys will be used to help SCE and the USFS identify where we should focus the Recreation Use and Needs Surveys in 2023. Attached is a draft copy of the recreation nexus questions we're planning to ask and we'd like get a call set up for next week to get your input on them.

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Can you please send over a few dates/times that work for you all and include anyone I may have missed?

Thank you, hope you're all well!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614
www.KleinschmidtGroup.com

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From: Barnett, Adam -FS
To: Shannon Luoma
Subject: RE: [External Email]Lee Vining Nexus Survey Schedule
Date: Wednesday, May 25, 2022 9:16:53 AM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.jpg

Hi Shannon,

Nunatak TH is not collocated with the Tioga Lk Overlook/Glacier TH. They are about 0.9 mi apart. Not sure if it's practicable to survey both at the same time.

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

Caring for the land and serving people

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Tuesday, May 24, 2022 3:23 PM
To: Leong, Tristan -FS <tristan.leong@usda.gov>; Barnett, Adam -FS <adam.barnett@usda.gov>
Cc: Irons, Sheila -FS <sheila.irons@usda.gov>; Sanchez, Monique - FS <monique.sanchez@usda.gov>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Matthew Harper <Matthew.Harper@Kleinschmidtgroup.com>; Angela Whelpley <Angela.Whelpley@KleinschmidtGroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: [External Email]Lee Vining Nexus Survey Schedule

[External Email]
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Hello everyone!
Per our discussion yesterday, attached is the schedule identifying sites, dates we will survey and the order in which each site will be surveyed each day. Once you open the spreadsheet you'll see that with the two shifts per day, we're only allowing ~15 minutes per facility. Right now the plan is to proceed as shown in the spreadsheet, but plan to check in with our field team regularly and maintain

flexibility as needed.

Thanks, let us know if you have questions.
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614
www.KleinschmidtGroup.com

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B-31.1_Photos of snow and ice at Tioga Lake

From: Erdman, James@Wildlife
To: Steve Norton; Mellison, Chad; Marquez, Alyssa@Wildlife
Cc: Shannon Luoma; Carissa Shoemaker; Brad Blood; Finlay Anderson; Matthew Woodhall
Subject: RE: Current Photos from Tioga Lake - Lee Vining Hydro Relicense Project
Date: Tuesday, May 10, 2022 10:23:40 AM
Attachments: image005.png
image006.png
image007.png

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Hi Steve,
Thanks for sharing those photos. Looks pretty cold and blustery.
I appreciate seeing them since the road is still closed down low for local access.
The variable weather is continuing to slow field time so far.
Even cold, windy and wintery down in the Owens Valley and Bishop.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, May 10, 2022 10:09 AM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: Current Photos from Tioga Lake - Lee Vining Hydro Relicense Project

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Hey Jim,
Below are the photos Edison staff took on Monday during their latest trip to Tioga Lake.
I'm not sure when their next visit is scheduled, but I will send you those photos as soon as I get them.
-Steve

Steve Norton
PSOMAS | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Sent: Monday, May 9, 2022 4:12 PM

Here are the requested photos:

Looking across the lake from near the dam

B-31.1_Photos of snow and ice at Tioga Lake

B-31.1_Photos of snow and ice at Tioga Lake

Near the inlet to Tioga Lake

B-31.1_Photos of snow and ice at Tioga Lake

B-31.1_Photos of snow and ice at Tioga Lake

B-31.1_Photos of snow and ice at Tioga Lake

And further upstream of the inlet

B-31.1_Photos of snow and ice at Tioga Lake

Carissa Shoemaker

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Wednesday, May 18, 2022 2:46 PM
To: Erdman, James@Wildlife; Steve Norton; Mellison, Chad
Cc: Shannon Luoma; Carissa Shoemaker; Brad Blood; Finlay Anderson; Matthew Woodhall
Subject: RE: Snow Pack at Tioga Lake

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Thanks Steve and Jim,

I may be available as well on Friday June 3. However, this is the last work day I have before I take June off so I may be finishing up some Projects. I'll have to play it by ear.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, May 18, 2022 12:57 PM
To: Steve Norton <steve.norton@psomas.com>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: RE: Snow Pack at Tioga Lake

Hi Steve (and all),
Thanks for passing that photo along. I appreciate the coordination.
I was at Tioga Pass yesterday assessing access and trying to judge Toad timing too.
Please see attached set of photos from Saddlebag and Tioga Lakes area. I also visited a couple of the headwaters ponds above the south Tioga Inlet.
Also attached are 2 photos of Saddlebag Lake. Both are May photos, similar dates to 5/17/2022 (5/25/2020; 5/15/2021). Looks to be just a bit more snow than the last two years around Saddlebag.
In my opinion the survey start date of May 30 will be fine for most of the lower (Tioga/Ellery area) sites. It may actually be a bit early for the Saddlebag Lake inlet sites. I think it will also be good for the Saddlebag Creek assessment. The meadow areas and floodplain are currently inundated and breeding habitat for toads may be apparent.
I do plan to get back up to the area before May 30 to access Maul Lake in the Harvey Monroe Hall area and will keep you posted regarding access and timing.
I have a 3-day field survey scheduled for May 31-June 2. I am available (potentially) to visit the Tioga area on Friday June 3.
Please share these photos with anyone I may have not included in this email.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, May 17, 2022 2:26 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: FW: Snow Pack at Tioga Lake

WARNING: This message is from an external source. Verify the sender and exercise caution when clicking links or opening attachments.

Hi Jim!
The most recent photo of the snow pack at Tioga Lake is below. I'm looking to schedule the first survey during the week of May 30th. Are you available any time that week to join us? This invitation extends to Alyssa and Chad as well, if you're interested. Just let me know and we'll work around your schedules if you think you can make it.
Hopefully we'll see you up there!
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Sent: Monday, May 16, 2022 5:20 PM
Subject: Re: (External):RE: Lee Vining Relicense - Email Request for SCE Ops

Inlet as of 5/16

B-31.2_Discussion re snow pack at Tioga Lake for Yosemite toad survey

B-31.2_Discussion re snow pack at Tioga Lake for Yosemite toad survey

Carissa Shoemaker

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Monday, May 23, 2022 11:33 AM
To: Marquez, Alyssa@Wildlife; Steve Norton
Cc: Shannon Luoma; Carissa Shoemaker; Brad Blood; Finlay Anderson; Matthew Woodhall; lauren.rosenkranz@kleinschmidtgroup.com
Subject: RE: First Lee Vining Herp Survey

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Steve, (and all),
Thanks for the update and tentative schedule. Wednesday and Thursday June 1 & 2 sounds good.
Keep us posted on final date and time.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Monday, May 23, 2022 10:43 AM
To: Steve Norton <steve.norton@psomas.com>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; lauren.rosenkranz@kleinschmidtgroup.com
Subject: RE: First Lee Vining Herp Survey

Sounds good. Thanks for the update Steve.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Steve Norton <steve.norton@psomas.com>
Sent: Monday, May 23, 2022 10:19 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall

<Matthew.Woodhall@sce.com>; lauren.rosenkranz@kleinschmidtgroup.com
Subject: First Lee Vining Herp Survey

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Hi Jim and Alyssa,
I'm trying to make Friday an option for this first survey, but I'm not sure I can make it happen. I've confirmed a schedule of Wednesday and Thursday (June 1 and 2) with my other biologist. Friday is our contingency day, but I've got something scheduled for that evening and we would have to leave late morning regardless. I'll keep you updated if I can definitively push stuff around and make Friday a firm commitment, but I'm not there at this point.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Wednesday, May 18, 2022 2:46 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Steve Norton <steve.norton@psomas.com>; Mellison, Chad <chad_mellison@fws.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: RE: Snow Pack at Tioga Lake

Thanks Steve and Jim,

I may be available as well on Friday June 3. However, this is the last work day I have before I take June off so I may be finishing up some Projects. I'll have to play it by ear.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, May 18, 2022 12:57 PM
To: Steve Norton <steve.norton@psomas.com>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall

<Matthew.Woodhall@sce.com>
Subject: RE: Snow Pack at Tioga Lake

Hi Steve (and all),
Thanks for passing that photo along. I appreciate the coordination.
I was at Tioga Pass yesterday assessing access and trying to judge Toad timing too.
Please see attached set of photos from Saddlebag and Tioga Lakes area. I also visited a couple of the headwaters ponds above the south Tioga Inlet.
Also attached are 2 photos of Saddlebag Lake. Both are May photos, similar dates to 5/17/2022 (5/25/2020; 5/15/2021). Looks to be just a bit more snow than the last two years around Saddlebag.
In my opinion the survey start date of May 30 will be fine for most of the lower (Tioga/Ellery area) sites. It may actually be a bit early for the Saddlebag Lake inlet sites. I think it will also be good for the Saddlebag Creek assessment. The meadow areas and floodplain are currently inundated and breeding habitat for toads may be apparent.
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Please share these photos with anyone I may have not included in this email.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, May 17, 2022 2:26 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: FW: Snow Pack at Tioga Lake

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Hi Jim!
The most recent photo of the snow pack at Tioga Lake is below. I'm looking to schedule the first survey during the week of May 30th. Are you available any time that week to join us? This invitation extends to Alyssa and Chad as well, if you're interested. Just let me know and we'll work around your schedules if you think you can make it.
Hopefully we'll see you up there!
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Sent: Monday, May 16, 2022 5:20 PM
Subject: Re: (External):RE: Lee Vining Relicense - Email Request for SCE Ops

Inlet as of 5/16

B-32_Coordination re first herp survey date

B-32_Coordination re first herp survey date

B-33.1_Discussion re second herp survey dates

From:	Mellison, Chad
To:	Steve Norton; Erdman, James@Wildlife; Marquez, Alyssa@Wildlife
Cc:	Shannon Luoma; Carissa Shoemaker; Brad Blood; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall
Subject:	RE: [EXTERNAL] Second Lee Vining Hydro Herp Survey
Date:	Tuesday, June 7, 2022 5:35:40 PM
Attachments:	image001.png image002.png image003.png

WARNING: The sender of this email could not be validated and may not match the person in the "From" field.

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Hello Steve, I will not be able to make it. Keep finding toads!

CHAD

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, June 7, 2022 4:37 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: [EXTERNAL] Second Lee Vining Hydro Herp Survey

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hi Jim, Alyssa, and Chad,
In a very brief summary from last week: we saw adult YOTO in amplexus in the meadow southeast of Saddlebag Lake where the snow had recently melted but no evidence of toad at any other location within the FERC boundary or associated survey area.

We will be conducting our second survey next week on Wednesday, June 15th and Thursday, June 16th. If any of you are available for either day, please let me know. It would be great to have you out there.

We currently anticipate the third survey to be in mid- to late-July.

Thanks and let me know!

-Steve

Steve Norton
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Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

B-33.2_First herp survey summary results and dates for second survey coordination with CDFW

From:	Erdman, James@Wildlife
To:	Steve Norton; Mellison, Chad; Marquez, Alyssa@Wildlife
Cc:	Shannon Luoma; Carissa Shoemaker; Brad Blood; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall
Subject:	RE: Second Lee Vining Hydro Herp Survey
Date:	Tuesday, June 14, 2022 1:12:14 PM
Attachments:	image001.png image002.png image003.png

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Hi Steve,
Thanks for the information on the first survey results and dates for the second survey.
I will be bringing a new seasonal employee onboard on Wednesday morning and am planning on visiting the Tioga Pass area ponds for some protocol training.
We will be searching for YOTO and larvae above Tioga Lake. Assuming these ponds are NOT part of the FERC survey effort for you.
What time are you planning your survey effort for? We should be arriving at Tioga Pass around 1030 or 1100.
It would be nice to have lunch or a post survey beverage to cool down if we can swing it.
Please let me know your time frame and perhaps a potential meeting location. Suggest Saddlebag Lake parking? No worries if we cannot connect.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, June 7, 2022 4:37 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: Second Lee Vining Hydro Herp Survey

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Thanks and let me know!
-Steve

Steve Norton
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Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From:	Mellison, Chad
To:	Steve Norton; Erdman, James@Wildlife; Marquez, Alyssa@Wildlife
Cc:	Shannon Luoma; Carissa Shoemaker; Brad Blood; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall
Subject:	RE: [EXTERNAL] Second Lee Vining Hydro Herp Survey Results
Date:	Wednesday, June 29, 2022 11:19:39 AM
Attachments:	image001.png image002.png image003.png

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Thank you Steve

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, June 29, 2022 11:01 AM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: [EXTERNAL] Second Lee Vining Hydro Herp Survey Results

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Hello all,
During the most herp survey, we confirmed the Yosemite toad (*Anaxyrus canorus*) adults had successfully reproduced several hundred tadpoles in the ponded meadow southeast of Saddlebag Reservoir. We estimated between 500-1,000 tadpoles were present. Please note, we also observed three dead adults in the water. No lacerations or other wounds were visible. For reference, we observed 13 living adults at this location during the previous survey in early June.
Prior to conducting the 2022 surveys, the Relicensing Team agreed to expand the herp survey area to include portions of the reach between Saddlebag Reservoir and Ellery Reservoir where suitable breeding habitat was likely present. During the most recent survey (June 15-16), we observed toad (*Anaxyrus* sp.) tadpoles in two locations (see attached kmz). Both locations were on the west-side of the Lee Vining Creek floodplain, opposite the active, flowing channel. Herbaceous vegetation was present in both locations and we could not achieve an accurate count of tadpoles but at least 30 were observed. Although all the tadpoles observed were very small (approximately 1 week old) and identification was difficult, comparisons on size, color, shape, and behavior were made with the Sierran treefrog (*Pseudacris sierra*) tadpoles observed in the vicinity and the Yosemite toad tadpoles observed in the known location by Saddlebag Reservoir. Efforts to visually confirm the species at this location are anticipated for mid to late July.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Tuesday, June 14, 2022 1:12 PM
To: Steve Norton <steve.norton@psomas.com>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: RE: Second Lee Vining Hydro Herp Survey

Hi Steve,

Thanks for the information on the first survey results and dates for the second survey.

I will be bringing a new seasonal employee onboard on Wednesday morning and am planning on visiting the Tioga Pass area ponds for some protocol training.

We will be searching for YOTO and larvae above Tioga Lake. Assuming these ponds are NOT part of the FERC survey effort for you.

What time are you planning your survey effort for? We should be arriving at Tioga Pass around 1030 or 1100.

It would be nice to have lunch or a post survey beverage to cool down if we can swing it.

Please let me know your time frame and perhaps a potential meeting location. Suggest Saddlebag Lake parking? No worries if we cannot connect.

Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, June 7, 2022 4:37 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Mellison, Chad <chad_mellison@fws.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Brad Blood <bblood@psomas.com>; lauren.rosenkranz@kleinschmidtgroup.com; Matthew Woodhall <Matthew.Woodhall@sce.com>
Subject: Second Lee Vining Hydro Herp Survey

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We currently anticipate the third survey to be in mid- to late-July.

Thanks and let me know!

-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Heather Neff
To: Shannon Luoma
Subject: FW: Lee Vining Relicensing Fish Monitoring Permit
Date: Monday, June 13, 2022 10:03:09 AM

FYI

Heather Neff
Senior Aquatic Ecologist, Stillwater Sciences
Office: 530-756-7550 ex. 322
Cell: 530-848-9289
heather@stillwatersci.com

From: Ken Jarrett <Ken@stillwatersci.com>
Sent: Wednesday, June 8, 2022 2:47 PM
To: Alyssa.Marquez@Wildlife.ca.gov; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>
Cc: Heather Neff <heather@stillwatersci.com>; Lauren Dusek <Lauren@stillwatersci.com>
Subject: RE: Lee Vining Relicensing Fish Monitoring Permit

Hi Alyssa and Nick,

I wanted to follow up on my email from last month regarding CDFW Regional Biologist approval for Lee Vining Fish Monitoring methods. Our Scientific Collection Permit from CDFW covering fish monitoring efforts for the Lee Vining Hydro Relicensing studies requires written approval from the CDFW Regional Biologist prior to efishing.

Can you provide permission for Stillwater's upcoming reservoir electrofishing efforts in the three Lee Vining Project Reservoirs (Tiogga, Saddlebag, and Ellery lakes) which is scheduled to occur in this August, and can you provide permission for our stream fish electrofishing efforts scheduled to occur this September at the locations listed below?

Lee Vining Creek

- Between Slate Creek and Glacier Creek
- Between Glacier Creek and Ellery Lake
- Between Poole Powerhouse and the pool upstream of the Los Angeles Department of Water and Power Diversion Dam

Glacier Creek

- Downstream of Tioga Dam

Please let me know if there is someone else I should be contacting or if you would like additional details.

Thank you,

Ken Jarrett
Fisheries Biologist
office 805-570-7499 x502
cell 916-717-3113
Ken@stillwatersci.com

From: Ken Jarrett
Sent: Monday, May 23, 2022 4:06 PM
To: Alyssa.Marquez@Wildlife.ca.gov; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>
Cc: Heather Neff <heather@stillwatersci.com>
Subject: Lee Vining Relicensing Fish Monitoring Permit

Hi Alyssa and Nick,

Stillwater recently received our Scientific Collection Permit covering fish monitoring activities under the Lee Vining Relicensing Studies for Stream Fish and Reservoir Fish Monitoring. One of the conditions on our permit states that we "must obtain the local regional biologist's written permission prior to each electrofishing effort." Are either of you considered the local regional biologist? If so, can you provide permission for Stillwater's upcoming reservoir electrofishing efforts in the three Lee Vining Project Reservoirs (Tiogga, Saddlebag, and Ellery lakes) which is scheduled to occur in this August, and can you provide permission for our stream fish electrofishing efforts scheduled to occur this September at the locations listed below?

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Glacier Creek

- Downstream of Tioga Dam

Please let me know if there is someone else I should be contacting or if you would like additional details.

Thank you,

Ken Jarrett
Fisheries Biologist
office 805-570-7499 x502
cell 916-717-3113
Ken@stillwatersci.com

From: McNeill, Richard - FS, BISHOP, CA
To: Allison Rudalevige
Cc: Shannon Luoma
Subject: Re: [External Email]Lee Vining veg mapping discussion
Date: Tuesday, June 14, 2022 6:10:21 PM
Attachments: image001.png
Outlook-Forest Ser.png
Veg_mapping_20220614.zip

Hi Alison

In the attached compressed folder is the spatial data for the Inyo NF Terrestrial Ecological Unit Inventory for the LV FERC project and the user's guide for that data.

The spatial data has our current veg mapping and the guide should answer your questions about the minimum mapping unit.

I am going to be in the field most of next week, and all of the week after, so please get back to me as soon as possible if you have any questions.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service
Inyo National Forest

cell: 760-920-7579
fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Allison Rudalevige <allison.rudalevige@psomas.com>
Sent: Tuesday, June 14, 2022 15:40
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: RE: [External Email]Lee Vining veg mapping discussion

I don't think it's necessarily a complicated discussion, so it could be as short as 15 minutes.

If you want to consider my question before we talk, basically I would like to know what minimum mapping unit to use for vegetation polygons. Our Study Plan includes updating the existing USFS vegetation map and identifying any sensitive natural communities. I will be starting with the existing USFS vegetation map and making necessary modifications in the field. However, I don't know what minimum mapping unit was used to generate that map but I expect it was rather coarse scale. When I do vegetation mapping on a project level (e.g., for a site that's a few hundred acres), I map at a rather fine scale (e.g., the smallest vegetation polygon is approximately 1/10 acre). I hesitate to use that scale for the USFS veg map update though. But I'm not sure of the appropriate scale to use.

~Allison

Allison D. Rudalevige

Senior Biologist, Resource Management
5 Hutton Centre Drive Suite 300, Santa Ana, CA 92707
714.751.7373
www.Psomas.com

From: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, June 14, 2022 2:48 PM
To: Allison Rudalevige <allison.rudalevige@psomas.com>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: Re: [External Email]Lee Vining veg mapping discussion

Hi Alison

I am out of the office this week, but trying to answer emails.

How long will this discussion need?

rick

Get Outlook for iOS

From: Allison Rudalevige <allison.rudalevige@psomas.com>
Sent: Tuesday, June 14, 2022 12:33:11 PM
To: McNeill, Richard - FS, BISHOP, CA <Richard.McNeill@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>
Subject: [External Email]Lee Vining veg mapping discussion

[External Email]
If this message comes from an **unexpected sender** or references a **vague/unexpected topic;**
Use caution before clicking links or opening attachments.
Please send any concerns or suspicious messages to: Spam.Abuse@usda.gov

Hi Richard

Would you be available for a call to discuss vegetation map updates at Lee Vining? I would like to discuss mapping effort and minimum mapping unit. We'll be starting from the INF maps and I want to ensure my scale is appropriate. I'm available after 2 PM this week and next week (Mon-Thurs) and Fridays until noon.
Thank you

~Allison

Allison D. Rudalevige
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist
Resource Management
714.481.8024 | www.Psomas.com

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Carissa Shoemaker

From: Shannon Luoma
Sent: Thursday, June 16, 2022 4:17 PM
To: Rick Wood; Washington, Jameisha - FS, Lee Vining, CA
Cc: Barnett, Adam -FS
Subject: RE: [External Email]Big Bend Campground

Hello!
Thanks for getting back to me! For the rebar, it will be installed flush with ground surface plastic safety caps so they should not present a safety hazard. We also plan to install the rebar or mag nails in discrete locations away from heavily trafficked walking paths.

Please let me know if this is sufficient or if you need more information.
Thanks!

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Rick Wood <rickywood@clm-services.com>
Sent: Monday, June 13, 2022 8:20 PM
To: Washington, Jameisha - FS, Lee Vining, CA <Jameisha.Washington@usda.gov>
Cc: Barnett, Adam -FS <adam.barnett@usda.gov>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: Re: [External Email]Big Bend Campground

1. Good question, Jameisha. What's the method of marking hazards?

2. The CG is easily accessed anytime on foot.

3. The CG will open Friday, 6/17.

Best,
Rick Wood
Inyo Recreation (North)
Operations Manager
(c) 760-209-4722
(o) 760-934-5795
PO Box 629
Mammoth Lakes, CA 93546
rickywood@clm-services.com
www.camprrm.com

On Mon, Jun 13, 2022, 8:02 PM Washington, Jameisha - FS, Lee Vining, CA <Jameisha.Washington@usda.gov> wrote:

> hi Adam and Shannon,
>
> This campground is managed by our concessionaire Vista. I have cc'd Rick Wood.

1. Is the FS okay with the survey team placing markers such as rebar at select locations along the creek in the campground? They will be placed at ground level and effort will be made to make sure they're safe and not a tripping (or other) hazard. How do you plan to mark or mitigate tripping hazards.
2. Can the team access the campground even if it's closed? Yes, they can walk in around the gate on foot.
3. Will it be closed all summer? No, Rick is working on hazard tree abatement.

Thanks,
Jameisha Washington
Recreation Staff Officer
Inyo National Forest
760.965.6893
Jameisha.Washington@usda.gov

From: Barnett, Adam -FS <adam.barnett@usda.gov>
Sent: Monday, June 13, 2022 9:13 AM
To: Washington, Jameisha - FS, Lee Vining, CA <Jameisha.Washington@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: FW: [External Email]Big Bend Campground

Hi Jameisha, can you answer Shannon's questions below? Thanks

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

Caring for the land and serving people

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Friday, June 10, 2022 9:01 AM
To: Barnett, Adam -FS <adam.barnett@usda.gov>
Subject: [External Email]Big Bend Campground

[External Email]
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Hey Adam!
As you know, we have field crews going out this summer to conduct surveys. Our channel morphology survey team was planning to be in and around Big Bend Campground (and other areas downstream of Poole) to identify transects locations. A couple questions as we just recently realized Big Bend is closed:

1. Is the FS okay with the survey team placing markers such as rebar at select locations along the creek in the campground? They will be placed at ground level and effort will be made to make sure they're safe and not a tripping (or other) hazard.
2. Can the team access the campground even if it's closed?
3. Will it be closed all summer?

Thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager

Office: 425.528.1614
www.KleinschmidtGroup.com

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From:	Buckmaster, Nick@Wildlife
To:	Moyer, Patricia (Trisha)@Wildlife
Cc:	Shannon Luoma
Subject:	RE: Lee Vining E-fishing permit
Date:	Friday, June 17, 2022 2:54:41 PM
Attachments:	image001.jpg

We are supportive of this effort. Thanks

From: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Sent: Friday, June 17, 2022 2:44 PM
To: Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: FW: Lee Vining E-fishing permit

Hi Nick,
Could you respond to Shannon Luoma at Kleinschmidt please, or forward to someone that can assist her?
Thanks,
Trisha

Trisha A. Moyer

CDFW- Desert Inland Region 6
Habitat Conservation Program Supervisor
787 North Main Street Suite 220
Bishop, CA 93514

(760) 835-4304

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Friday, June 17, 2022 11:43 AM
To: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Subject: RE: Lee Vining E-fishing permit

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Hi Tricia – attached is a thread from our fish team reaching out to Nick and Alyssa on 5/23 and 6/8 as well as my email to Alyssa on 6/10, which is when I received her out of office and why I reached out to you.

Let me know if you need anything else. Have a great weekend.
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Sent: Thursday, June 16, 2022 9:05 PM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Subject: Re: Lee Vining E-fishing permit

please forward to me the emails to Alyssa that have gone unanswered.

Get Outlook for iOS

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Thursday, June 16, 2022 4:04:34 PM
To: Moyer, Patricia (Trisha)@Wildlife <Patricia.Moyer@Wildlife.ca.gov>
Subject: Lee Vining E-fishing permit

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Hi Trisha!
I'm reaching out because we're supporting SCE on the Lee Vining relicensing and will have a team out in August and September to conduct some electrofishing. Our Scientific Collection Permit from CDFW requires written approval from the CDFW Regional Biologist prior to efishing. The team has been trying to reach Nick and Alyssa since May with no response. I know it's field season and that Alyssa is now out of the office. Any chance you can help us get approval for our study? Or tell us who else to reach out to at CDFW?

The electrofishing efforts in the three Lee Vining Project Reservoirs (Tioga, Saddlebag, and Ellery lakes) is scheduled to occur in this August, and the stream fish electrofishing efforts are scheduled to occur this September at the locations listed below:

Lee Vining Creek

- Between Slate Creek and Glacier Creek
- Between Glacier Creek and Ellery Lake
- Between Poole Powerhouse and the pool upstream of the Los Angeles Department of Water and Power Diversion Dam

Glacier Creek

- Downstream of Tioga Dam

Thank you!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager

Office: 425.528.1614
www.KleinschmidtGroup.com

From: Barnett, Adam -FS
To: Shannon Luoma
Subject: RE: [External Email]Lee Vining Electrofishing
Date: Monday, July 25, 2022 5:00:33 PM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.jpg

HI Shannon,

I passed this along to the district staff.

Thanks,

Adam

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

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From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Thursday, July 21, 2022 5:07 PM
To: Barnett, Adam -FS <adam.barnett@usda.gov>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: [External Email]Lee Vining Electrofishing

[External Email]
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Hi Adam!
Hope your summer is going well. We're going to have a crew out conducting electrofishing and gill netting in Ellery, Tioga and Saddlebag lakes the week of August 1. The attached kmz file shows the approximate locations of the proposed sampling locations, which will vary based on actual reservoir conditions. We plan to check the gill nets approximately every 8 hours and conduct e-fishing at night. For the site at Ellery near the campground we adjusted our schedule so we're e-fishing just

after dark as opposed to the middle of the night in an effort to be less disruptive. For the gillnetting, it's likely campers may hear the motor boat in the middle of the night we the crew goes to check them.
Could you please help us notify the camp hosts at Ellery and Tioga so they're aware surveys will be conducted August 2-4? We plan to reach out to Saddlebag Resort as well.

Let me know if you have questions, thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager

Office: 425.528.1614
www.KleinschmidtGroup.com

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Lauren Rosenkranz

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Tuesday, July 26, 2022 3:14 PM
To: Shannon Luoma; Lauren Rosenkranz
Subject: FW: Form submission from: Contact the County

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

-----Original Message-----
From: Ingrid Braun <ibraun@monosheriff.org>
Sent: Tuesday, July 26, 2022 3:05 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: RE: Form submission from: Contact the County

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Ms. Shoemaker,
All Mono County ordinances regarding Boating can be found on the County website (mono.ca.gov). Under the Government tab, click on County Code, then go to Title 13 - Roads, Parks, and Waterways. To save you the time, there are no restrictions specific to Ellery and Tioga Lakes, which are in the Lee Vining Creek watershed. Both Ellery and Tioga are on Forest Service land, so you should inquire with the Inyo National Forest for any restrictions they may have. Mono Lake does have restrictions from April 1 - August 1 in certain areas. Mono Lake is a California State Park, so check with them for any specific restrictions.

Ingrid Braun, Sheriff-Coroner
Mono County Sheriff's Office

-----Original Message-----
From: Cheyenne Stone <cstone@mono.ca.gov>
Sent: Monday, July 25, 2022 3:08 PM
To: Ingrid Braun <ibraun@monosheriff.org>
Subject: FW: Form submission from: Contact the County

Cheyenne M. Stone
Mono County Assistant to the CAO
1290 Tavern Rd, Suite 119
Mammoth Lakes, CA 93546

(760) 932-5408 (Direct)
(760) 920-0027 (Cell)

-----Original Message-----
From: Mono County California via Mono County California <noreply@mono.ca.gov>
Sent: Monday, July 25, 2022 3:03 PM
To: Cheyenne Stone <cstone@mono.ca.gov>
Subject: Form submission from: Contact the County

Submitted on Monday, July 25, 2022 - 3:03pm Submitted by anonymous user: 136.226.57.71 Submitted values are:

Name: Carissa Shoemaker
E-mail Address: carissa.shoemaker@erm.com County Department: Unknown
Comments:
Hello there,
I am wondering if there are any County restrictions regarding motorized boats on reservoirs in Mono County, specifically the lakes in the Lee Vining Creek watershed. I haven't been able to locate information on it elsewhere.
Thank you!
delivery_email: cstone@mono.ca.gov

The results of this submission may be viewed at:
https://eur01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fmonocounty.ca.gov%2Fnode%2F7%2Fsubmission%2F3979&data=05%7C01%7Ccarissa.shoemaker%40erm.com%7Ca6ce8792cae844b3533d08da6f52de1d%7Cf2fe6bd39c4a485bae69e18820a88130%7C0%7C0%7C637944699072743680%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=Hi8%2Fm6N6yELMmywkwH4lSWxoWLmllE0xq6KknuQSOE0%3D&reserved=0

_____

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From: Marquez, Alyssa@Wildlife
To: Shannon Luoma
Subject: RE: motor boats on Lee Vining reservoirs
Date: Wednesday, July 27, 2022 1:21:28 PM
Attachments: image001.jpg

Hi Shannon,

Just tired your number listed below. I am not aware of any motor boat restrictions that CDFW would have on the reservoirs along Lee Ving Creek. It seems like the FS would be the only ones with restrictions like that, so I'm not sure who else would have those rules.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Tuesday, July 26, 2022 4:50 PM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: motor boats on Lee Vining reservoirs

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Hi Alyssa!
I hope your summer is going well. I have some questions about the motor boat restrictions on the Lee Vining reservoirs. We're gearing up for our reservoir sampling effort and will need to use a motor boat, so I'm trying to sort out who we need permission from. Both the Forest Service and the County have said it is not their rule, so I'm wondering if it is CDFW's. Give me a call when you get a chance.

Thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614
www.KleinschmidtGroup.com

B-40_Discussion re boats in project reservoirs

Lauren Rosenkranz

From: Joey Verdian <jverdian@stillwatersci.com>
Sent: Tuesday, August 9, 2022 1:02 PM
To: adam.barnett@usda.gov
Cc: Heather Bowen Neff; Ian Pryor; Shannon Luoma; Carissa Shoemaker
Subject: Lee Vining Creek - Pressure Transducer Installation
Attachments: LVC_PT_Locations.JPG; LVC_PT Locations.kmz; Typical water level station.JPG

Hello Adam,
This email is a follow up to our conversation regarding equipment installation in Lee Vining Creek, to support the FERC relicensing process for the Lee Vining Hydroelectric Project (FERC No. 1388). Please see details below regarding the proposed equipment installation.

1. Equipment description:
    a. Four separate water level stations, each consisting of a pressure transducer suspended in metal pipe that is affixed to the creek using a T-Post or channel iron. Other options for installation include bolting the station to a tree or bedrock. The method of installation for each water level station will depend on field conditions. See attached photo for a typical water level station setup.
2. Locations:
    a. See the attached screenshot or kmz for approximate locations. The exact location will be determined in the field.
3. Duration of equipment deployment:
    a. Approximately 1-year, from mid-August 2022 to late summer or early fall of 2023.

Please let me know if you have any questions.
Regards,
Joey

Joey Verdian
Geologist
office 510-848-8098 x187
jverdian@stillwatersci.com

Stillwater Sciences
2855 Telegraph Avenue, Suite 400, Berkeley, CA 94705
tel 510-848-8098

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B-41.1_Discussion re pressure transducer installation

B-41.1_Discussion re pressure t
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B-41.2_USFS approves pressure transducer installation

From:	Carissa Shoemaker
To:	Lauren Rosenkranz
Subject:	FW: [External Email]Lee Vining Creek - Pressure Transducer Installation
Date:	Tuesday, September 6, 2022 3:06:49 PM
Attachments:	image001.png image002.png image003.png image004.png R2022050402575_LeeViningCreekTransducer.pdf

---

Carissa Shoemaker

I am on a part-time schedule, working a full day on Fridays. Other weekdays I will be online for short periods at a time, usually early afternoon and late evenings.

ERM
M 907 575 0294

From: Heather Neff <heather@stillwatersci.com>
Sent: Tuesday, September 6, 2022 12:48 PM
To: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Subject: FW: [External Email]Lee Vining Creek - Pressure Transducer Installation

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Hi Shannon and Carissa, please see the approval from USFS to install pressure transducers. We are working out the schedule for this effort now. Thanks!

Heather Neff
Senior Aquatic Ecologist, Stillwater Sciences
Office: 530-756-7550 ex. 322
Cell: 530-848-9289
heather@stillwatersci.com

From: Joey Verdian <jverdian@stillwatersci.com>
Sent: Tuesday, September 6, 2022 11:45 AM
To: Ian Pryor <Ian@stillwatersci.com>
Cc: Heather Neff <heather@stillwatersci.com>
Subject: FW: [External Email]Lee Vining Creek - Pressure Transducer Installation

USFS has approved the PT installation.

Joey Verdian
Geologist, Stillwater Sciences
office 510-848-8098 x187
jverdian@stillwatersci.com

From: Barnett, Adam -FS <adam.barnett@usda.gov>
Sent: Tuesday, September 6, 2022 10:37 AM
To: Joey Verdian <jverdian@stillwatersci.com>
Subject: FW: [External Email]Lee Vining Creek - Pressure Transducer Installation

Hi Joey,

Sec 106 clearance attached. You may proceed.

Thanks,

Adam

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

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Bishop, CA 93514
www.fs.fed.us

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From: Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>
Sent: Tuesday, September 6, 2022 10:07 AM
To: Barnett, Adam -FS <adam.barnett@usda.gov>
Subject: RE: [External Email]Lee Vining Creek - Pressure Transducer Installation

Hi Adam –
My apologies. Here is the Section 106 report. Since they are staying within the stream channel, this a screened undertaking with no potential to cause effects. Please let me know if you have any questions.

Thanks,
Ashley

Ashley Blythe Haverstock
Acting Heritage Program Manager and Tribal Liaison

Forest Service
Inyo National Forest

ashley.blythehaverstock@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

Caring for the land and serving people

From: Barnett, Adam -FS <adam.barnett@usda.gov>
Sent: Tuesday, September 6, 2022 9:02 AM
To: Blythe Haverstock, Ashley - FS <ashley.blythehaverstock@usda.gov>
Subject: FW: [External Email]Lee Vining Creek - Pressure Transducer Installation

Hi Ashley,

Can Joey proceed with the requested installation?

Thanks

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

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From: Joey Verdian <jverdian@stillwatersci.com>
Sent: Tuesday, September 6, 2022 8:37 AM
To: Barnett, Adam -FS <adam.barnett@usda.gov>
Subject: RE: [External Email]Lee Vining Creek - Pressure Transducer Installation

Hi Adam,
Just following up on this email thread. Any updates regarding permission for the PT installation?
Joey

Joey Verdian
Geologist, Stillwater Sciences

office 510-848-8098 x187
jverdian@stillwatersci.com

From: Joey Verdian
Sent: Friday, August 26, 2022 1:01 PM
To: Barnett, Adam -FS <adam.barnett@usda.gov>
Subject: RE: [External Email]Lee Vining Creek - Pressure Transducer Installation

Hi Adam,
Great, looking forward to receiving the 106.
Thanks,
Joey

Joey Verdian
Geologist, Stillwater Sciences
office 510-848-8098 x187
jverdian@stillwatersci.com

From: Barnett, Adam -FS <adam.barnett@usda.gov>
Sent: Monday, August 15, 2022 12:30 PM
To: Joey Verdian <jverdian@stillwatersci.com>
Subject: RE: [External Email]Lee Vining Creek - Pressure Transducer Installation

Hi Joey,

No concerns from our hydrologist and botanist. Our archeologist will be reviewing Tues and will provide a Sec 106 compliance memo.

Adam

Adam Barnett
Public Services Staff Officer

Forest Service
Inyo National Forest

p: 760-873-2461
c: 760-920-8104
adam.barnett@usda.gov

351 Pacu Lane, Suite 200
Bishop, CA 93514
www.fs.fed.us

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From: Joey Verdian <jverdian@stillwatersci.com>
Sent: Tuesday, August 9, 2022 1:02 PM
To: Barnett, Adam -FS <adam.barnett@usda.gov>
Cc: Heather Neff <heather@stillwatersci.com>; Ian Pryor <Ian@stillwatersci.com>; Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Carissa.Shoemaker@erm.com
Subject: [External Email]Lee Vining Creek - Pressure Transducer Installation

[External Email]
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Hello Adam,
This email is a follow up to our conversation regarding equipment installation in Lee Vining Creek, to support the FERC relicensing process for the Lee Vining Hydroelectric Project (FERC No. 1388). Please see details below regarding the proposed equipment installation.

1. Equipment description:
    a. Four separate water level stations, each consisting of a pressure transducer suspended in metal pipe that is affixed to the creek using a T-Post or channel iron. Other options for installation include bolting the station to a tree or bedrock. The method of installation for each water level station will depend on field conditions. See attached photo for a typical water level station setup.
2. Locations:
    a. See the attached screenshot or kmz for approximate locations. The exact location will be determined in the field.
3. Duration of equipment deployment:
    a. Approximately 1-year, from mid-August 2022 to late summer or early fall of 2023.

Please let me know if you have any questions.
Regards,
Joey

Joey Verdian
Geologist
office 510-848-8098 x187
jverdian@stillwatersci.com

Stillwater Sciences
2855 Telegraph Avenue, Suite 400, Berkeley, CA 94705
tel 510-848-8098

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Inyo National Forest Heritage Program
NHPA Section 106 Consultation for Screened Undertaking (Class B)
No Potential to Effect Expedited Review
Pursuant to the Regional Programmatic Agreement (2013, Amended 2018)

Project Name: Lee Vining Creek Transducer Installation
Report Number: R2022050402575
Ranger District: Mono Lake
County: Mono
Author: Ashley A Blythe Haverstock
Report Date: September 6, 2022
Primary Purpose or Job Code: FERC

Description of Project and APE: The Inyo National Forest is considering a proposal by Stillwater Sciences to install water level measurement devices within Lee Vining Creek in support of the Lee Vining FERC Relicensing Project. Four separate water level stations will be, each consisting of a pressure transducer suspended in metal pipe that is affixed to the creek using a T-Post or channel iron. Other options for installation include bolting the station to a tree or bedrock. The method of installation for each water level station will depend on field conditions and the exact locations will be determined in the field. The equipment will remain in the creek for approximately 1 year, from September 2022 through late summer or early fall of 2023. The area of potential effects is limited to the equipment footprint, which is entirely within the Lee Vining Creek stream channel.

Project Planning Acres: >1

Legal Location: Section 15, 23, 25 T1N, R25E

7.5' USGS Quadrangle Map Reference(s): Mount Dana

CULTURAL RESOURCE SPECIALIST ASSESSMENT OF UNDERTAKING

I certify that the above project is a Screened Undertaking (Class B) in accordance with the *Programmatic Agreement among the U.S.D.A. Forest Service, Pacific Southwest Region (Region 5), the California State Historic Preservation Officer, the Nevada State Historic Preservation Officer, and the Advisory Council on Historic Preservation Regarding Processes for Compliance with Section 106 of the National Historic Preservation Act for Management of Historic Properties by the National Forest of the Pacific Southwest Region (2013, Amended 2018).*

Screened Undertaking Category: (h)Activities limited within stream channels, not including terraces, cut banks, etc.;

Summary Rationale: Activities associated with the proposed undertaking as described have no potential to effect historic properties. Due to the nature of the proposed undertaking, no Class I avoidance or monitoring and no Class II or Class III Standard Protection Measures are required to protect historic properties. The project may be implemented as proposed. In the event any unanticipated discoveries are made, or the project scope changes, all project work will be halted and the HPM will be consulted.

Project Consultation Cost: $47.02

Reviewed/Approved By HPM/HPM Delegate:

Ashley A. Blythe Haverstock, HPM — September 6, 2022 (Date)

Attachments:
☒ maps
☒ photographs
☐ other _____

PT-1
PT-2
Big Bend Campground
Aspen Campground
PT-3
Mono Dome
Moraine Campground
PT-4
Lower Lee Vining Campground
120
Google Earth

Lauren Rosenkranz

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Tuesday, August 9, 2022 3:26 PM
To: Steve Norton; Matthew Woodhall; Brad Blood; Shannon Luoma; Finlay Anderson
Cc: Black, Russell@Wildlife
Subject: Yosemite Toads References and papers
Attachments: Goebel boreas 2009.pdf

Hi Steve and all,
Here are the names of folks I know have done work on Yosemite Toads or can provide exceptional resource information.

Roland Knapp; UCSB; Sierra Nevada Aquatic Research Lab; Mammoth Lakes. roland.knapp@ucsb.edu
Rob Grasso; Yosemite National Park Ecologist. Rob_Grasso@nps.gov
David Bradford; EPA retired; performed early studies at Tioga Pass and Glacier Canyon. dbradfo@herpconbio.org
Cathy Brown; USFS Region 5 Biologist. Prolific writer involved in amphibians (SNYLF and YOTO).
Catherine.Brown@usda.gov
Andrew Rothstein; performed recent genetic work on SNYLF including museum specimens. May be working on Yoto.

It looks like I do not have an email address for Andrew. Will try to track down through Roland.
Attached is a paper on Mitochondrial DNA evolution in the Anaxyrus boreas species group.
The paper is from 2009 and gives a pretty good rundown of relatedness of various Bufo sp.
First article that I opened. This paper has a trove of references that may be useful.
More later.
Sierrally

James Erdman
Environmental Scientist
Fisheries & High Mountain Lakes
California Department of Fish & Wildlife
Inland Desert-Region 6-North
Bishop Field Office
787 North Main St., Suite 220
Bishop, Ca. 93514
Office Ph. (760)-873-6071
CDFW Cell (760)-567-0413
James.Erdman@wildlife.ca.gov

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Mitochondrial DNA evolution in the *Anaxyrus boreas* species group

Anna M. Goebel [a,b,*], Tom A. Ranker [c,1], Paul Stephen Corn [d], Richard G. Olmstead [e,2]

[a] University of Colorado Museum of Natural History, 265 UCB, University of Colorado, Boulder, CO 80309-0265, USA
[b] Florida Gulf Coast University, Department of Biological Sciences, Fort Myers, FL 33965, USA
[c] University of Colorado Museum of Natural History, Department of Ecology and Evolutionary Biology, University of Colorado, Boulder, CO 80309, USA
[d] USGS Northern Rocky Mountain Science Center, Aldo Leopold Wilderness Research Institute, 790 E. Beckwith Avenue, Missoula, MT 59801, USA
[e] E.P.O. Biology Department, University of Colorado, Boulder, CO 80309, USA

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Conservation

ABSTRACT

The *Anaxyrus boreas* species group currently comprises four species in western North America including the broadly distributed *A. boreas*, and three localized species, *Anaxyrus nelsoni*, *Anaxyrus exsul* and *Anaxyrus canorus.* Phylogenetic analyses of the mtDNA 12S rDNA, cytochrome oxidase I, control region, and restriction sites data, identified three major haplotype clades. The Northwest clade (NW) includes both subspecies of *A. boreas* and divergent minor clades in the middle Rocky Mountains, coastal, and central regions of the west and Pacific Northwest. The Southwest (SW) clade includes *A. exsul*, *A. nelsoni*, and minor clades in southern California. *Anaxyrus canorus*, previously identified as paraphyletic, has populations in both the NW and SW major clades. The Eastern major clade (E) includes three divergent lineages from southern Utah, the southern Rocky Mountains, and north of the Great Basin at the border of Utah and Nevada. These results identify new genetic variation in the eastern portion of the toad's range and are consistent with previous regional studies from the west coast. Low levels of control region sequence divergence between major clades (2.2–4.7% uncorrected pair-wise distances) are consistent with Pleistocene divergence and suggest that the phylogeographic history of the group was heavily influenced by dynamic Pleistocene glacial and climatic changes, and especially pluvial changes, in western North America. Results reported here may impact conservation plans in that the current taxonomy does not reflect the diversity in the group.

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1. Introduction

Historical classifications of toads (Amphibia: Bufonidae) recognized species groups based on morphological similarity. Blair (1972b,c) identified at least 37 species groups in the genus *Bufo* (Laurenti, 1768) from the approximately 200 species recognized at that time and placed the North American toads into seven species groups (*boreas*, *punctatus*, *retiformis*, *debilis*, *quercicus*, *cognatus*, *americanus*). Collectively these groups comprise the Nearctic toads, genus *Anaxyrus* (Tschudi, 1845; Frost et al., 2006a). Relationships within groups are less clear than group identity, and cryptic speciation has long been recognized as a problem in toads (Blair, 1972b). More recently, mitochondrial DNA has been used to identify relationships within those groups and all studies have identified highly divergent toad lineages not recognized by taxonomy (Graybeal, 1993; Shaffer et al., 2000; Stephens, 2001; Masta et al., 2002; Smith and Green, 2004; Jaeger et al., 2005).

The *boreas* species group, as currently recognized (Stebbins, 2003; Frost, 2007), is comprised of two subspecies broadly distributed across North America and three species with localized distributions (Fig. 1). *Anaxyrus boreas* (Baird and Girard, 1852) is found from the east slope of the Rocky Mountains to the Pacific Ocean and from northern Baja California to Alaska and the Yukon. The subspecies *A. b. boreas* (Baird and Girard, 1852) occupies most of this range, but *A. b. halophilus* (Baird and Girard, 1853) occurs on the West Coast from northern California to Baja California. The subspecies are thought to be sympatric in northern California

* Corresponding author. Current address: Florida Gulf Coast University, Department of Biological Sciences, 10501 FGCU Boulevard South, Fort Myers, FL 33965, USA. Fax: +1 239 590 7200.
E-mail addresses: agoebel@fgcu.edu (A.M. Goebel), ranker@hawaii.edu (T.A. Ranker), scorn@usgs.gov (P.S. Corn), olmstead@u.washington.edu (R.G. Olmstead).
[1] Present address: University of Hawai'i at Manoa, Department of Botany, 3190 Maile Way, St. John 101, Honolulu, HI 96822, USA.
[2] Present address: Department of Biology, Box 355325, University of Washington, Seattle, WA 98195, USA.

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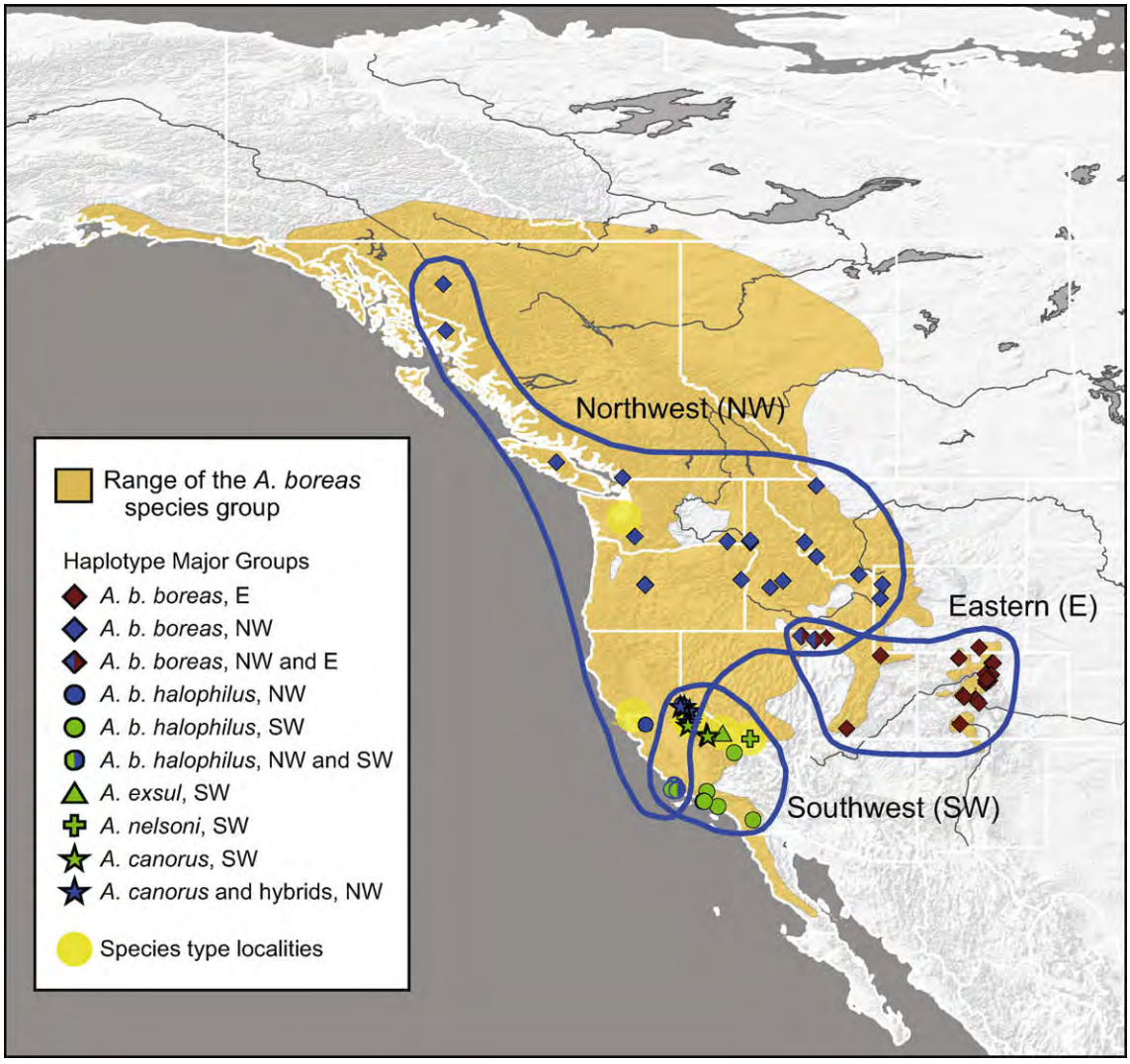

Fig. 1. Distribution of the *boreas* group and localities of specimens examined. Current taxon identities are indicated by symbol shapes (e.g., *Anaxyrus b. boreas*-diamond) as provided in the Key. The major mtDNA haplotype clades (NW-northwest, SW-southwest, E-eastern) are indicated by color/shade of symbol and their distributions are encircled. Populations enclosed by multiple circles contain representatives of multiple haplotype clades. Type localities are identified by large yellow or light circles. The range map was compiled using a number of published (Baxter and Stone, 1980; Committee on the Status of Endangered Wildlife in Canada, 2002; Environment Yukon, 2005; Green and Gregory, 2007; Grismer, 2002; Hammerson, 1999; Stebbins, 2003; Thompson et al., 2004) or online (http://www.alaskaherps.info/; http://imnh.isu.edu/digitalatlas; http://www.wdfw.wa.gov/wlm/gap/dataprod.htm) sources and expert advice.

(Camp, 1917a; Stebbins, 2003). The other three species are considered Pleistocene relicts (Myers, 1942; Karlstrom, 1958, 1962). *Anaxyrus exsul* (Myers, 1942) occurs only in Deep Springs Valley of east central California (Fellers, 2005). *Anaxyrus nelsoni* (Stejneger, 1893) is currently known only in the Amargosa River drainage of southwestern Nevada (Altig and Dodd, 1987; Goebel et al., 2005). *Anaxyrus canorus* (Camp, 1916) is narrowly distributed at high elevations in the Sierra Nevada and is sympatric with *A. boreas* at the northern end of its distribution (Karlstrom, 1962; Morton and Sokoloski, 1978; Davidson and Fellers, 2005).

Morphological characters that distinguish some *boreas* group taxa are striking (e.g., the black coloration of *A. exsul* contrasts brown color typical of toads), but morphological variation within the group is limited (Karlstrom, 1962; Myers, 1942). Schuierer (1963), Burger and Bragg (1946), and Karlstrom (1962), noted that specimens in Colorado and/or Alaska were morphologically different (e.g., smaller size, smoother skin, more pronounced warts) from toads in the more coastal northwest, but Karlstrom (1962) found these same characters to vary with age, sex and elevation and did not consider them diagnostic. Other unusual forms were noted in Montana, and Alberta (Black, 1970, 1971; Schueler, 1982). Sanders and Cross (1963), noted chromosomal differences between *A. b. boreas* in Colorado and *A. b. halophilus* in California but early chromosomal data are difficult to interpret due to the limited techniques available at the time. However, these comments suggest the possibility of cryptic speciation.

All previous molecular phylogenetic analyses that include members of the *boreas* group were either regional studies that examined a small portion of the toad's range on the west coast and western Nevada (Feder, 1973; Graybeal, 1993; Shaffer et al., 2000; Stephens, 2001; Simandle, 2006; Simandle et al., 2006) or were phylogenetic analyses of deeper relationships among toads and frogs that included few specimens of the *boreas* group (Maxson et al., 1981; Graybeal, 1997; Macey et al., 1998; Darst and Cannatella, 2004; Pauly et al., 2004; Goebel, 1996, 2005; Pramuk, 2006; Frost et al., 2006a). Molecular analyses of the group are further complicated because the species are recently diverged and quite distant from potential outgroups (Pauly et al., 2004; Pramuk, 2006; Frost et al., 2006a) making rooting by outgroups difficult (Wheeler, 1990; Huelsenbeck et al., 2002). Non-molecular phylo-

genetic studies that included specimens of the group similarly focused only on deeper relationships of bufonids (Karlstrom, 1962; Tihen, 1962; Schuierer, 1963; Blair, 1963, 1964, 1972b; Bogart, 1972; Sanders and Cross, 1963; Graybeal, 1997).

Our goal was to provide a broader molecular analysis of the *boreas* group. By examining mtDNA of all taxa and toads from across the distribution, we hoped to put the regional studies into a larger context and to examine diversity within the whole group. We specifically wanted to include specimens from the eastern portion of the range as these were not included in previous analyses. Toads from the Southern Rocky Mountain Population (SRMP: Colorado and a few localities in south central Wyoming and northern New Mexico) were of special concern due to declines that probably began in the 1970's (Corn, 2003; Muths and Nanjappa, 2005). The SRMP is listed as endangered by the State of Colorado (Hammerson, 1999), but was removed as a candidate species for listing by the US Endangered Species Act in 2006 in part due to a lack of genetic distinction (Thompson, 2005). The combination of potential morphological divergence of the SRMP from the rest of the group (Schuierer, 1963; Burger and Bragg, 1946; Karlstrom, 1962), a disjunct distribution (Fig. 1), and recent declines, suggested a need for a phylogenetic analysis that included toads from the SRMP in Colorado. To identify relationships among more divergent lineages, we analyzed slowly evolving genes (12S ribosomal DNA and a portion of cytochrome oxidase I) and rapidly evolving DNA data (the control region and restriction sites of the whole mtDNA) with parsimony and Bayesian analyses.

2. Materials and methods

2.1. Data collection and alignment

Specimens (288 individuals from 58 sites, Table 1 and Fig. 1) were collected from all currently recognized taxa and throughout much of the range of the *boreas* group (Fig. 1). Specimens were chosen from localities where taxa exist in isolation whenever possible, because hybridization was suspected among some taxa (Karlstrom, 1962; Morton and Sokoloski, 1978; Mullally and Powell, 1958). All taxon identities were determined by collectors using morphology (hybrids were determined by intermediate morphological characteristics) and range maps (Stebbins, 2003). Thirteen species of *Anaxyrus* with varying levels of divergence from the *boreas* group were included as outgroups along with species of *Ollotis* (Frost et al., 2006b) and *Chaunus* (also called *Rhinella*, Chaparro et al., 2007) as further outgroups (Graybeal, 1997; Pramuk et al., 2001; Pauly et al., 2004; Pramuk, 2006; Frost et al., 2006a). Locality information, voucher identity, number of samples from each locality, restrictions site haplotype numbers and GenBank accession numbers for sequences, are in Table 1. Total DNA was extracted from tissue using standard phenol extraction and proteinase K digestion (Maniatis et al., 1982) or with either the DNeasy Tissue or QIAamp DNA Blood Mini Kits (Qiagen Inc., Valencia CA). Restriction site polymorphisms of the whole mtDNA molecule were identified using standard techniques (Southern, 1975; Maniatis et al., 1982; Koetsier et al., 1993). Genomic DNA was cut with 16 six-base cutting restriction enzymes (ApaI, BamHI, BglI, BglII, ClaI, Csp45I, DraI, EcoRI, EcoRV, KpnI, NheI, PstI, PvuII, SmaI, StuI and XhoI). After digestion, fragments were separated by size with agarose gel electrophoresis, transferred to nylon membranes, and probed with four fragments comprising the complete mtDNA of *Chaunus marinus* (syn. *Bufo marinus*). Restriction sites were mapped (Goebel, 1996) using double digests and serial probing with the four mtDNA fragments.

Sequences of the control region (CR) cytochrome oxidase I (COI), and 12S ribosomal DNA (12S) were determined with amplification and sequencing methods described by Goebel et al. (1999). The 12S was amplified using four primers (12SA-L, Kocher et al., 1989; tRNAphe-L, 12SF-H, tRNAval-H, Goebel et al., 1999). COI sequences were obtained using two primers (CO1e-H, Palumbi et al., 1991; CO1af-L, Goebel et al., 1999) and CR sequences were determined using six primers (CytbA-L, ControlJ-L, ControlK-H, ControlO-H, ControlP-H; Wrev-L, Goebel et al., 1999). The primer ControlP2-H (5′-CATAGATTCASTTCCGTCAGATGCC-3′) was located six bases internal to ControlP-H and was used for sequencing because it provided superior data compared to the terminal amplification primer ControlP-H. For outgroups, 537 bp of the 3′ end of the control region (CR_{537}) were obtained using a combination of four primers (Wrev-L, Control J-L, ControlB-H, ControlP-H; Goebel et al., 1999). Sequences of both strands were obtained for all 12S and COI sequences and at least one accession of all unique CR sequences.

Data were collected in a hierarchical fashion. Restriction sites (RS) were collected initially from all specimens available before 1995 and 31 haplotypes were identified. An 882 bp fragment of CR (CR_{882}) was obtained for all unique RS haplotypes in each *population* (collection site or set of geographically close sites) even when the same RS haplotype occurred in multiple populations. Sequences were also obtained for most *A. exsul*, *A. nelsoni* and *A. canorus* available. Sequences from 12S and COI were obtained from the more divergent haplotypes initially identified with RS and CR and from at least two accessions of all named taxa. For samples added after all RS data were collected the CR_{537} fragment was sequenced first. Then the additional 355 bp (the full CR_{882}) fragment was obtained from all unique CR_{537} haplotypes in each population. Sequence data assisted in refining restriction site maps. After identification of insertions, deletions, and repeated regions in the CR, restriction sites that mapped close to the repeated regions were re-scored or excluded from the analysis if they could not be identified with confidence in all samples.

Sequences were aligned manually. Within the *boreas* group, gaps due to insertions/deletions occurred as single bases with only a few exceptions. A 7-bp gap was found in the 5′ end of CR_{882} in samples from two geographically close sites (Teton Co., WY and Beaverhead Co., MT). The rarity of the deletion and its limited geographic distribution suggest it was a single evolutionary event and it was scored as a single gap. Several larger (163–173 bp) unique repeated regions and a common 21-bp repeated fragment were found within the 5′ end of CR_{882} also, and were excluded from analyses. Sequence alignments of 12S and CR_{537} partitions with outgroup taxa were more ambiguous due to multiple adjacent gaps and those sites were deleted from analyses (6 sites from 12S, 149 from CR_{537}). Only unique haplotypes were included in analyses. Alignments were deposited in TreeBase (Study accession number = S2194, Matrix accession number = M4155-M4161).

2.2. Data analysis

The four data partitions (12S, COI, CR, RS) were first assessed separately. Data for the control region were analyzed both for the larger CR_{882} fragment and the smaller CR_{537} fragment, because CR_{537} was obtained for many more specimens. The protein-coding gene COI was not partitioned further in analyses of the *boreas* group because there were no second position changes, only two first position changes, and no amino acid substations. In exploratory analyses of COI with outgroups data were partitioned further into first positions (11 variable positions) and third positions (there were no second position changes and no amino acid substitutions) but the additional partitioning did not affect rooting position or relationships within the *boreas* group, so COI data were not partitioned further in final analyses.

Table 1
Specimens examined: localities, voucher specimens, and DNA data.

Taxon locality(s)	Voucher	Locality code	Number of samples (n = 288)	RS haplotype (n = 194)	GenBank Accession Nos. for sequence data					
					CR_{882} (n = 117)		CR_{537} (n = 52)		COI (n = 50)	12S (n = 22)
Anaxyrus boreas boreas										
Kane Co., UT, 3 sites	USNMFT211044–8	KaUT	17	1 (9)	EF532065	EF532070	EF532068	EF532073	EF532015	EF531993
	USNMFT064347				EF532066		EF532069	EF532074	EF532016	EF531994
	USNMFT18024–9				EF532067		EF532071	EF532072	EF532017	
Box Elder Co., UT, Red Butte Canyon, Upper Rocky Pass Spring, Lynn Reservoir		BEUT	7	—	EF532075	EF532080	EF532078		EF532018	EF531995
					EF532076	EF532112	EF532079		EF532019	
					EF532077				EF532038	
Summit Co., UT, East Fork of Bear River	USNMFT211041	SuUT	1	2 (1)	EF532082				EF532020	EF531996
Elko Co., NV	AMG554	ElNV	3	—	EF532081	EF532101			EF532032	
					EF532100					
Larimer Co., CO, Rocky Mountain NP Lost Lake and Kettle Tarn	USNMFT064334	LaCO	23	3 (16)	EF532084	EF532094			EF532022	EF531997
	AMG138			4 (1), 5 (3)	EF532092				EF532028	
Gunnison Co., CO, near Crested Butte White Rock Basin and West Brush Creek		GuCO	3	3 (2), 4 (1)	EF532089				EF532026	EF531998
					EF532090				EF532027	
Summit Co., CO, near Montezuma	AMG027	SuCO	4	3 (4)	EF532086				EF532024	
Chaffee Co., CO, Brown Creek, Collegiate Peaks Cpgd Denny Creek and Hartenstein Lake	USNMFT064330	ChCO	27	3 (19)	EF532085				EF532023	
				4 (8)	EF532088				EF532025	
Albany Co., WY; SW Medicine Bow NP		AlWY	2	3 (2)	EF532083				EF532021	
Route Co., CO; First Creek		RoCO	2	3 (2)	EF532091					
Clear Creek Co., CO; Henderson Region, Georgetown, Bethyl Creek		CCCO	20	3 (7)	EF532095	EF532098			EF532030	
				4 (7), 5 (6)	EF532097	EF532099			EF532031	
Boulder Co., CO Indian Peaks Wilderness	USNMFT211037	BoCO	4	3 (2), 5 (2)	EF532093	EF532096			EF532029	
Mineral Co., CO, Cliff Creek	AMG544A	MiCO	1	—	EF532087					
Deschutes Co., OR, near Three Creeks Lake	USNMFT211042	DeOR	10	6 (4), 10 (1)	EF532102	EF532127			EF532036	EF532006
				11 (1), 12 (1)	EF532108	EF532136			EF532044	EF532007
				17 (1), 21 (1)	EF532109	EF532138			EF532048	
				22 (1)	EF532110				EF532049	
Surrey, British Columbia, Latimer Lake	MVZ178495,178498, 178500,501	SuBC	4	6 (2), 8 (2)	EF532103	EF532107			EF532033	
					EF532106				EF532035	
Vancouver Isle, British Columbia	AMG355	VaBC	3	7 (3)	EF532104	EF532105			EF532034	EF531999
Columbia Co., WA, N. Fork Touchet River	MJA:AMG112	CoWA	1	13 (1)	EF532116			EF532040	EF532001	
Skamania Co., WA, Mt. St. Helens	MSB 92531-92538	SkWA	8	—	EF532146		EF532148	EF532152	EF532052	
					EF532147		EF532150	EF532153		
					EF532149		EF532151			
Glacier Co., MT, Glacier NP	USNMFT211007–9	GlMT	4	13 (1)	EF532180		EF532181			
					EF532117		EF532182			
Ravali Co., MT, Kramis Pond	BSFS18016-18023	RaMT	8	—	EF532183	EF532187	EF532185		EF532055	
					EF532184	EF532189	EF532188			
					EF532186		EF532190			
Beaverhead Co., MT, Red Rocks NWR and Twin Lakes, Beaverhead NF	AMG033	BeMT	9	13 (5)	EF532124				EF532039	
				15 (4)	EF532113	EF532119			EF532041	
Teton Co., WY, Yellowstone NP, and Jackson Hole	USNMFT211036	TeWY	8	13 (4)	EF532118	EF532123			EF532042	EF532002
				14 (1)	EF532120	EF532125			EF532043	
				15 (2)	EF532121	EF532126				
				16 (1)	EF532122					
Nez Perce Co., ID, Mud Bog Meadows, China Creek, and Benton Meadows	USNMFT064339	NPID	5	9 (5)	EF532111	EF532115			EF532037	EF532000
					EF532114					
Washington Co., ID, Grouse Creek	AMG541	WaID	8	—	EF532154	EF532158	EF532155	EF532159	EF532053	
					EF532156	EF532160	EF532157	EF532161		

Boise Co., ID, Missouri Mines	AMG532	BoID	9	—	EF532163 EF532164 EF532166	EF532167	EF532162 EF532165 EF532168	EF532170 EF532169	EF532054	
Boise Co., ID. Bull Trout Lake	AMG554	BoID	9	—	EF532172 EF532174 EF532178		EF532171 EF532173 EF532175	EF532176 EF532177 EF532179		
Alaska, Chickamon Rivers	AMG633	ChAK,	19	—	EF532193 EF532196 EF532197		EF532191 EF532192 EF532194 EF532195 EF532198 FF532199 EF532200 EF532201	EF532203 EF532204 EF532205 EF532206 EF532207 EF532208 EF532209 EF532202	EF532056	
British Columbia, Little Tahltan River		LTBC	2				EF532210	EF532211		
Anaxyrus boreas halophilus										
Inyo Co., CA, Darwin Canyon	MVZ178484–9	InCA	6	27 (2), 28 (2) 29 (2)	EF532218 EF532219	EF532220 EF532221			EF532061	EF532012
Mariposa Co., CA, Yosemite NP	Shaffer et al. (2000)[c]	MaCA	1		EF532230					
Santa Clara Co., CA	DM:AMG294	SCCA	1	22 (1)			EF532137			
Ventura Co., CA, Piru and Santa Monica Mts	UCSB29622-29623	VeCA	5	29 (4), 30 (1)	EF532224				EF532063	EF532013
Los Angeles Co., CA Santa Monica Mts and California State University	UCSB29624-29625 ROM21064	LACA	3	29 (3)	EF532222					
Santa Barbara Co., Santa Maria and Lompac to Solvang	UCSB29619-29621	SBCA	16	21 (1)	EF532144	EF532223			EF532062	
	UCSB29626-29637			20 (13) 25 (1), 31 (1)	EF532145 EF532226					
Alpine Co, CA, Eldorado NF, Little Indian Valley	DM:AMG286	AlCA	5	6 (1), 19 (4)	EF532128	EF532129				
San Diego Co., CA, S. of Warner Springs		SDCA	6	29 (6)	EF532225	EF532227			EF532064	EF532014
Contra Costa Co., Corrall Hollow Road	MVZ186282–8	CCCA	7	23 (6) 24 (1)	EF532139 EF532140 F532141	EF532142 EF532143			EF532050 EF532051	
Anaxyrus exsul										
Inyo Co, CA, Buckhorn Spring	MVZ142943–142947	InCA	5	26 (5)	EF532212 EF532213	EF532214 EF532215			EF532057 EF532058	EF532008 EF532009
Anaxyrus nelsoni										
Nye Co., NV, Crystal Springs	KH:AMG167-8	NyNV	2	27 (2)	EF532216 EF532217				EF532059 EF532060	EF532010 EF532011
Anaxyrus canorus										
Mono Co., CA, Sonora Pass	MVZ164900–02	MoCA	3	18 (3)	EF532130 EF532131	EF532132			EF532045 EF532046	EF532003 EF532004
Alpine Co., Co., CA, Tryon Medow	DM:AMG293	AlCA	2	19 (1), 20 (1)	EF532133				EF532047	EF532005
Mariposa Co., CA, Yosemite NP	Shaffer et al. (2002)[a]	MaCA	2	—	EF532228	EF532232				
Fresno Co., Kings Canyon NP	Shaffer et al. (2002)[b]	FrCA	3	—	EF532229 EF532231	EF532233				
A. canorus X A. boreas										
Alpine Co., CA, Wheeler Lake	DM:AMG291-2	AlCA	2	6 (1), 19 (1)	EF532134	EF532135				
Outgroups										
Anaxyrus hemiophrys(Manitoba, Canada)	DMG4337	–	1	–	–		EF532270		EF532252	EF532234
Anaxyrus americanus (Ontario, Canada)	ROM21661	–	1	–	–		EF532271		EF532253	EF532235
Anaxyrus houstonensis (Texas, USA)	AHPFS3095	–	1	–	–		EF532272		EF532254	EF532236
Anaxyrus woodhousii (Colorado, USA)	AMG-1	–	1	–	–		EF532273		EF532255	EF532237

(*continued on next page*)

Table 1 (*continued*)

Taxon locality(s)	Voucher	Locality code	Number of samples (n = 288)	RS haplotype (n = 194)	GenBank Accession Nos. for sequence data			
					CR_{882} (n = 117)	CR_{537} (n = 52)	CO1 (n = 50)	12S (n = 22)
Anaxyrus terrestris (Mississippi, USA)	AHPFS3200	–	1	–	–	EF532274	EF532256	EF532238
Anaxyrus microscaphus (Nevada, USA)	EG:AMG288	–	1	–	–	EF532275	EF532257	EF532239
Anaxyrus californicus (California, CA)	EG:AMG292	–	1	–	–	EF532276	EF532258	EF532240
Anaxyrus cognatus (Nebraska, USA)	HS:AMG83	–	1	–	–	EF532277	EF532259	EF532241
Anaxyrus speciosus (Nebraska, USA)	HS:AMG84	–	1	–	–	EF532278	EF532260	EF532242
Anaxyrus quercicus (South Carolina, USA)	DMH93–56	–	1	–	–	EF532281	EF532263	EF532245
Anaxyrus debilis (Arizona, USA)	ASDM88275	–	1	–	–	EF532279	EF532261	EF532243
Anaxyrus retiformis (Arizona, USA)	ASDM90116	–	1	–	–	EF532280	EF532262	EF532244
Anaxyrus punctatus (Arizona, USA)	ASDM93107	–	1	–	–	EF532282	EF532264	EF532246
Chaunus[d] *marinus* (Peru)	USNM206332	–	1	–	–	EF532285	EF532267	EF532249
Chaunus[d] *marinus* (Mexico)	AMG33 (purchased)	–	1	–	–	EF532286	EF532268	EF532250
Chaunus[d] *beebei* (Trinidad)	USNM286990	–	1	–	–	EF532287	EF532269	EF532251
Ollotis mazatlanensis (Mexico)	ASDM90125	–	1	–	–	EF532283	EF532265	EF532247
Ollotis alvarius (Arizona, USA)	ASDM90124	–	1	–	–	EF532284	EF532266	EF532248

Locality codes are on tree terminals. The identity of haplotypes from restriction site (RS) data only (1–31) is followed in parentheses by the number of individuals in each locality with that RS haplotype. GenBank accession numbers are provided for each DNA fragment (CR, COI, 12S). Abbreviations for voucher placements are: AHPFS, University of Texas, Austin TX; ASDM, Arizona Sonora Desert Museum, Tucson, AZ; BSFS, Biological Survey Field Series (Stephen corn); MSB, New Mexico Museum of Southwestern Biology; MVZ, Museum of Vertebrate Zoology, Berkely CA; RM, Redpath Museum, McGill University; ROM, Royal Ontario Museum, Ontario, Canada, AZ; UCSB, University of California, Santa Barbara; USNM, United States National Museum collection in Washington DC, USA; USNMFH, United States National Museum Field Herp (these specimens to be deposited at UCM, University of Colorado Museum, Boulder CO); and collections by AMG, Anna M. Goebel; DMG, David M. Green; DM, David Martin; DMH, David M. Hillis; EG, Eric Gergus; HS, Hobart Smith; KH, Karin Hoff; MJA, M.J. Adams. Adult and juvenile animals from Colorado were not killed for vouchers, when tadpoles or toadlets were collected a single animal was kept as a voucher for each locality. Many samples from Colorado were blood tissue only and do not have vouchers, *Anaxyrus boreas boreas* is listed as Endangered by the State of Colorado and many historic vouchers exist.

[a] Tissue from samples Y173–3, Y172–3 published in Shaffer et al. (2000).

[b] Tissue from samples S202–4, S202–2, S230–5 published in Shaffer et al. (2000).

[c] Tissue from sample Y004–4 published in Shaffer et al. (2000).

The data partitions were combined in two ways so that only samples with all data were included in analyses. The first combination included 22 samples for which four partitions (12S/COI/CR_{882}/RS) were available. The second combination included 44 samples from three partitions (COI/CR_{882}/RS). By excluding 12S from this combination, the number of samples was doubled and few informative sites were excluded. Because RS data were collected from the whole mtDNA, overlap between RS and sequence data was identified at ten restriction sites (DNA Strider 1.01, Christian Marck). In phylogenetic analyses with multiple partitions restriction sites, found within sequenced regions, were excluded.

In order to compare the utility of the partitions, 22 samples with all data types were examined with independent analyses for each partition (trees not shown). Utility was first assessed by estimating the number of unique haplotypes and variable characters in each partition, because variable markers are critical for examining differentiation within and among closely related populations. A second measure of utility, the proportion of parsimony informative characters per total length of alignment, was also calculated. A larger number of parsimony informative characters does not necessarily result in greater resolution, or support for clades, but we include it as a first measure to estimate efficiency of data collection.

Maximum parsimony (MP) methods were used to generate phylogenetic hypotheses using PAUP* (Swofford, 2002). Parsimony analyses were conducted on each partition and on the two combined datasets. Two MP analyses were conducted per partition (RS, CO1, CR_{882}, CR_{537}, 12S), one with all characters weighted equally and a second with all characters weighted on the re-scaled consistency index (RCI). Transversions and transitions were treated equally and gaps were weighted equally with substitutions (Ogden and Rosenberg, 2007). Heuristic searches were performed using tree bisection-reconnection (TBR) branch-swapping and using the steepest descent option. One million random addition sequence replicate searches were performed for all analyses. Due to the large number of trees in RS analyses, only three trees were saved per replicate. Nodal support for all parsimony analyses was assessed using non-parametric bootstrapping (Felsenstein, 1985), which was computed from 10^4 replicates using a heuristic search, TBR branch-swapping and saving 100 random addition sequence replicates per replicate.

Bayesian methods were also used to generate phylogenetic hypotheses for all partitions of the data, and the two combined datasets. Appropriate models for sequence evolution were explored (Modeltest 3.7, Posada and Crandall, 1998; Mr. Modeltest 2.2, Nylander, 2004). However, there was uncertainty surrounding model choice for ingroup analyses because different models were chosen with hierarchical likelihood ratio tests (hLRT), the Akaike Information Criterion (AIC and AICc; Akaike, 1974), and Bayesian Information Criterion (BIC and BICc, Schwarz, 1978), especially for the smaller data sets. Models for final analyses were based on the model chosen by AIC. However, exploratory analyses using the alternate models were examined for conflict in topology and variation in support levels. For the RS data a single substitution rate (nst = 1) and a proportion of invariant sites (rates = propinv) was used. The presence of invariant sites (coding = noabsence) allowed the data set to have some cutting sites in all samples. For analyses of combined data sets, the models chosen for individual partitions were used and the partitions were unlinked. The relative rates were also unlinked by setting the rate prior to 'variable'.

Bayesian analyses were conducted using MrBayes 3.1.2 (Ronquist and Huelsenbeck, 2003; Huelsenbeck and Ronquist, 2005). For both exploratory and final analyses two simultaneous runs were conducted from random starting trees using four Markov chains (one cold, three heated, temperature of 0.2). In shorter exploratory analyses, five million generations were run and trees

Table 2
Data description for data partitions and combinations of partitions for the *boreas* group

Data description	Single partitions					Partition combinations	
	12S	COI	CR_{882}	CR_{537}	RS	All data: 12S/COI/CR_{882}/RS	Three partitions COI/CR_{882}/RS
Number samples	22	50	117	169	194	22	44
Length of alignment	890	394	882	537	60 sites[a]	2226	1336
Number unique haplotypes	15	18	59	45	31	19	40
Number variable characters[b]	25	27	115	100	30	154	141
Number parsimony informative characters[b]	18	19	91	76	22	111	106
Consistency index	0.90	0.80	0.69	0.66	0.68	0.78	0.73
Rescaled consistency index	0.78	0.72	0.61	0.58	0.58	0.69	0.68
Range of uncorrected *p*-distances (no gaps)	1.1–0.0	3.3–0.3	4.7–0.1	6.0–0.2	–	2.6–0.0	3.8–0.0

[a] The 60 restriction sites represent 360 bp; restriction enzymes recognized six bases at each cutting site.
[b] A character consists of a DNA base or restriction site.

were sampled every 400 generations. The program Tracer 1.4 (Rambaut and Drummond, 2007) was used to assess stationarity by examining plots of all parameter values against generation, convergence was assessed by comparing the values across four runs (two exploratory and two final). Analyses suggested that both stationarity and convergence were achieved for all individual and combined partitions of the data very early (within 500,000 generations all ingroup analyses and one million generations for analyses with outgroups). In the exploratory analyses we set a very conservative burnin of four million generations on the two runs which yielded 5000 trees total. In final analyses 20 million generations were run, trees were sampled every 1000 generations and burnin was set at five million generations yielding 30,000 trees total. These trees were used to create a majority rule consensus tree (FigTree, Rambaut, 2008) as shown in figures.

Two approaches were used to identify a root within the *boreas* group. Outgroup rooting was conducted with Bayesian methods described for final analyses above, on a combined 12S/COI/CR data set and 13 outgroup taxa. Bayesian methods described above were also used to root with a molecular clock (as in Steele and Storfer, 2006) except that the prior probability distribution on branch lengths was set to a coalescence clock model, which forces a root on the tree. Ingroup rooting with a molecular clock was conducted on the larger CR data set and the two combined data sets.

3. Results

3.1. Identification of major clades and minor groups

A combined analysis of all data partitions (2226 characters, Table 2) from 22 specimens identifies three major haplotype groups (Fig. 2). Rooting with molecular clock methods identifies the three major groups as clades (but see outgroup rooting below). We refer to the three lineages as Northwest (NW), Eastern (E) and Southwest (SW); the clade names correspond to their respective geographic regions (Fig. 1). The three major clades correspond only in part with their taxonomic identities. The NW major clade corresponds roughly with the species *A. boreas* and includes the type localities for both subspecies, *A. b. boreas* (Columbia River and Puget Sound: Baird and Girard, 1852) and *A. b. halophilus* (Solano Co., CA; Baird and Girard, 1853), which is near San Francisco. The SW major clade includes *A. exsul*, *A. nelsoni* and some *A. canorus*, which are identified from their type localities and are discussed below. The SW clade also includes some divergent lineages in southern California currently considered *A. b. halophilus*. The eastern clade (E) is not differentiated taxonomically, but is currently part of *A. b. boreas*, and sister to the NW clade.

Due to the more intensive sampling ($N = 117$, Table 2) analyses of CR_{882} identifies all major clades as well as minor groups (Fig. 3), and refines geographic distributions (Figs. 1 and 4). Rooting with a clock model identifies the major groups as clades, but fails to resolve their sister relationships. Minor groups within the SW major clade (Figs. 3 and 4) include a weakly supported *A. nelsoni* (SW-*nelsoni*), a divergent and strongly supported group from nearby Darwin Canyon, Inyo Co, CA (SW-Darwin Canyon), and a strongly supported, but less divergent group of toads from the southernmost distribution of the *boreas* group in California (SW-SCA). Four genetically divergent but geographically close specimens of *A.*

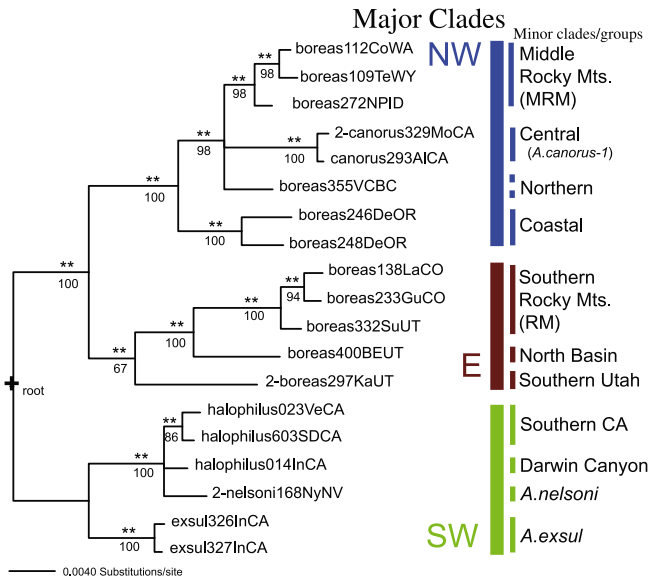

Fig. 2. Major haplotype clades: Bayesian majority rule consensus tree from analyses of 22 samples with all data types combined (2226 aligned sites, Table 2). The terminals are identified first by taxon names: *boreas* (*Anaxyrus b. boreas*), halophilus (*A. b. halophilus*), nelsoni (*A. nelsoni*), exsul (*A. exsul*) and canorus (*A. canorus*). The numbers after the species name are unique identification numbers for individual specimens (AMG numbers). Abbreviations for localities (as in Table 1) follow the AMG number. When multiple specimens had identical haplotypes, the number of specimens with that haplotype precedes the species name and all localities for that haplotype are identified. Bayesian posterior probability values are above the branches and are indicted by double asterisks (**) for values 97–100, numeric values are provided for lower support values. Numbers below the branches are bootstrap values above 50 based on RCI-weighted parsimony analyses of the same data set. The major haplotype clades (NW-northwest, SW-southwest, E-eastern) are identified by thick bars to the right of the tree. The minor haplotype clades (identified by thin bars) or assemblages (identified by dotted lines) are identified in greater detail in the analysis of the control region (Fig. 3). The tree shown was based on the HKY + I evolutionary models chosen for each partition and the partitions were unlinked. Additional results (exploratory analyses not shown) including majority rule trees based on clock models and strict consensus trees of RCI-weighted parsimony analyses, did not conflict with, and varied little in support values, to the tree shown. The analysis shown was not rooted, but the position of the root (symbol +) was inferred from an independent analysis using a coalescence clock model.

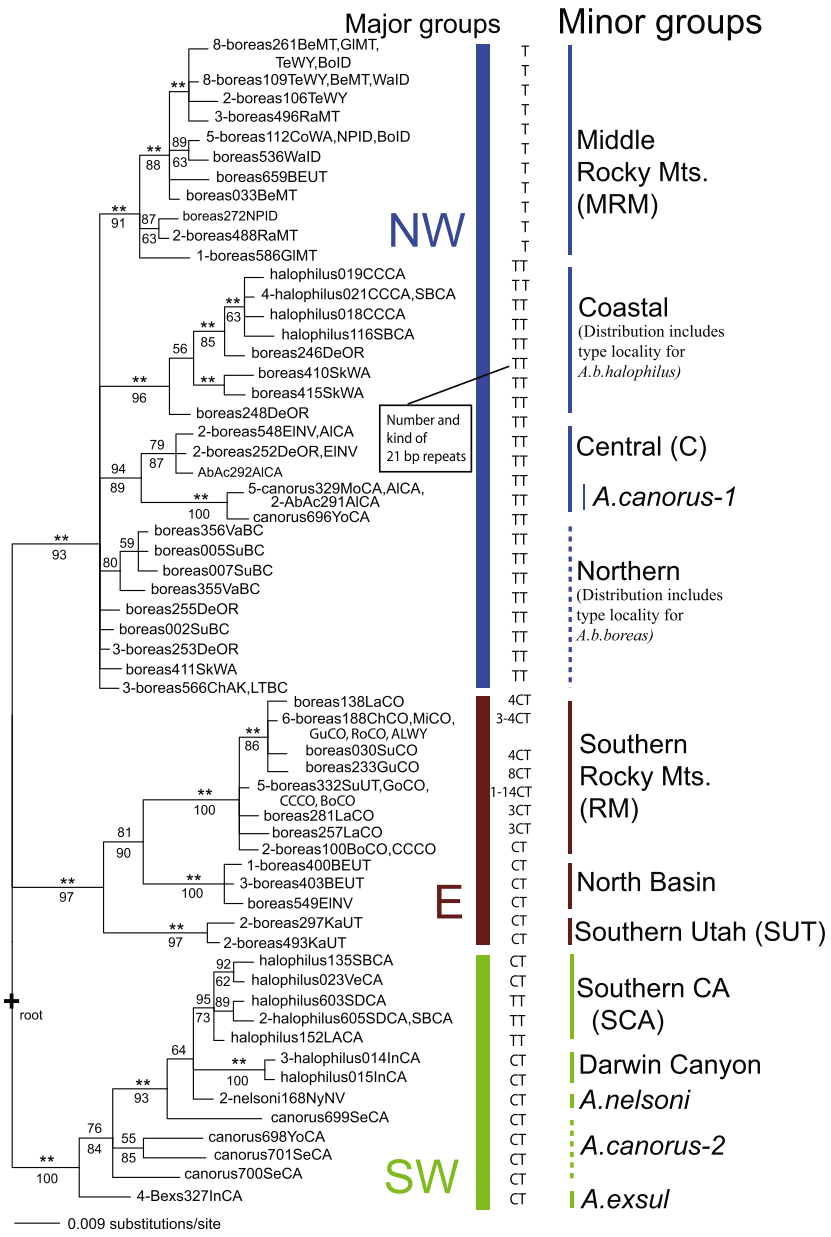

Fig. 3. Major and minor groups: Bayesian majority rule consensus tree from analyses of the large fragment of the control region (CR_{882}; 117 samples, Table 2). Terminals, Bayesian support values, bootstrap values and the root were identified as in Fig. 2 with one exception: the taxon designation AbAc represents a hybrid of *A. boreas* and *A. canorus*. The minor group names *A. canorus-1* and *A. canorus-2* follow the conventions of Shaffer et al. (2000). Thick bars identify the major haplotype clades (NW, SW, E, Fig. 1). Thin bars identify the minor haplotype groups (Fig. 4). Note that two minor groups, NW-northern in the NW major group and *A. canorus*-2 in the SW major group, are not clades and are identified by dotted lines. Majority rule tree shown was based on the HKY + I model. Additional exploratory analyses (not shown) based on HKY + Γ, HKY + I + Γ were identical to or consistent in topology with the analysis above and varied little in support values. The analysis shown was not rooted, but the position of the root (symbol +) was inferred from an independent analysis using a coalescence clock model. Notations to the right of the thick bars identify the kind and number of a 21 bp repeated fragment (Table 4). The letters "T" and "C" each refer to the specific sequence of the repeated fragments present (C = GTACA TATTA TGAAT GCA**C**G A; T = GTACA TATTA TGAAT GCA**T**G A). The number preceding the "C" refers to the number of copies of the "C" fragment if more than one copy was found, and a range is provided for terminals representing haplotypes from multiple specimens that were identical except for the number of repeated copies.

canorus form an additional paraphyletic assemblage within the SW group (called *A. canorus*-2 in discussions below). The mtDNA of *A. canorus* was previously found to be paraphyletic or polyphyletic (Graybeal, 1993; Shaffer et al., 2000; Stephens, 2001; Pauly et al., 2004) and analyses here show *A. canorus* to be paraphyletic and place the two previously recognized and highly divergent groups (*A. canorus*-1 and *A. canorus*-2) within the NW and SW major clades, respectively. The last SW minor haplotype group, *A. exsul*, is sister to all other toads in the SW major group. The Eastern (E) major clade consists of three strongly supported haplotype groups (Figs. 3 and 4), including toads at the northern end of the Great Basin (E-NBasin) at the border of Utah and Nevada, toads in the southern Rocky Mountains of Colorado including the Uinta Mts. of Utah (E-RM), and a third group of toads from southern Utah (E-SUT) that is sister to all other toads in the E major clade.

The NW major haplotype clade covers the largest geographic region and is comprised of three generally less divergent monophyletic groups and one non-monophyletic assemblage. The NW-middle Rocky Mountain (NW-MRM) group consists of toads from western Washington, Idaho, Montana, and northwestern Wyoming. A second group consists of toads along the western coast (NW-Coastal Fig. 3 and 4) from Washington, Oregon, and into

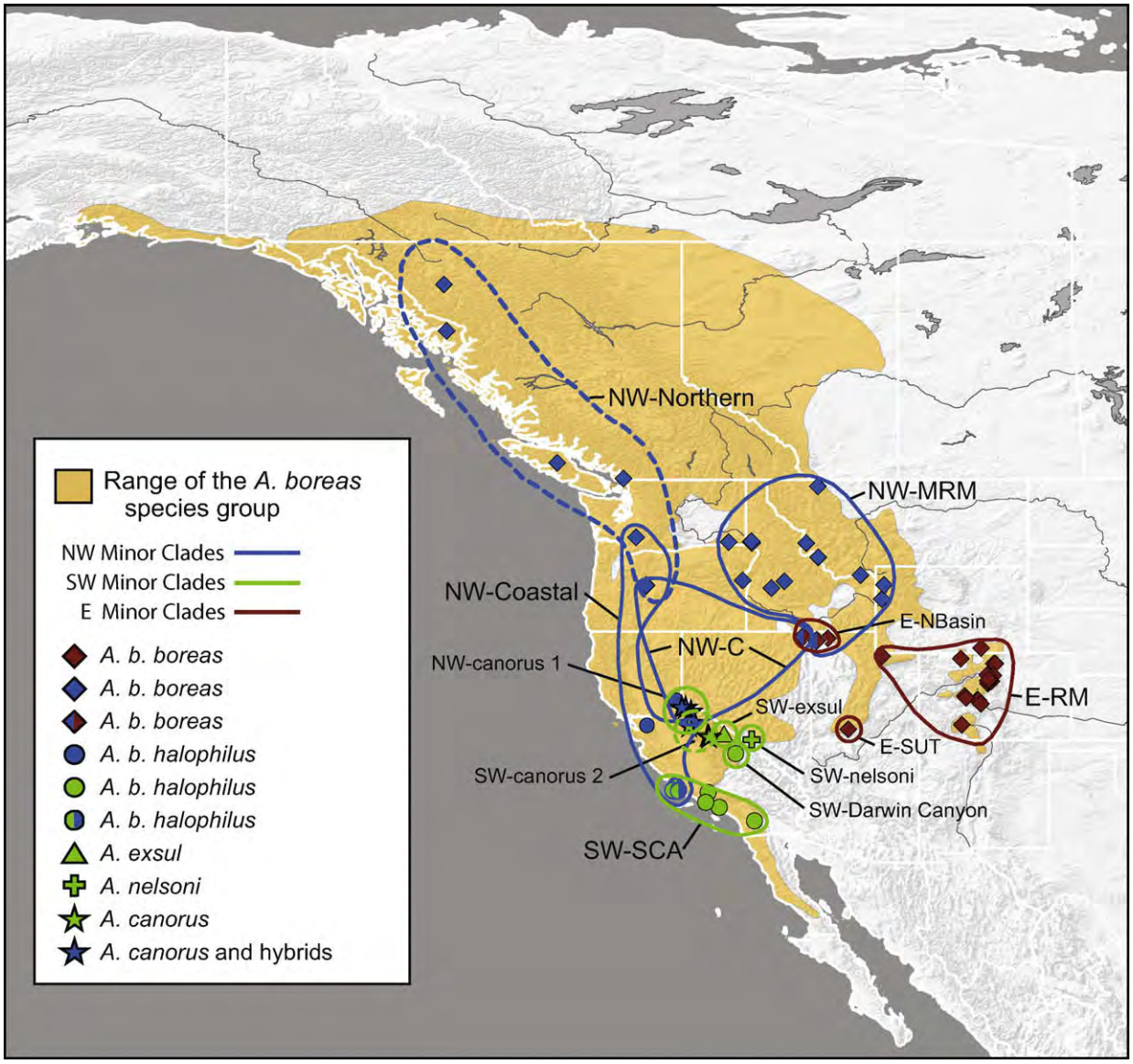

Fig. 4. Sample localities and distributions of minor haplotype groups. Specimens analyzed, species identities and map information are as in Fig. 1. Circles indicate geographic distributions of minor mtDNA haplotype groups. Groups drawn with solid lines are clades, groups drawn with dashed lines are non-monophyletic assemblages (NW-northern and *A. canorus*-2). Sites with multiple divergent mtDNA lineages are within overlapping circles.

California, as far south as Santa Barbara and east into the Sierra Nevada. This clade includes the type locality of *A. b. halophilus*. The NW-coastal clade corresponds to the northern distribution of the subspecies *A. b. halophilus* (Stebbins, 2003), although it extends further north, into Washington State. A third minor group, NW-central (NW-C), consists of toads from the central region of western US (northeastern Nevada, central Oregon, and the Sierra Nevada of California) and includes toads identified as *A. boreas* as well as *A. canorus*, and known hybrids of *A. b. boreas* × *A. canorus* (within *A. canorus*-1). All localities sampled from the NW-central clade share haplotypes with other NW clades (Deschutes Co., OR) or other major clades (E in northwest Nevada, SW at the northern end of the Sierra Nevada). A fourth group (NW-northern) is a non-monophyletic assemblage of toads in the northern coastal regions of North America from Oregon north into Canada and Alaska and the type locality for *A. b. boreas* (vicinity of Puget Sound; Schmidt, 1953) is found within the distribution of this group. The Bayesian majority rule tree using a coalescent molecular clock (not shown) identified NW-northern as monophyletic but this was not strongly supported (posterior probability 83%).

3.2. Data partitions

Bayesian analyses of RS, COI and 12S (Fig. 5A–C) although less resolved, are consistent with the major and minor groups discovered with CR_{882} (Fig. 3) and combinations of partitions (Figs. 2 and 5D) with a single exception. The COI data partition identifies the E group as polyphyletic, with the E-Southern Utah group sister to the NW clade rather sister to the rest of the E clade, although this placement is not strongly supported. Identical results for this placement were obtained in exploratory analyses using all models chosen for the COI partition (GTR + I + Γ, GTR + I, GTR + Γ, HKY + I + Γ, HKY + I, HKY + Γ) and placement as sister to the NW clade was supported in some analyses with posterior probability values up to 91%.

12S provided little data (Table 2) but results were consistent with other partitions and combinations of partitions. The majority rule consensus tree of 12S based on the HKY + I model chosen by the Akaike weights (Fig. 5C) was less resolved than exploratory analyses (not shown) with more complex models using a gamma distribution for across-site rate variation (HKY + I + Γ, one of the

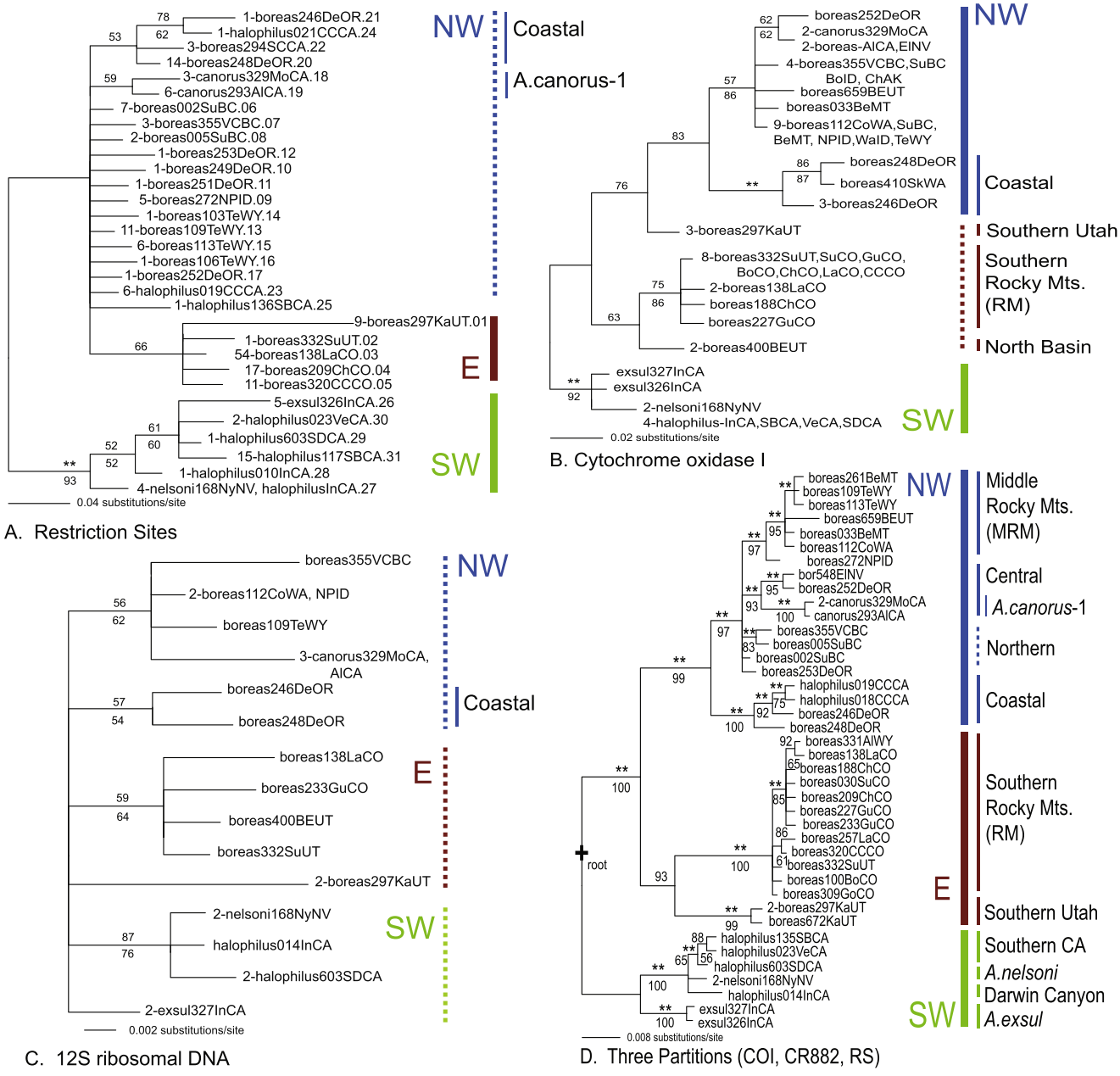

Fig. 5. Bayesian majority rule consensus trees from three analyses of individual partitions (RS, COI and 12S) and a combined analysis (COI/CR_{882}/RS). Terminals, Bayesian support values, bootstrap values, and roots were shown as in Fig. 2. Thick bars to the right of trees identify the major haplotype clades (NW, SW, E; Fig. 1). Minor groups (Fig. 4) are identified as clades (thin bars) or assemblages (dotted lines). (A) Bayesian majority rule consensus tree of restriction sites. The last number of each OTU is the haplotype number based on RS only identified in Table 1. (B) Bayesian majority rule consensus tree of cytochrome oxidase I (HKY + I model). (C) Bayesian majority rule consensus tree of 12S ribosomal DNA (HKY + I model). (D) Bayesian majority rule consensus tree of three partitions, COI/CR_{882}/RS, combined (HKY + I models for sequence data, partitions unlinked). The analysis shown is not rooted, but the position of the root (symbol **+**) was inferred from an independent analysis using a coalescence clock.

models chosen by hLRT, and GTR + I + Γ, used with outgroups), and with analyses using a molecular clock. Although analyses with more complex models identified the major clades E, NW, SW and some minor clades (as found in partition combinations) support was still low, but higher than for less complex models (Lemmon and Moriarity, 2004). The combined analyses of three partitions excluding 12S (COI/CR_{882}/RS, Fig. 5D) identified all major groups and all minor groups for which the larger data set were available (samples from E-north Basin and from *A. canorus*-2 were missing some data). Thus, in analyses of the *boreas* group only, excluding the 12S (loss of 890 bp) resulted in the loss of only a few variable and parsimony informative characters (Table 2), but due to the hierarchical sampling strategy, doubled the number of samples that could be analyzed without missing data.

Within CR_{882}, the number of copies and the sequence of a 21-bp repeated region showed a phylogenetic pattern (Fig. 3, Table 4). The repeat varied in number from a single copy to more than 14 copies although the exact number of copies was not identified in samples with large numbers of repeats (greater than 14) due to poor sequence data common in long highly repeated regions. Within the *boreas* group, the sequence of the repeat varied at site 19, where specimens had either a "C" or a "T" (Table 4). Some phylogenetic patterns can be seen in both the number and sequence of copies although the patterns were not always fixed among clades (Fig. 3). The sequence of the repeated fragment seems to be relatively conserved; additional variation was found at one site in a single specimen of the *boreas* group and the homologous fragment could be found in all outgroups (Table 4). The number varied with-

Table 3
Data description and tree information of analyses of 22 samples in the *boreas* group with all data types

Data partition or combination:	12S	COI	CR_{882}	CR_{537}	RS
Length of alignment in base pairs	890	394	882	537	60 sites[a]
Number unique haplotypes	15	13	17	14	14
Efficiency: % haplotypes per bp	1.6%	**3.3%**	1.9%	2.6%	**3.9%**
Number variable characters	25	23	**79**	54	24
Efficiency: % of variable characters per bp	2.8%	5.8%	9.0%	**10.1%**	6.7%
Number parsimony informative characters	18	19	**64**	44	19
Efficiency: % PI characters per base pair	2.0%	4.8%	7.2%	**8.2%**	5.3%
Range of uncorrected *p*-distances (no gaps)	1.1–0.0	3.0–0.0	4.5–0.0	6.0–0.0	–
Length of most parsimonious tree	29	29	104	73	30

Numbers discussed in the text are in bold and underlined.
[a] The 60 restriction sites represent 360 base pairs.

in the *boreas* group, but high numbers of copies were found only in the "C" copy and in the E-southern Rocky Mountains, except for one specimen from Contra Costa Co., CA, that had eight or more copies of "T". Only a single copy was found in outgroups. Although neither the number of copies nor the sequence variation were included in the analyses of the whole group, both seem to show some phylogenetic information that might be useful in examining regional variation.

The utility of partitions varied in a comparison of 22 samples with all data (Table 3). The shortest fragments (RS and COI) were the most efficient in identifying the largest number of unique haplotypes per base pair of sequence obtained (3.9% and 3.3% respectively). The larger CR_{882} fragment identified the greatest total number of variable (79) and parsimony informative characters (64), but the smaller CR_{537} fragment was the most efficient in identifying the greatest proportion of variable (10.1%) and parsimony informative characters (8.2%) per length of sequence obtained. Comparing only three efficiency parameters (% haplotypes/bp, variable characters/bp, and parsimony informative characters/bp), CR_{537} was the most efficient in identifying variable and parsimony informative characters per length of sequence obtained. Analyses of CR_{537} (not shown) included only 61% of the larger CR_{882} fragment. This resulted in the loss of 14 unique mtDNA haplotypes, however, all relationships were identical to analyses with CR_{882} data and all major and all but one minor group was resolved (some haplotypes from the southern California were identical to *A. nelsoni* haplotypes).

3.3. Rooting

Bayesian analysis conducted with a coalescence clock identifies the SW group as sister to a NW/E clade (Figs. 2, 3 and 5D). Bayesian analyses with outgroups (Fig. 6) strongly supports the monophyly of the *boreas* species group, the monophyly of both the E and NW major clades, and the monophyly of a combined E/NW clade. However, the majority rule tree identifies the SW group as paraphyletic, and *A. exsul* as sister to the NW/E clade. This root placement is not strongly supported, but suggests that at least portions of the SW, if not the entire SW, may be ancestral in the species complex. With the exception of root placement, all relationships within the *boreas* species group identified from analyses with outgroups, are consistent with analysis of ingroups only. Strongly supported relationships among the taxa used as outgroups were consistent with strongly supported results from previous analyses of mitochondrial genes (Frost et al., 2006a; Pauly et al., 2004; Graybeal, 1997; Pramuk et al., 2001; Pramuk, 2006). In exploratory analyses the root position was affected by outgroups chosen; rooting with single species within the Nearctic clade resulted in various weakly supported placements of the root (analyses not shown). However, rooting with multiple divergent species in the Nearctic clade, rooting with species in the *Ollotis* or *Chaunus* genera, or a combination of Nearctic and *Ollotis*/*Chaunus* always resulted in a root placement between *A. exsul* and the rest of SW.

4. Discussion

4.1. Discovered mtDNA Clades

The phylogenetic pattern of mtDNA indicates that the species *A. boreas*, as recognized by Stebbins (2003), is not monophyletic (Figs. 2, 3 and 5D). *Anaxyrus boreas* is either paraphyletic, with multiple localized species (*A. exsul*, *A. nelsoni*, *A. canorus* and perhaps other undescribed taxa) derived from within *A. boreas*, or *A. boreas* is polyphyletic and comprises only portions of three major mtDNA clades, NW, SW and E (Fig. 3). The subspecies *A. b. boreas* occurs in both the NW and E major clades, and A. *b. halophilus*, in the SW and NW. We suggest that *A. boreas* comprises a widespread clade corresponding only to the NW major clade whose distribution includes the type locality (mouth of the Columbia River, Baird and Girard, 1852). Although taxon rank (species or subspecific evolutionary units) is not clear based solely on mtDNA, the NW haplotype groups and assemblages comprise a set of monophyletic units. *Anaxyrus boreas boreas* is best represented by the NW-northern assemblage, because the type locality occurs within its distribution (vicinity of Puget Sound; Baird and Girard, 1852). *Anaxyrus boreas halophilus* is best represented by NW-coastal, because this mtDNA haplotype is the only one that occurs in the vicinity of the type (Benicia, Solano Co., CA; Baird and Girard, 1853). The distribution of the mitochondrial NW-coastal clade and *A. b. halophilus* (Stebbins, 2003) differ somewhat at the northern and southern edges: the NW-coastal clade occurs a little farther north (into Washington State), but not as far south as the previously described *A. b. halophilus* (NW-coastal occurs only down to Santa Barbara, CA). Although we included few samples from central California, the sole distribution of the NW-Coastal haplotype in this region is supported by more extensive sampling by Stephens (2001), who identified the "central CA *boreas*" clade with a similar distribution to our NW-Coastal clade, and a similar relationship to the northern *A. canorus* and *A. boreas*. Our results are also consistent with the geographic distributions of clades/groups of Graybeal (1993) and Feder (1973), who examined mitochondrial cytochrome b sequences and allozymes, respectively. Careful morphological studies of the whole group, especially of the type specimens, are clearly needed in light of the mtDNA evidence because genetic analyses have previously identified unrecognized morphological differentiation (e.g., Shaffer et al., 2004; Vredenburg et al., 2007). More extensive analyses of nuclear data (e.g., genes examined in Feder, 1973; Maxson et al., 1981; Graybeal, 1997; Simandle, 2006; Pramuk, 2006; Frost et al., 2006a) and finer sampling would be valuable to determine taxonomic status.

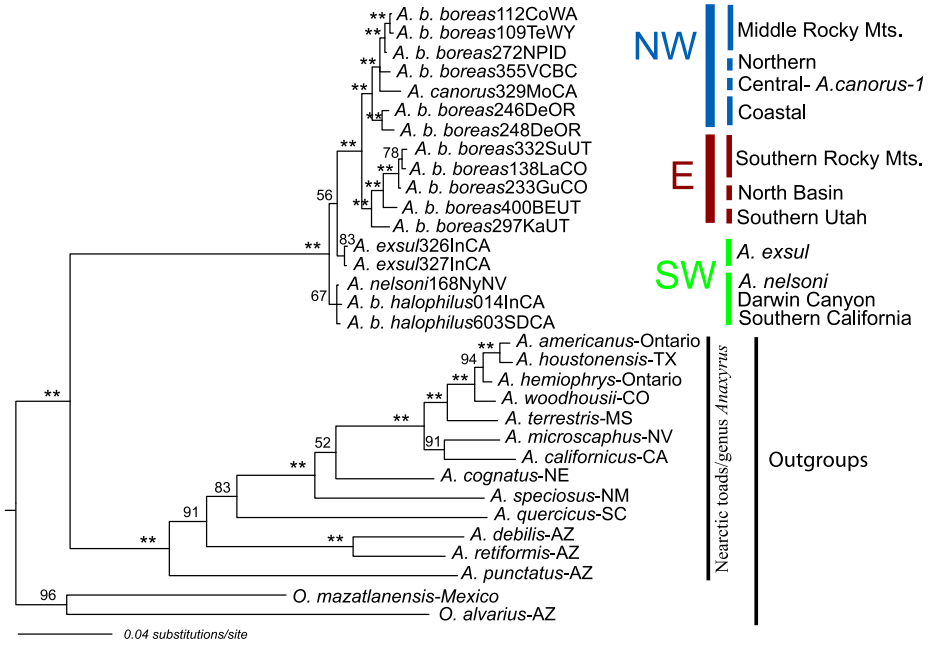

Fig. 6. Bayesian majority rule consensus tree of the *boreas* species group rooted with outgroups. Analysis based on 1671 bp of sequence data (Table 2) including the 12S (894 aligned sites), COI (394 aligned sites) and CR (379 aligned sites) DNA partitions. Analysis includes 35 unique haplotypes (from 40 samples) although some of the more divergent outgroups included in the analysis (Table 1) were removed from the figure so that the topology and branch lengths within the *boreas* group could be seen more clearly. Terminals, Bayesian posterior probabilities and clades are identified as in Fig. 2. Analysis is based on unlinked partitions and the GTR + I + Γ model for all partitions of the data.

Table 4
Sequence alignment of a 21 bp repeated region

Species groups	Number samples	Sequence of all 5′ copies variable site: 19	Sequence of final 3′ copy variable sites: 17, 19
boreas species group:			
Common forms:			
E-(all), SW(n = 16)	35	GTA CAT ATT ATG AAT GCA **C**GA	GTA CAT ATT ATG AAT GCA **T**GA
NW(n = 38), SW(n = 4)	42	GTA CAT ATT ATG AAT GCA **T**GA	GTA CAT ATT ATG AAT GCA **T**GA
NW-MRM	29		GTA CAT ATT ATG AAT GCA **T**GA
Unique sequence:			
NW-MRM (AMG586)	1	GTA CAT ATT ATG AAT GCA **T**GA	GTA CAT ATT ATG AAT G**T**A **T**GA
Outgroups:			
americanus species group	5		GTA CAT ATT AT**T** AAT G**T**A **TW**A
A. microscaphus	1		GTA CAT ATT AT**T** AAT G**T**A **TV**S
A. punctatus	1		GTA CAT ATT AT**T** AAT GCA **TA**G
O. mazatlanensis, *O. alvarius*	2		GTA CAT ATT ATG **Y**AT GCA **T**GA
C. marinus	2		GTA CAT ATT ATG **Y**AT GCA **C**GA

The number of copies and the sequence of the repeat fragment varied within and among major groups (Fig. 3).
When sequence variation was found in outgroups the variation was identified with standard abbreviations: W = A/T, V = A/C/G, S = C/G, Y = C/T.

We suggest the SW major clade corresponds to a suite of new and previously described species or assemblages (Figs. 3 and 4). These include *A. exsul*, *A. nelsoni*, several lineages from southern CA including Darwin Canyon (currently regarded as *A. b. halophilus*) and the assemblage *A. canorus-2* (discussed below). *Anaxyrus exsul* occurs in only four isolated desert springs in the Deep Springs Valley, between the Inyo and White Mountains of California (Fellers, 2005; Simandle, 2006), the type locality. The small population size and relatively long time of geographic isolation (Hubbs and Miller, 1948) are consistent with the monophyly and high divergence found in mtDNA here. *Anaxyrus nelsoni* is currently known only from several desert springs and the Amargosa River within the Oasis Valley, NV (Altig and Dodd, 1987; Goebel et al., 2005; Simandle, 2006) and specimens for analyses here were collected from the type locality at Crystal Springs. The mtDNA of two *A. nelsoni* were sister, but were not highly differentiated from mtDNAs in southern California. This lack of divergence suggests a close relationship to previously unrecognized lineages of the SW clade. A broad distribution of close relatives is further supported both by allozyme data (Feder, 1973), which identified populations in Owens Valley and Darwin Canyon that shared alleles (in low frequency) with *A. nelsoni* and *A. exsul* and by the wider distribution of *A. nelsoni*, suggested in early studies (Stejneger, 1893; Linsdale, 1940; Wright and Wright, 1949; Karlstrom, 1962). In contrast, results from Pauly et al. (2004) suggest that some *A. nelsoni* mtDNA haplotypes are nested within our NW group (one specimen of *A. nelsoni* was more closely related to *A. boreas* of Alaska and *A. canorus-1*, than to *A. exsul* and toads from southern CA). It is possible that like *A. canorus*, mtDNAs of *A. nelsoni* may contain haplotypes of both the NW and SW mtDNA major clades. The clade, SW-Darwin Canyon, has a divergent haplotype but is not recognized taxonomically. The minor clade with the largest distribution, SW-southern CA is found only in southern California. This clade is consistent with the "southern *boreas*" clade of Stephens (2001) in its distribution and

relationship to the southern *A. canorus*. Similarly, Graybeal (1993) found *A. boreas* from San Diego to be sister to the southern *A. canorus*, and both were closely related to *A. exsul*.

The eastern mtDNA clade comprises three divergent groups. Southern Utah (E-SUT), is a disjunct population discovered in 1994 (Ross et al., 1995). The group E-north Basin is similarly divergent, but haplotypes from the NW-central and NW-middle Rocky Mountains also occur in the region. The E-Rocky Mountain clade was discovered largely from the geographically disjunct region in Colorado and southeastern Wyoming (the Southern Rocky Mountain Population, SRMP), but a single haplotype from this clade was also discovered in the Uinta Mts. of Utah. The SRMP, listed as endangered in Colorado, is disjunct from all other toads (Fig. 1): the Red Desert and dry plains in southwest and central Wyoming serve as effective barriers between toads in northwest Wyoming and southeast Wyoming, and toads in Colorado are separated from those in Utah by at least 200 km and the dry intermountain basin of the Green River. The complete geographic isolation of the toads in the SRMP suggest that the closely related haplotype in the Uinta Mountains, Utah, is due to incomplete lineage sorting, commonly found in recently isolated groups.

Previous studies (Graybeal, 1993; Shaffer et al., 2000; Stephens, 2001; Pauly et al., 2004), found *A. canorus* to be polyphyletic or paraphyletic with *A. canorus*-2. The regional studies by Graybeal (1993) and Shaffer et al. (2000) identified *A. exsul* as a sister taxon to the southern lineage, *A. canorus-2*, corroborating a placement within the SW major clade. Data presented here identifies *A. canorus-2* as a paraphyletic assemblage, as was found by Stephens (2001). *Anaxyrus canorus-1* was found in this study to be within the widely distributed NW major clade (monophyletic with toads from northern and central CA as well as southern OR) and this is also consistent with Stephens (2001). The derivation of *A. canorus* from within *A. b. boreas* was suggested by both Stebbins (1951) and Karlstrom (1962) based on morphological similarities, and this is consistent with finding the *A. canorus*-1 lineage within the NW major clade. At this point *A. canorus* appears to be either multiple entities or derived from multiple divergent mtDNA lineages.

Results here are remarkably consistent with the very first molecular phylogeographic analysis of the group (Feder, 1973) based on allozyme data. UPGMA dendrograms, based on distances between populations, showed *A. exsul* to be most genetically similar to *A. nelsoni*, and an *A. exsul*/*A. nelsoni* group to be most similar to a *A. b. boreas*/*A. b. halophilus* group. Feder examined *A. b. boreas* only from Washington near the type locality (our NW-Northern group), and her *A. b. halophilus* were collected from within the distribution of our NW-Coastal clade; thus her results from nuclear DNA are similar to those found with mtDNA. Feder did not sample *A. boreas* from southern California (SW-CA clade) so it is still unclear whether nuclear DNA will identify a SW-southern California clade found with mtDNA. In contrast to our study, Feder found *A. canorus* to be sister to all other specimens in the group. This finding may reflect the difficulty of rooting a group of close taxa with distant outgroups, or is a result due to sampling a paraphyletic *A. canorus* from both the SW and NW lineages.

4.2. Sympatry, hybridization and introgression among mtDNA lineages

Introgression of mtDNA is of concern because it precludes accurate identification of organismic lineages with mtDNA analyses. Hybridization is of special concern among toads because both close and divergent species interbreed where they are sympatric (or in captivity; Blair, 1972a), and F1 specimens develop. This unusual level of hybridization in toads may occur because of external fertilization and the "trial and error" method of mate recognition by males in this species group (Karlstrom, 1962). Within the *boreas* group, *A. boreas* hybridizes with *A. hemiophrys* in Alberta (Stebbins, 2003), with *A. microscaphus* in southwestern Utah (Blair, 1955), and with *A. punctatus* in California, despite differences in habitat preferences, species-specific male mating calls, and different timing of reproduction among species (Feder, 1979). In addition, hybridization among lineages of divergent species may not always be identified by morphology (Lamb and Avise, 1987); some F1 hybrid individuals between *A. boreas* and *A. punctatus* were not recognized without genetic data (Feder, 1979). If hybrids from taxa that are highly morphologically divergent cannot be identified in the F1, surely hybrids among morphologically similar lineages go unnoticed. However, the occurrence of hybrids is not always associated with introgression and does not always imply conspecificity (i.e., lack of speciation, Mebert, 2008; Nosil, 2008). All hybrids identified in this study (from morphology) were among closely related lineages and limited to the NW-central minor group. Hybrids of *A. boreas* and *A. canorus* were identified by collectors at the northern end of the range of *A. canorus* (Figs. 2 and 4). Hybridization studies produced F2 hybrids of *A. canorus* and *A. boreas* in the laboratory (Blair, 1972c), but the collection localities of these specimens were not identified by Blair so their correlation with mtDNA studies is not clear. Hybridization between *A. b. boreas* and *A. b. halophilus* in northern California was mentioned, but not described in any detail by Camp (1917a) and Storer (1925), but the large range of sympatry was identified with morphological intermediates (Stebbins, 1951). It is not likely that specific levels of mtDNA divergence indicate reproductive isolation (Hillis, 1988). However, genetic distances (uncorrected *p*-differences) among *A. americanus*, and *A. hemiophrys*, used as outgroups here, had lower levels of mtDNA divergence than those found among the major clades in the *boreas* group yet they are maintained by hybrid zones (Green, 1983) with limited introgression (Green and Pustowka, 1997). Yet regions of sympatry are of special concern because introgression is possible, but not necessarily occurring, where the toads have the opportunity to interbreed. Analyses of nuclear genes that assort independently are critical in these regions.

4.3. Value of partitions

Due to the increased ease of sequencing, RS of the whole mtDNA are rarely used today in phylogenetic analyses and were thought to have a limited lifespan even when they were first collected (Felsenstein, 1992). But RS here provided two surprises. First, RS were most efficient at identifying the largest number of haplotypes per bp examined (Table 3), a characteristic that is very useful in identifying large numbers of individuals and in looking at very fine relationships (Avise et al., 1998; Waldman et al., 1992). A second surprise was the emergence of phylogenetic signal consistent with other sequence data, when RS were analyzed with Bayesian methods (Fig. 5A). Similar topologies among Bayesian analyses of data partitions suggest that RS data contain usable phylogenetic signal and, if available from past analyses, could be combined with sequence data rather than discarded. Similarly, 12S was one of the first DNA regions for which primers were developed (Palumbi et al., 1991) and was used commonly for vertebrate systematics. Despite the limited variability among close lineages (Tables 2 and 3), the gene can provide a tree topology consistent with larger data sets (Figs. 2 and 5C) especially with analyses using more complex models of evolution.

The control region provided a higher number of variable characters than ribosomal and protein-coding genes (Tables 2 and 3) as was found in previous studies (Liu et al., 2000; Fu et al., 2005). However, in some species the 5′ end of CR_{882} contains inserts or repeated regions that make amplification, sequencing, or alignment difficult (Goebel et al., 1999; Liu et al., 2000; Smith and Green, 2004; Stöck et al., 2006; this study) and was excluded in analyses

with outgroups in this study due to both the inability to amplify the fragment in some species and difficulty in aligning taxa from multiple divergent species groups. The smaller CR_{537} fragment, which excludes the 5′ end of the longer CR_{882}, still provided the greatest number of variable and parsimony informative characters per bp examined (Table 3) with only slightly less resolution than the longer CR_{882} fragment. COI has been proposed as a gene useful in barcoding (Herbert et al., 2003; Herbert and Gregory, 2005), which is a process to provide a unique genetic identity for divergent lineages. In this group COI identified divergent lineages (Fig. 5B), even this small fragment (394 bp) would function as a barcode. Although barcoding has many limitations (Meier et al., 2006), CR_{882} or CR_{537} might be useful among bufonids to assist in this process.

4.4. Rooting and estimating time of divergence

Lack of a definite root is not uncommon in intraspecific phylogenetic analyses due to the high similarity of haplotypes within species or species groups and the often distant outgroup haplotypes (Castelloe and Templeton, 1994; Wood et al., 2008). In this study, rooting methods with a molecular clock provided consistent results (SW was sister to a NW/E clade in analyses with larger combined data sets), whereas rooting with outgroups suggested the root was within the SW group. Absence of a clearly inferred root precludes identification of monophyletic groups, because monophyly depends on root position. However, all lines of evidence suggest that the E and NW groups are monophyletic and that the SW group is either sister to the E/NW clade, or sister to that clade plus *A. exsul*.

Estimates of divergence times can be made from mtDNA sequence similarities if a relatively constant rate of molecular evolution is assumed (e.g., Shaffer and McKnight, 1996; Macey et al., 1998; Masta et al., 2003). We estimated times of divergence from a rate of 1.644% bp changes per lineage, per million years as estimated by Stöck et al. (2006) for control region sequences in *Bufo virdis*. We recognize that our estimate is limited because *B. virdis* is quite distant from *A. boreas* (Frost et al., 2006a) and estimated rates change both among lineages and with the depth of evolution. In addition, dates based on single mtDNA genes (compared to 5–10 nuclear genes) have a high variance (Carstens and Knowles, 2007) and the rate of 1.644% did not include an estimate of error. In the *boreas* group, the largest uncorrected pair-wise sequence divergences of CR_{882}, varied between major lineages (E-SW: 2.846–4.684%, E-NW: 2.163–4.299%, S-NW: 2.278–4.303%) about twice as much as within major lineages (E: 0.0–2.253%, SW: 0.0–2.088%, NW: 0.0–2.507). Estimated from rate of 1.644%, the mtDNA of the major groups began diverging at least 1.425–0.658 Mya, and mtDNA began diverging within major groups at least 0.762–0.685 Mya (NW-0.762, SW-0.635, E-0.685 Mya). In general, the divergence of mtDNA predates isolation of populations into species (Arbogast et al., 2002). Acknowledging the substantial variance that might be associated with these estimates, it is reasonable to assume that the major clades began diverging from each other as long ago as the early to mid-Pleistocene, and minor groups began diverging after that. This is consistent previous hypotheses of Pleistocene divergence within the group (Myers, 1942; Karlstrom, 1958 and 1962; Blair, 1972c; Maxson et al., 1981).

4.5. MtDNA phylogeography and biogeographic history

Pleistocene glaciation has long been thought to affect the evolutionary history of species in western North American (Avise et al., 1998; Pielou, 1991; Hewitt, 1996, 2000), leaving two specific phylogeographic patterns in multiple species. First, low diversity in many species of the northern regions of North America are often explained by range expansions following retreating glaciers (e.g., Highton and Webster, 1976; Zink, 1996 (birds), Green et al., 1996; Hovingh, 1997; Lee-Yaw et al., 2008 (amphibians), Soltis et al., 1997(plants); Conroy and Cook, 2000 (rodent)). This pattern is best seen in the NW-northern group (Fig. 4) because the control regions of toads in Alaska were quite similar to those in Washington State (Fig. 3). The NW-Middle Rocky Mountain Group also has less genetic diversity compared to the E clade although the geographic distributions sampled here were similar in size. Second, refugia from Pleistocene glaciations resulted in shared phylogeographic distributions of species. The Klamath-Siskiyou Mountains, near the border of Oregon and California, remained unglaciated throughout the Pleistocene and still contain high biological diversity and endemism (e.g., Wake, 1997; Wilke and Duncan, 2004 (Slug); Mead et al., 2005; Steele and Storfer, 2006). This region could have served as a refugium for boreal toads in the NW group, and allowed the divergence of the NW-coastal minor group from the more northern NW-northern assemblage (Fig. 4). Other refugia in the Pacific Northwest have been proposed (e.g., Columbia River, McCusker et al., 2000 (fish); Miller et al., 2005; Wagner et al., 2005) and these too may have resulted in distinct northern and southern lineages of multiple species of plants, salamanders and newts (Soltis et al., 1997; Brunsfield et al., 2001; Steele and Storfer, 2006; Kuchta and Tan, 2005) and the distinct minor groups seen in *A. boreas*. A similar pattern of species with northern and southern populations is seen in the Sierra Nevada in frogs (Macey et al., 2001), salamanders (Moritz et al., 1992; Tan and Wake, 1995), and snakes (Rodrgíuez-Robles et al., 1999) as well as *A. canorus* (Shaffer et al., 2000; Stephens, 2001) which occurs in both the NW and SW clades. Explanations for other patterns of divergence are less clear. Divergence among minor groups further from the coast (between the NW-northern and NW-middle Rocky Mountains) echoes variation found in diverse organisms, including amphibians, mammals and trees (Carstens et al., 2005a,b). However, the vicariance between western and inland populations of tailed frogs (*Ascaphus*; Nielson et al., 2001, 2006), giant salamanders (*Dicamptodon*; Daugherty et al., 1983), and lungless salamanders (*Plethodon*; Howard et al., 1993) resulted from drying of the Columbia Plateau after the rise of the Cascade Mountains during the Pliocene. These amphibians are all associated with streams or seeps in forest habitats and inland and western species are distinctly allopatric. *Anaxyrus boreas* occupies a wider range of habitats, and is currently distributed across the Columbia Plateau between the middle Rocky Mountains and Cascades (Nussbaum et al., 1983). It is more likely that the phylogeography of *A. boreas* in this region more resembles that of voles (*Microtus richardsoni*) and willow (*Salix melanopsis*), which show evidence of post-Pleistocene dispersal (Carstens et al., 2005a).

Species that were highly water-dependent were also impacted heavily by the complex pluvial cycles in the Great Basin, that may have resulted in multiple range contractions and expansions (Mifflin and Wheat, 1979; Stokes, 1986; Green et al., 1996; Hovingh, 1997; Hewitt, 1996 and 2000; Masta et al., 2003). Present distributions of salamanders (*Ambystoma tigrinum*) and anurans (*Lithobates pipiens*, *Rana luteiventris*, *Anaxyrus woodhousii*, *A. punctatus* and *A. boreas*) are all consistent with fragmentation of populations in the Pliocene and Pleistocene within the Great Basin region. Flooding over large regions from glacial melting could have allowed great dispersal distances perhaps explaining nearly identical haplotypes of the NW-central group, found in northern California, north eastern Nevada and central Oregon. Wet periods may have allowed toads to enter regions that are now geographically isolated by dry deserts, such as eastern California (*A. exsul*), Nevada (*A. nelsoni*), and the Southern Rocky Mountains in Colorado (SRMP). Subsequent isolation may have allowed populations to diverge. The complexity of the divergence pattern may depend heavily on

factors that are difficult to ascertain now, such as the number of pluvial cycles, population sizes, and whether ancestral haplotypes were retained or lost (e.g., Masta et al., 2003).

4.6. Conservation implications

A rearrangement of the taxonomy of the *boreas* species group would profoundly influence the conservation of several species and lineages, some of which have undergone recent declines (Hammerson, 1999; Corn, 2003; Davidson and Fellers, 2005; Muths and Nanjappa, 2005), or exist in small numbers of isolated, vulnerable populations (Stephens, 2001; Fellers, 2005; Goebel et al., 2005; Simandle, 2006). *Anaxyrus canorus* is a current candidate for Federal listing (US Fish and Wildlife Service, 2002), but is paraphyletic, split between the NW and SW haplotype groups. Different taxonomic outcomes from additional research are possible (recognition as two distinct species or, conversely, combination with other minor groups). These two possibilities would have significant but likely opposite effects on decisions to list populations as threatened or endangered. Populations of *A. b. boreas* in southern Wyoming, Colorado and northern New Mexico (SRMP) were removed from the US Federal candidate species list, because their loss would not significantly affect the distribution of *A. b. boreas*, and they were not genetically distinct from populations in Utah (Thompson, 2005). Recognition of the eastern major group as one or more distinct species could result in reconsideration of that decision. The *boreas* species group has many highly divergent and isolated lineages at the southern edge of its distribution and especially surrounding the Great Basin region (similar to the *Rana luteiventris*, Bos and Sites, 2001). Recognizing this phylogeographic pattern may encourage wildlife agencies to proceed with caution when managing and protecting toads and/or other amphibians in and surrounding the Great Basin, as they may be composed of many cryptic lineages.

Although we are cautious about delimiting species here, we, like Wood et al. (2008), believe some, if not many divergent mtDNA lineages are species, and provide a better reflection of species diversity than the current taxonomy. Several previous names exist that might be appropriate for phylogeographic groups. Provo, UT is the type locality of *A. pictus* (Cope, 1875) which was later determined to be *A. boreas* (Cope, 1889). This name may be appropriate for clades in the eastern portion of the region, depending on their taxonomic status. Specimens from Provo were not examined here, and both the E-N Basin and E-Rocky Mountain haplotype clades occur close by. The La Brea Tar Pits (Camp, 1917b) are the type locality for *A. nestor* (currently a synonym of *A. b. halophilus*, Tihen, 1962). This name may be appropriate for potential species within the SW clade, and falls within the distribution of the SW-southern California haplotype clade.

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Lauren Rosenkranz

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, August 10, 2022 3:09 PM
To: Steve Norton; Brad Blood; Shannon Luoma; Matthew Woodhall; Finlay Anderson
Cc: Black, Russell@Wildlife
Subject: Buca information
Attachments: Maier_Details_BucaPapers_2019.docx; Maier_et_al-2019-Evolution.pdf; Maier-2018-Anaxyrus-canorus-breeding-behavior.pdf; Maier-2022-Anaxyrus-canorus-GenePoolBoundaries.pdf; Yoto_Declines_ShermanMartin93.pdf; Buca_Climate_Disease_HatchSuccess_2020.pdf; Brown_etal_YotoStatus_2012.pdf

Hi Steve (and all),
Attached are a few more papers I located in my files.
The “Buca_Climate_Disease_HatchSuccess_2020” and “Yoto_Declines_ShermanMartin93” directly involve the Buca population at Tioga Pass.
Sierrally

James Erdman
Environmental Scientist
Fisheries & High Mountain Lakes
California Department of Fish & Wildlife
Inland Desert-Region 6-North
Bishop Field Office
787 North Main St., Suite 220
Bishop, Ca. 93514
Office Ph. (760)-873-6071
CDFW Cell (760)-567-0413
James.Erdman@wildlife.ca.gov

CA/NV Amphibian Folks:

---------- Forwarded message ---------
From: **Paul Maier** <maierpa@gmail.com>
Date: Mon, Nov 11, 2019 at 6:30 AM
Subject: Yosemite Toad Evolution Paper(s)
To: Dave Bradford <dbradfo@herpconbio.org>, <canv.aptf@gmail.com>

Hi Dave,

I want to announce that my first dissertation chapter is now published in the journal *Evolution* (attached).

In this article, we found that ice ages and physiographic differences between glacial refugia help to shape the phylogenetic structure of the Yosemite toad. Not only that, we discovered several "fused" lineages—toads formed by intraspecific hybridization, persistent through time.

Maier P.A., Vandergast A.G., Ostoja S.M., Aguilar A., Bohonak A.J. (2019). Pleistocene glacial cycles drove lineage diversification and fusion in the Yosemite toad (*Anaxyrus canorus*). Evolution. In press. https://www.doi.org/10.1111/evo.13868

Also, I realized that there is backlog I have not shared with APTF: two Natural History Note articles (attached), and my dissertation. Please feel free to share any/all.

Maier P.A. (2018). Evolutionary past, present, and future of the Yosemite toad (*Anaxyrus canorus*): A total evidence approach to delineating conservation units. Ph.D. dissertation. University of California Riverside, and San Diego State University, San Diego, CA. https://escholarship.org/uc/item/7jf3x4kg

Maier P.A. (2018). *Anaxyrus canorus* (Yosemite toad) breeding behavior. Herpetological Review, 49(4):727–728.

Maier P.A. (2019) Anaxyrus canorus (Yosemite toad) larval diet. Herpetological Review, 50(1)111–112.

Best, Paul

Paul Maier, Ph.D.

Evolutionary Bio./Genomics
Email: maierpa@gmail.com
www.mountainmanmaier.com
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doi:10.1111/evo.13868

Pleistocene glacial cycles drove lineage diversification and fusion in the Yosemite toad (*Anaxyrus canorus*)

Paul A. Maier,[1,2,3] Amy G. Vandergast,[4] Steven M. Ostoja,[5] Andres Aguilar,[6] and Andrew J. Bohonak[1]

[1]*Department of Biology, San Diego State University, 5500 Campanile Dr., San Diego, CA 92182*

[2]*FamilyTreeDNA, Gene by Gene, 1445 N Loop W, Houston, TX 77008*

[3]*E-mail: maierpa@gmail.com*

[4]*U.S. Geological Survey, Western Ecological Research Center, San Diego Field Station, 4165 Spruance Road, Suite 200, San Diego, CA 92101*

[5]*USDA California Climate Hub, Agricultural Research Service, John Muir Institute of the Environment, University of California, Davis, 1 Shields Ave., Davis, CA 95616*

[6]*Department of Biological Sciences, California State University, Los Angeles., 5151 State University Dr, Los Angeles, CA 90032*

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Species endemic to alpine environments can evolve via steep ecological selection gradients between lowland and upland environments. Additionally, many alpine environments have faced repeated glacial episodes over the past two million years, fracturing these endemics into isolated populations. In this "glacial pulse" model of alpine diversification, cycles of allopatry and ecologically divergent glacial refugia play a role in generating biodiversity, including novel admixed ("fused") lineages. We tested for patterns of glacial pulse lineage diversification in the Yosemite toad (*Anaxyrus* [*Bufo*] *canorus*), an alpine endemic tied to glacially influenced meadow environments. Using double-digest RADseq on populations densely sampled from a portion of the species range, we identified nine distinct lineages with divergence times ranging from 18 to 724 thousand years ago (ka), coinciding with multiple Sierra Nevada glacial events. Three lineages have admixed origins, and demographic models suggest these fused lineages have persisted throughout past glacial cycles. Directionality indices supported the hypothesis that some lineages recolonized Yosemite from east of the ice sheet, whereas other lineages remained in western refugia. Finally, refugial niche reconstructions suggest that low- and high-elevation lineages have convergently adapted to similar climatic niches. Our results suggest glacial cycles and refugia may be important crucibles of adaptive diversity across deep evolutionary time.

KEY WORDS: **Ecological selection, glacial refugia, glacial pulse, hybridization, Pleistocene, secondary contact.**

Vicariance by glacial expansion and retreat has long been thought to drive speciation (Mayr 1942; Anderson 1948; Stebbins 1950; Anderson 1953; Haffer 1969). Pleistocene ice ages have fragmented and promoted speciation for a high proportion of boreal organisms over the past two million years (Bernatchez and Wilson 1998; Weir and Schluter 2004). Species endemic to alpine or montane environments are prone to new lineage formation because their narrow distributions and specialized habitat requirements are closely linked to the process of glaciation (Knowles, 2000, 2001; Shepard and Burbrink, 2008, 2009; McCulloch et al. 2010; Qiu et al. 2011; Liberal et al. 2014; Wallis et al. 2016). For example, endemic alpine species of butterfly (Schoville and Roderick 2009), chipmunk (Rubidge et al. 2014), and amphibian (Rovito 2010; Schoville et al. 2011) are habitat specialists of glacially deposited lake, meadow, or talus habitats; repeated glacial episodes have forced these species to retreat into refugia,

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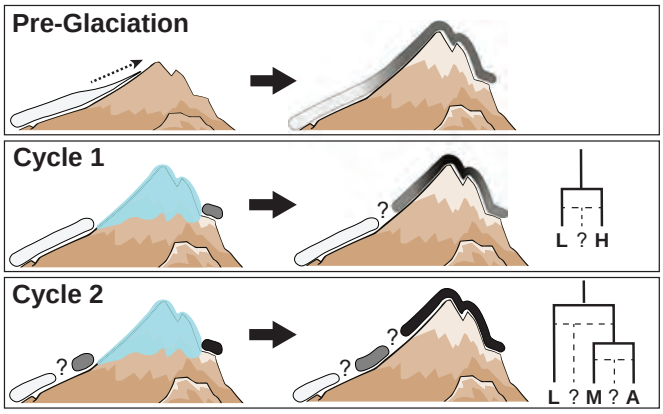

Figure 1. The glacial pulse model of alpine lineage formation. The profile of a mountain range (e.g., west to east) over time is shown. Prior to Pleistocene glacial cycles, mountains may not have reached modern stature. A hypothetical ancestral species (white) colonizes the young mountain range and eventually shows signs of ecological adaptation over an elevational gradient (indicated by grayscale cline). During the first glacial maximum ("Cycle 1"), vicariant populations experience divergent climates in isolation, due to physiographic differences caused by the mountains (e.g., rain shadow effect). Refugia on the east side may resemble higher elevation habitat than refugia on the west side, promoting further ecological and genetic divergence. Refugial populations maintain partial reproductive isolation during secondary contact. Low to moderate levels of divergence may allow a third hybrid lineage (denoted by "?") to form. The high (H) lineage repeats the process during Cycle 2, bisecting into montane (M), alpine (A), and possibly another fused hybrid ("?") lineage. This process may continue recursively, subdividing species into ecologically distinct lineages until ecological or genetic differences are too minor to maintain permanent barriers.

where they fractured into new lineages before recolonizing the mountains. Many alpine endemics are heterogeneously adapted to their environments along an elevational cline (Chabot and Billings 1972; Billings 1974), and time spent in glacial refugia may reinforce adaptive differences. The linear nature of glacial barriers and rain shadow effect provide ample potential for climatic differentiation, since orographic patterns of rainfall promote dramatically different refugia on opposite sides of a mountain range (Mulch et al. 2008). Thus, alpine endemics may be prone to repeated glacial "pulses" of isolation, divergent adaptation, and secondary contact (Hewitt 1996). We suggest that alpine speciation and intraspecific lineage divergence is best understood under this model, whereby pulses of glacial action and climatic differentiation bisect lineages, which can then recursively subdivide during subsequent glacial cycles (Fig. 1). This general framework explains ubiquitous patterns of species and lineage endemism in alpine zones, and provides specific testable hypotheses about the fate of new lineages where secondary contact zones emerge.

Secondary contact zones in alpine systems worldwide tend to share concordant patterns but different locations among species (Remington 1968; Petit et al. 2003; Swenson and Howard 2005; Wallis et al. 2016). This suggests that common glacial barriers may affect entire ecosystems, but species-specific traits such as dispersal ability may play a role. What is less clear is whether these zones typically maintain lineage integrity, either by lowered or augmented hybrid fitness (Fig. 1), or homogenize lineages back together by unimpeded gene flow. The outcome depends upon the extent of reproductive isolation, ecological divergence, and whether admixed populations survive into the next glacial cycle. Patchworks of multiple contact zones that reticulate cyclically across time are not uncommon, further confusing inference about population history (Hewitt, 1988, 1996, 1999, 2001, 2004, 2011). Following secondary contact, one possible outcome is that divergent lineages will produce hybrids with intrinsic genetic incompatibilities via epistasis, regardless of hybrid environment. Such a "tension zone" tends to be restricted in space, owing to a balance between migration and selection (Harrison 1993; Harrison and Larson 2014). This has been observed for two closely related lineages of newt in the Sierra Nevada, as evidenced by high inbreeding, elevated linkage disequilibrium, and heterozygote deficit at secondary contact (Kuchta 2007). Another possible outcome is for admixture to occur along an ecotone where hybrid fitness surpasses parental fitness, but only in that specific environmental context. This is known as a "bounded hybrid superiority zone," and is especially common along alpine gradients (Abbott and Brennan 2014). Two closely related lineages of *Lycaeides* butterfly reach secondary contact at lower montane elevations in the Sierra Nevada, where a reproductively isolated hybrid lineage has developed alpine adaptations, such as high host specificity for alpine-endemic plants, a loss of egg adhesion, and novel color patterns (Gompert et al. 2006). If recombinant hybrid genotypes maintain complete isolation from parental types due to local adaptation, it is considered homoploid hybrid speciation (Buerkle et al. 2000; Abbott et al. 2013).

Between the extremes of tension zones and homoploid speciation, there is mounting evidence for a third intermediate outcome. If intraspecific hybrids experience moderate vigor and reduced outcrossing with parental lineages, they may form a semi-isolated hybrid population via lineage fusion. Although only a few instances of homoploid hybrid speciation have been described in animals (e.g., Mavárez and Linares 2008; reviewed in Schumer et al. 2014), observational bias may limit examination to pairs of distantly related species. By contrast, detailed accounts of intraspecific lineage fusion exist (e.g., Behm et al. 2010; Webb et al. 2011; Vonlanthen et al. 2012; Garrick et al. 2014; Rudman et al. 2016; Lamichhaney et al. 2018), often with evidence that lineages are temporally stable (e.g., Li et al. 2016). Regardless of whether early-generation hybrids have reduced fertility or reproductive

success, subsequent generations can still form a stable lineage (Arnold et al. 1999), and provide an important source of adaptive novelty (Hedrick 2013). Lineage fusion might be common for alpine endemics, because the temporal scale of glacial cycles is short enough that lineages may have accumulated some adaptive genetic differences without having become intrinsically incompatible. Hence, this process is particularly likely when refugial environments are similar enough to minimize postzygotic barriers (Seehausen 2006; Seehausen et al. 2008), and is one hypothesized source of lineage diversity under the glacial pulse model (Fig. 1).

The Sierra Nevada Mountains of California are an ideal system for testing the hypotheses of the glacial pulse model. A complex history of geological and climatic changes has dynamically altered California's landscape for millions of years, and driven sharp genetic discontinuities in plants and animals during the late tertiary and early quaternary periods (Calsbeek et al. 2003; Swenson and Howard 2005). California's juxtaposition of rising mountains, shifting plate tectonics, active volcanism, and resulting sharp ecotones has produced unparalleled levels of biodiversity and endemism (Myers et al. 2000; Lapointe and Rissler 2005). Over 73% of amphibian and squamate species that transect the Sierra Nevada exhibit lineage divergence in this ecoregion, although the biogeographic boundaries often do not coincide (Rissler et al. 2006). Endemism of lineages in California is especially high in patches of the western Sierra Nevada foothills and along the eastern crest, likely a consequence of glacial advance and retreat (Swenson and Howard 2005; Rissler et al. 2006). The earliest known glaciation (McGee) is thought to have occurred 2.5–1.5 million years ago during the early Pleistocene, by which time westward tilting (beginning about 5 million years ago, Pliocene) had caused the Sierra Nevada escarpment to attain sufficient height for glacial formation (Huber 1981; Unruh 1991; Gillespie and Clark 2011). The onset of Sierra Nevada glaciation matches well with major divergence times for many resident species (Calsbeek et al. 2003). Subsequent glacial cycles during the Pleistocene have played an important role in shaping biodiversity patterns in the region, by repeatedly isolating and reuniting populations (Avise et al. 1998; Hewitt 2004).

In this study, we tested for patterns of glacial pulse lineage formation in the Yosemite toad (*Anaxyrus canorus*), a Sierra Nevada endemic that is closely associated with Pleistocene glacial cycles. It breeds almost exclusively in the shallow, transient water bodies of mountain meadows (Ratliff 1985), which make up $<$3% of the landscape. However, currently existing meadows only formed about 10 thousand years ago (ka), as receding glaciers and rising snowpack levels helped retain more alluvium in stream valleys (Wood 1975). Hence, location of suitable habitat has likely shifted during glacial maxima. In addition, the species utilizes hydrologically distinct meadow types along an elevational gradient, from montane to subalpine (Ratliff, 1982, 1985; Weixelman et al. 2011; Viers et al. 2013). Given its evolutionary history of dependence on glacial cycles, and adaptation along an elevational cline, the Yosemite toad is an ideal subject for studying patterns of glacial pulse lineage formation. It has even been hypothesized that the entire species is a product of adaptation to boreal conditions during mountain uplift in the Pliocene, then repeated glacial vicariance, and eventual competitive exclusion of its sister species, the Western toad (*A. boreas*; Karlstrom 1962). If glacial pulses explain the origin of the species and continued generation of novel lineages, (1) species and lineage divergence times should correspond to dates of Pleistocene glacial oscillations, (2) most sister lineages should occupy divergent ecological niches that are similar to hypothesized refugial locations, and (3) size of secondary contact zones should depend on niche distinctness of the two lineages; narrow contact zones should form between ecologically distinct lineages, and wider contact zones should form between lineages with more similar ecologies. Lineage fusion may occur anywhere that secondary admixture occurs, if hybrid genotypes have moderate vigor or advantage, and remain semi-distinct from parental lineages.

Our goals were to: (1) delineate the phylogeographic boundaries and timing of past lineage isolation for the species (most recent common ancestor of Yosemite and Kings Canyon National Parks), and more specifically within Yosemite National Park; (2) reconstruct refugial niches and locations of post-glacial recolonization, to test the hypothesis that climatically distinct refugial niches reinforced lineage divergence; and (3) resolve geographic boundaries of contact zones between lineages to test hypotheses of age, symmetry, and viability of interlineage admixture. We used a spatially dense sampling scheme in Yosemite rather than sparsely sample the entire species, because our goal was to resolve population processes at likely lineage boundaries (Shaffer and Fellers 2000; Stephens 2001; Goebel and Ranker 2009), rather than discover all lineages. We also employed a double-digest RADseq genomic sampling scheme to provide thousands of genome-wide nuclear markers that can accurately reconstruct species and population history. The glacial pulse model provides a novel framework for shedding light on patterns of alpine speciation and endemism worldwide, by hypothesizing that endemic species and their young lineages may have arisen by a common, cyclical process.

Materials and Methods

STUDY REGION

Yosemite toads (*Anaxyrus canorus*) are meadow-breeding specialists restricted to the central Sierra Nevada of California, and found between 1950 and 3444 m (Mullally and Cunningham 1956; Karlstrom 1962). The species breeds almost exclusively in shallow, snowmelt ponds within meadows, which seasonally

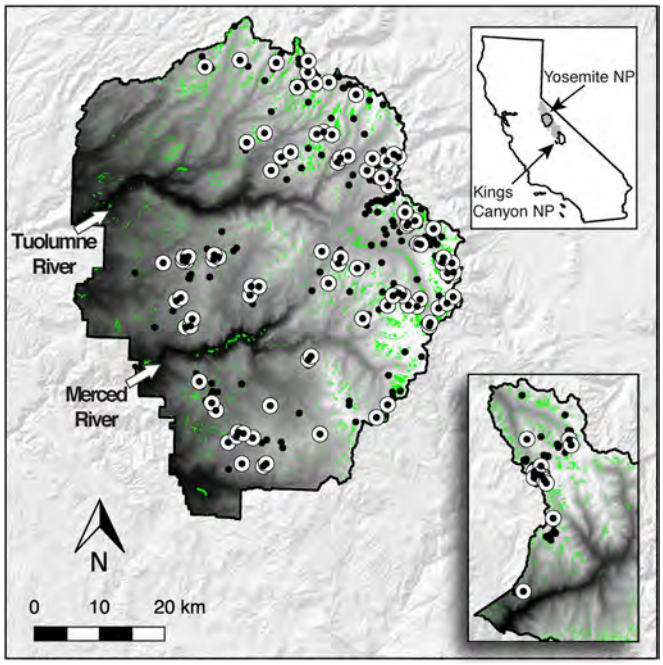

Figure 2. **Study region. Primary study area in Yosemite NP (YOSE), CA includes approximately 33% of known Yosemite toad sites, whereas the outgroup area in Kings Canyon NP (KICA), CA (bottom right inset) includes the southernmost 4% of known sites. Top right inset shows the range of Yosemite toads in gray, and the boundaries of YOSE and KICA in black. Green polygons are all meadows within the parks. Solid black circles indicate all known Yosemite toad meadows identified between 1915 and the present. White circles indicate the meadows sampled and sequenced in the present study, in YOSE ($n = 90$) and KICA ($n = 12$). Eight samples of *Anaxyrus boreas* and one sample of *A. punctatus* from throughout California are not shown. Random noise is added to locations in order to protect the locations of this threatened species.**

dry up. Lower elevation sites are typically spring-fed mesic or hydric meadows characterized by adjacent stands of montane red fir (*Abies magnifica*) and lodgepole pine (*Pinus contorta* var. *murrayana*), whereas subalpine and alpine meadows are typically larger, snow-fed, more xeric, and surrounded by whitebark pine (*Pinus albicaulis*) or boulders (Keeler-Wolf et al. 2012; Viers et al. 2013; Fig. 2). Yosemite National Park (YOSE; 3,027 km^2) was chosen as the primary study area because it overlaps with previous studies (Shaffer and Fellers 2000; Wang 2012; Berlow et al. 2013), likely contains genetic discontinuities (Shaffer and Fellers 2000; Stephens 2001; Goebel and Ranker 2009), and is representative of the ecological and elevational conditions experienced by the species. We also sampled northern Kings Canyon National Park (KICA; 467 km^2) at the southern terminus of the species range, because it likely contains the most distantly related outgroup lineage within the species.

TISSUE SAMPLING AND SITE SELECTION

Tail tissue was collected from larval toads using a sterilized razor blade during summers of 2011–2013. All samples were preserved in 95% EtOH and stored at –20°C within one week. An existing USGS meadow layer based on a vegetation map with 0.5 ha resolution was used to delimit sampling sites (Keeler-Wolf et al. 2012; Berlow et al. 2013). Sites (= meadows) were chosen to maximize representation across all known breeding locations from a recent six-year survey effort (Ostoja et al., in prep.) and overlap with previous studies. Tadpoles were sampled haphazardly across all available egg clutches, pools, and multiple years to maximize inclusion of available genetic diversity in each meadow. Although egg clutches were not directly observed, we were conscious of phenotypic indicators suggesting different clutches (e.g., average size and stage), and we sampled tadpoles from all likely clutches. A minimum of five samples was used per meadow if additional meadows were sequenced within 1 km, otherwise 10 samples per meadow were used, unless insufficient samples were available. This scheme maximized intra- and inter-meadow sampling representation across the study area. Toe clips from eight *Anaxyrus boreas* samples spanning California (including samples from YOSE) and a single *A. punctatus* sample (next closest relative) were obtained as outgroups for phylogenetic analysis from the Museum of Vertebrate Zoology (University of California, Berkeley) and USGS (Western Ecological Research Center).

MOLECULAR METHODS

A total of 653 samples were chosen for sequencing (535 samples from 90 meadows in YOSE, 109 from 12 meadows in KICA, and nine outgroup samples). Genomic DNA was extracted using a combination of 96-well glass fiber plate (Ivanova et al. 2006) and DNeasy blood and tissue spin column (Qiagen) protocols. We constructed double-digest RADseq libraries following the protocol of Peterson et al. (2012; S1 Protocol), and then sequenced them using 2 × 100 bp reads on an Illumina HiSeq 2500. Details are described in the Supporting Information.

BIOINFORMATIC DATA PROCESSING AND SUMMARY STATISTICS

Raw data were filtered and processed using Stacks version 1.19 (Catchen et al., 2011, 2013). A detailed bioinformatic pipeline is described in the Supporting Information. Briefly, two datasets were generated from a total of 3261 loci: (1) SNPs (one SNP kept per locus), and (2) full RAD-locus haplotypes (concatenated paired-end reads were used where possible, otherwise Read 1 was used) (Table S1). Some analyses required SNP data, whereas others could accommodate the full diversity present among multiple SNPs at a locus due to intra-locus recombination. Therefore, we built and implemented a custom python script (fasta2genotype.py, github.com/paulmaier/fasta2genotype) to output RAD haplotypes

in addition to SNPs. After applying a locus genotype coverage threshold of 10 reads, loci were removed from meadows if absent from >25% individuals and removed from the dataset if absent from >25% individuals overall. Only alleles with a minor allele frequency (MAF) of 0.005 or greater were kept. All markers in the haplotype dataset were initially tested for random mating genotype (Hardy-Weinberg) frequencies at the meadow scale using the adegenet package (Jombart 2008) in R version 3.3.3 (R Core Team 2019). Population genetic parameters were estimated using the populations.pl script of STACKS, and $N_e$values were estimated using the single-sample linkage disequilibrium method in NeEstimator version 2.01 (Do et al. 2014). All processing was performed on a high-performance biocluster at the Institute for Integrative Genome Biology, UC Riverside, CA.

LINEAGE BOUNDARIES AND DIVERGENCE HISTORY

We applied four analyses to estimate phylogeographic structure. First, a spatial principal components analysis (sPCA; Jombart et al. 2008) was performed to reveal the extent and location of cryptic phylogeographic discontinuities in YOSE. This method works by creating orthogonal synthetic variables that optimize the product of genetic variance and spatial autocorrelation (measured by Moran's I). We used the haplotype dataset (2318 loci; 6473 haplotypes), and a spatial connection network of the $k = 50$ nearest neighbors for each sample location in YOSE.

Phylogenetic structure among meadows was first estimated by creating a concatenated alignment of loci, and using the GTR + Γ nucleotide model in RAxML version 8.2.9 (Stamatakis 2014) and BEAST version 2.5.2 (Drummond and Rambaut 2007). This evolutionary model was chosen using jModelTest version 2.1.4, (Posada 2008) by selecting the model with lowest AIC score and significant likelihood ratio test. In concatenated analyses, choosing one allele at random from heterozygous sites can produce incorrect and biased topologies (Degnan and Rosenberg 2009; Weisrock et al. 2012; Lischer et al. 2014; Andermann et al. 2019). Excluding these sites altogether can bias branch lengths or other parameter estimates (Sota and Vogler 2003; Garrick et al. 2010). Encoding them with IUPAC ambiguity codes can also potentially bias branch lengths if the phylogenetic program treats them as missing data (Lischer et al. 2014); however, this can be avoided by using ambiguities as equally likely values in the likelihood calculations. We chose to use meadows (not representative individuals) as operational taxon units (OTUs), to avoid these sources of phylogenetic bias, and to fully account for all mutations detected in each local population. Therefore, any SNPs that were polymorphic within OTUs were summarized by IUPAC ambiguity codes.

For the RAxML analysis, we concatenated one SNP per locus and applied the Stamatakis method of ascertainment bias correction to account for the known number of invariable sites, and base frequencies. This ensured that bootstrap replicates sampled variable sites and provided reasonable estimates of node confidence. *A. punctatus* was used as the formal outgroup, and all eight samples of *A. boreas* were also included. A heuristic search was performed with RAxML for 10 independent runs using TBR branch swapping and 1000 bootstrap replicates for each. The tree with highest likelihood was compared with the combined bootstrap tree to check for differences in topology. In order to further assess the reciprocal monophyly of *A. boreas* and *A. canorus*, we repeated this analysis with a data matrix that balanced representation of *A. boreas* ($n = 8$) and *A. canorus* ($n = 12$; two individuals per major lineage).

We estimated divergence dates to determine if species and lineage divergence times correspond to dates of Pleistocene glacial oscillations. We used BEAST on a concatenated alignment of full sequences from all *A. canorus* individuals in the initial RAxML analysis. We used a coalescent Bayesian skyline tree model, because it had a higher harmonic mean marginal likelihood than either Yule or constant population models during preliminary runs. We used a strict clock, and calibrated the clockRate parameter with a normal prior bounded by the range of amphibian nuclear DNA rates (9.24×10^{-10} to 1.53×10^{-9} substitutions per site per year) described by Crawford (2003). Preliminary runs using a relaxed lognormal clock failed to converge, and ucld.stdev values were close to zero, consistent with a clock-like pattern of evolution across lineages. Divergence times with and without a strict clock were nearly identical. We chose the option to utilize IUPAC ambiguity code information in tree likelihood calculations. The MCMC chain was run for 5×10^7 generations with 10^7 burnin, logging every 10^3, and checked for convergence across two independent runs using Tracer 1.6.

Finally, we estimated the phylogeny under the multispecies coalescent (MSC) using SNAPP (Bryant et al. 2012). Unlike other MSC methods, SNAPP estimates species tree posterior probabilities directly from unlinked biallelic markers, which also avoids the need to integrate over all possible gene trees. We sampled one SNP per locus, and removed SNPs absent from one or more lineages, which resulted in a dataset with 2645 SNPs. To reduce computation time, we sampled four representative meadows per major lineage. Following Stange et al. (2018), we also fixed θ (population size) to be equal across lineages, with a uniform prior. Based upon the BEAST results, a strong Gaussian prior (mean = 1.967 million years ago, SD = 0.075 million years ago) was placed on the root age to approximate the same 95% HPD, and the clock rate was estimated. Two independent runs were performed with a chain length of 1×10^6, sampled every 250 steps, and checked for convergence using Tracer 1.6.

For all phylogenetic analyses, meadows with strong evidence of interlineage admixture were excluded, because they would violate basic model assumptions and bias branch lengths. These

meadows were detected using (1) sPCA scores that were intermediate between lineages, (2) NewHybrids estimates of two-generation genotype classes (Anderson and Thompson 2002), and (3) conflicting signals of ancestry, based on preliminary BEAST runs (Figs. S1–S3). For (3), the posterior sample of trees was examined with DensiTree version 2.5.2, and meadows with conflicting ancestry were identified. Although (3) may denote topological uncertainty for reasons other than admixture, we considered evidence from (1), (2), and (3) to be strong evidence of interlineage admixture.

Results from the foregoing analyses suggested that three separate contact zones exist between lineages, with distinct admixed individuals found in two contact zones (see Results). Such admixed lineages may originate by several processes. For example, lineage fusion may result if hybridization occurred briefly, and produced a genetically distinct lineage that persists through time. Another possibility is that hybrids have lowered fitness, but ongoing introgression toward the contact zone replenishes a distinct admixed lineage. These possibilities assume that admixture follows secondary contact; if lineages have never been fully isolated, then primary contact (i.e., isolation with migration) may explain the pattern. Finally, the null hypothesis is that admixture has not happened, and the lineage in question may reflect simple divergence.

We tested these demographic models of admixed lineage origins using fastsimcoal version 2.6 (Excoffier et al. 2013). Fastsimcoal can leverage the observed minor allele site frequency spectrum (SFS) to calculate composite likelihoods of complex models by simulating an expected SFS with coalescent simulations. This method is particularly suitable for large SNP datasets. Multidimensional folded SFSs were generated for fastsimcoal analysis using a custom python script (github.com/isaacovercast/easySFS). For each contact zone, SFSs were downsampled to equal sample sizes among lineages while also maximizing the number of segregating sites to increase statistical power, as recommended by Gutenkunst et al. (2009). All parameters were given uniform priors except for time parameters, which were given log-uniform priors. Each model was run for 10^5 coalescent simulations with 40 expectation-maximization (ECM) cycles, and replicated for 100 independent runs, to determine parameter values leading to the maximum likelihood. Likelihood ratios or AIC statistics are imprecisely estimated using composite likelihoods; hence, we used the qpcR package (Ritz and Spiess 2008) in R to calculate Akaike's weight of evidence, based on the highest overall likelihoods across 100 independent estimations of each model.

Confidence intervals for parameters were estimated by generating 100 non-parametric bootstrap datasets. Pseudoreplicate datasets were made by sampling SNPs with replacement using the vcfR (Knaus and Grünwald 2017) package in R. Each model was rerun 100 times, using the maximum likelihood model parameters as starting values. Parameter estimates of highest likelihood from each pseudoreplicate run were used to construct 95% confidence intervals.

REINFORCED LINEAGE DIVERGENCE FROM CLIMATICALLY DISTINCT REFUGIA

Next, we tested the hypothesis that sister lineages tend to occupy divergent climatic niches, and that glacial refugia may have reinforced their ecological divergence. Hypothesized Pleistocene refugia were reconstructed using environmental niche models (ENMs), because they provide a more spatially explicit and less subjective hypothesis of refugial distribution than coalescent approaches (Waltari et al. 2007). ENMs were constructed using Maxent version 3.4 (Phillips et al. 2004), and bioclimatic variables were obtained from WorldClim version 1.4 corresponding to present day (1960–1990) and the last glacial maximum (LGM; approximately 22 ka) (Hijmans et al. 2005). We used the Model for Interdisciplinary Research on Climate Earth System Model (MIROC-ESM), at a resolution of 2.5 arc-minutes. Sampling points for all non-admixed lineages were derived from occurrence data from 1915 to present. The number of points used was 222–1046, depending on lineage, with 25% set aside as test points. Present-day environmental niche models were constructed for each lineage separately using all 19 variables, removing those with permutation importance values of zero to reduce multicollinearity, and then rerunning the model. The final number of variables was 5–7 (Supporting Information). Each model was projected using the corresponding LGM dataset. We considered suitable refugial habitat to be locations with >0.8 probability of occurrence.

We tested the hypothesis that each lineage of toads recolonized meadows from Pleistocene refugia, in two ways. First, we used Fu's F_S (Fu 1997) to test for recent demographic expansion, using the SNP dataset ($n = 2318$ loci) in Arlequin version 3.5.2 (Excoffier and Lischer 2010). We used 10,000 coalescent simulations to assess significance. Fu's F_S estimates the probability of the observed number of alleles (k) given the number of pairwise sequence differences θ_π, with a significant ($P < 0.02$) negative value of the test statistic F_S indicating recent expansion. Next, we explicitly tested the hypothesis that a spatial range expansion had taken place from our Maxent-reconstructed refugia, using the method of Peter and Slatkin (2013) on the SNP dataset. This method infers a directionality index (ψ), based on pairwise allele frequency asymmetries that result from drift fixing lower frequency alleles during an expansion. Based on observed ψ values, the origin is inferred using time difference of arrival methods (TDOA). A key assumption of the method is even sample sizes, so five individuals were randomly chosen from every meadow. A block-jackknife approach was used to generate a null distribution (isolation by distance) to test significance of the model. Only pure

lineages were considered because admixed sample sizes were insufficient.

Climatic niche overlap of present-day lineages within YOSE was assessed using two methods. First, a linear discriminant analysis (LDA) on lineages was performed for all lineages (pure/admixed) using the six bioclimatic variables with highest loadings, with the MASS package (Venables and Ripley 2002) in R. Second, Schoener's D measuring niche overlap was calculated for each pair of non-admixed lineages, and a niche equivalency test was performed (Broennimann et al. 2012). All GIS extraction and manipulation was automated in R.

CONTACT ZONE WIDTH AND DYNAMICS

Finally, we tested the hypothesis that narrower contact zones tend to result from ecologically distinct lineages. For each of three contact zones, we estimated the geographic limits of admixture by estimating the ancestry proportion from the two parental lineages along a spatial transect, using STRUCTURE version 2.3.4 (Pritchard et al. 2000). Using the haplotype dataset ($n = 2318$ loci), we ran STRUCTURE for 10 replicates each at $K = 2$ for individuals along a spatial transect, using 10^5 steps and 10^4 burn-in. Results were combined using CLUMPP version 1.1.2 and visualized with R.

We estimated the approximate number of filial generations since admixture, along with hybrid index, to further test the stability of fused lineages. Presence of advanced hybrid genotypes is one indication of admixed population fitness, since any reproductive incompatibilities would likely curtail the extent of admixture to one or a few generations. We jointly estimated admixture index (S; the proportion of ancestry from one of the two parental populations) and interlineage heterozygosity (H_I; the observed heterozygosity for markers with one allele from each parental population). H_I can either be estimated as a discrete genotype class (e.g., F1), or as a continuous value from 0 to 1, where $H_I = 1$ is the maximal interlineage heterozygosity (i.e., F1 class). This latter type of analysis is more realistic in situations where hybrids are more than two generations old (Fitzpatrick 2012).

Joint estimation of S and H_I requires ancestry-informative markers that approach fixation within the two parental lineages. We chose ancestry-informative markers by subsampling the genomic data to those within the top 1% of markers contributing to spatial PC1, PC2, and PC3, which corresponded perfectly to the three clines. We chose diagnostic markers using sPCA loadings and not F_{ST}; sPCA is model-free, whereas F_{ST} is strongly influenced by intralineage diversity, and therefore a poor predictor of marker divergence (Noor and Bennett 2009; Cruickshank and Hahn 2014). We used the R package HIest (Fitzpatrick 2012) to estimate hybrid index S and H_I with the haplotype dataset. We optimized the maximum likelihood estimate (MLE) for each individual using 1000 simulated annealing iterations, with a starting grid size of 100. We determined approximate number of filial generations (e.g., F2, F3, F4, etc.) by contrasting empirical results with simulated values of S and H_I, assuming a population of size 50, no gene flow following admixture, and 25 ancestry-informative markers. We also identified "advanced" (>2 generations) hybrids using the HItest function in HIest, which compares the MLE of H_I and S to the MLE of a simple two-generation model, and rejects the simple model using a likelihood ratio test.

We used a principal components analysis (PCA) to assess the distinctiveness of hybrid genotypes compared to parental types. Advanced hybrids (based on S and H_I) forming distinct genetic clusters would be further evidence for lineage fusion. The prcomp package in R was applied to the haplotype dataset, after centering the data and scaling by the standard deviation.

Results

LINEAGE BOUNDARIES AND DIVERGENCE HISTORY

The current distribution of Yosemite toads within YOSE can primarily be traced back to four historic lineages. Y-North was found to be sister to the remaining YOSE lineages, with Y-South sister to a clade containing Y-East and Y-West, based on concatenated analyses (Fig. 3). Y-East was paraphyletic with respect to Y-West in the RAxML (but not the BEAST) tree (Fig. 3; Figs. S4 and S5), which likely reflects the recentness of that divergence. The SNAPP MSC tree recovered an identical topology to the concatenated trees, with Bayesian posterior probabilities of 1.0 for all clades (Fig. S6). The spatial PCA axes recapitulated the same phylogeny across geographic space (Fig. S1): the largest geo-genetic gradient was between Y-North and the remaining lineages (sPC1), followed by a gradient distinguishing Y-South (sPC2), and finally a gradient separating Y-East and Y-West (sPC3). These phylogenetic and spatial discontinuities (i.e., white areas of rapid sPC score turnover; Fig. S1) were concordant with the major glacial barriers: the main Pleistocene ice sheet, and the Merced and Tuolumne River gorges, which were also filled with glaciers (see glacial extent in Fig. 4). Additionally, we observed a pattern of increasing genetic diversity from low to high elevation (Tables S2 and S3; see Supporting Information Results).

In addition to the four primary lineages in YOSE, three distinct lineages with admixed ancestry ("East-North-A1," "East-North-A2," and "East-South-A") were detected by sPCA scores intermediate between major lineages, NewHybrids genotype classes, and conflicting signals of ancestry shown by DensiTree (Figs. S1–S3). Hence, these meadows were excluded from subsequent phylogenetic analysis. Outside of YOSE, two more lineages were found in the *A. canorus* outgroup sample of KICA ("Goddard" and "Evolution").

Lineages in YOSE began to diverge from those in KICA approximately 1.96 ± 0.14 million years ago (Fig. 3; Table S4). If

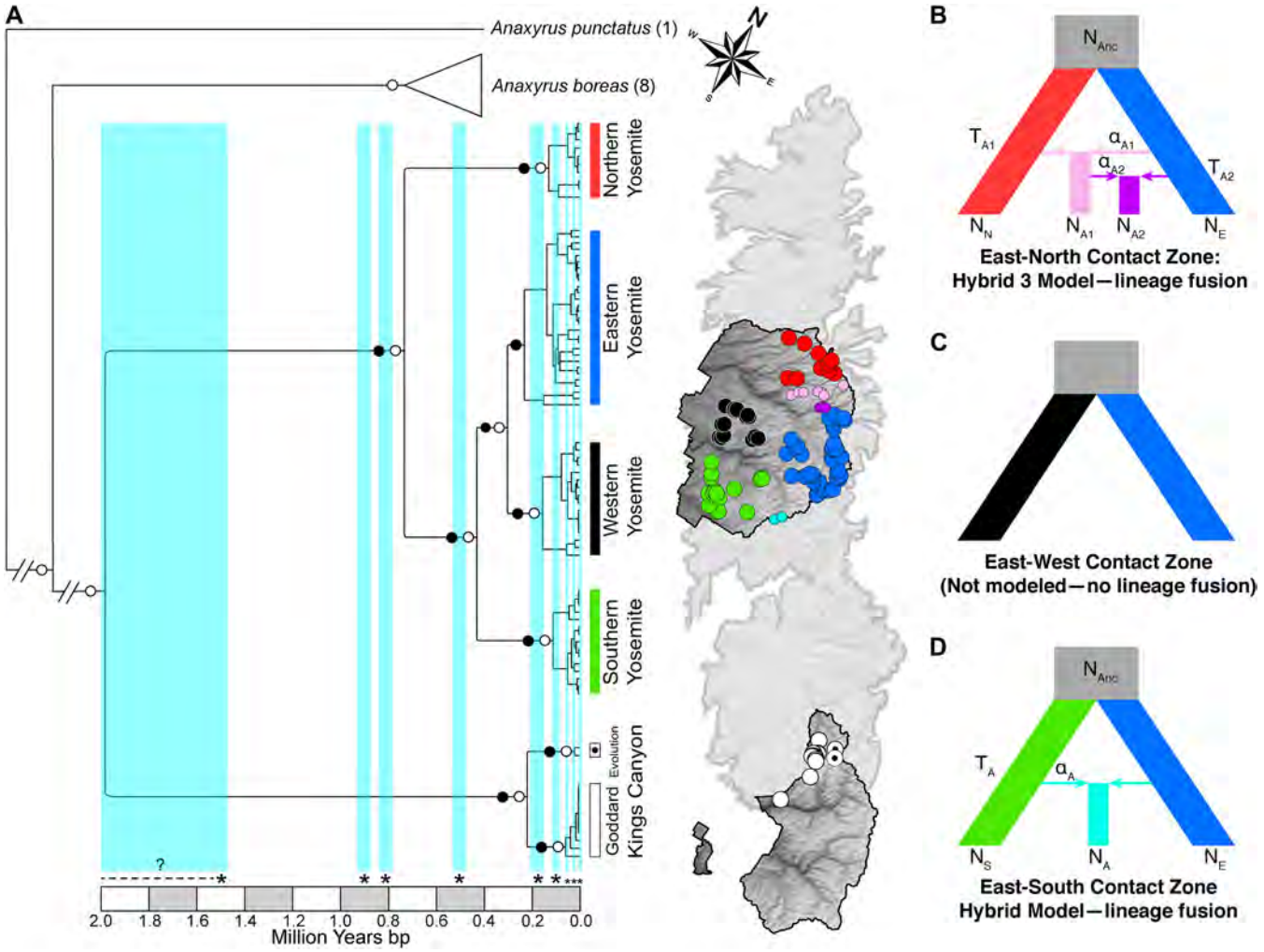

Figure 3. Lineage divergence and fusion. (A) Maximum clade credibility BEAST chronogram, with rate calibration based on a molecular clock of 9.24 × 10^{-10} to 1.53 × 10^{-9} substitutions per site per year, following Crawford (2003). A maximum likelihood phylogram from RAxML produced the same ingroup topology for major lineages, with the exception that Y-East was paraphyletic with respect to Y-West (Fig. S4). Outgroups to *Anaxyrus canorus* were only included for RAxML analysis. Black circles indicate posterior probabilities of 1.0, and open circles indicate bootstrap support values >95 for major clades. Outgroup branches for *A. boreas* and *A. punctatus* individuals are broken for clarity. Maps of both national parks are overlaid on the full distribution of *A. canorus*. Asterisks on the timeline denote ages of known glacial maxima based on Gillespie and Clark (2011), which are overlain on the tree by vertical blue stripes (see Table S4 for names and dates). (B–D) Most likely model of admixture history for each of the three contact zones. Lineage fusion was the most likely scenario in (B) and (D) based on fastsimcoal results, but no admixture was detected in (c), hence, no models were tested. See Figure S8 for a graphical representation of all 17 models tested. Parameters are defined in Table 2.

the two parks include the major lineages of the species, then the high-elevation *A. canorus* first speciated from *A. boreas* sometime during the McGee glaciation, in the early Pleistocene. The second oldest divergence between Y-North and the remainder of YOSE was estimated at 724 ± 51 ka. Only the youngest lineage (Evolution) had a crown date (18 ± 9 ka) corresponding to the most recent glaciation (Tioga; advance 21–20 ka, retreat 15–14 ka). Most divergences predated the Tioga, and had estimated dates similar to the McGee, Sherwin, Walker Creek, and Bloody Canyon glaciations (Fig. 3; Table S4). Additionally, all eight *A. boreas* samples from both northern and southern California (including from YOSE) formed one monophyletic lineage, sister to all *A. canorus* samples. *A. canorus* and *A. boreas* were reciprocally monophyletic regardless of taxon sampling and ascertainment used (Fig. S7). The estimated clockRate was 1.507 × 10^{-9} substitutions per site per year, which we used in subsequent fastsimcoal analyses.

Due to the configuration of Merced and Tuolumne River canyons, three contact zones exist between the four primary YOSE lineages: East-North, East-West, and East-South (Figs. 2–4). We

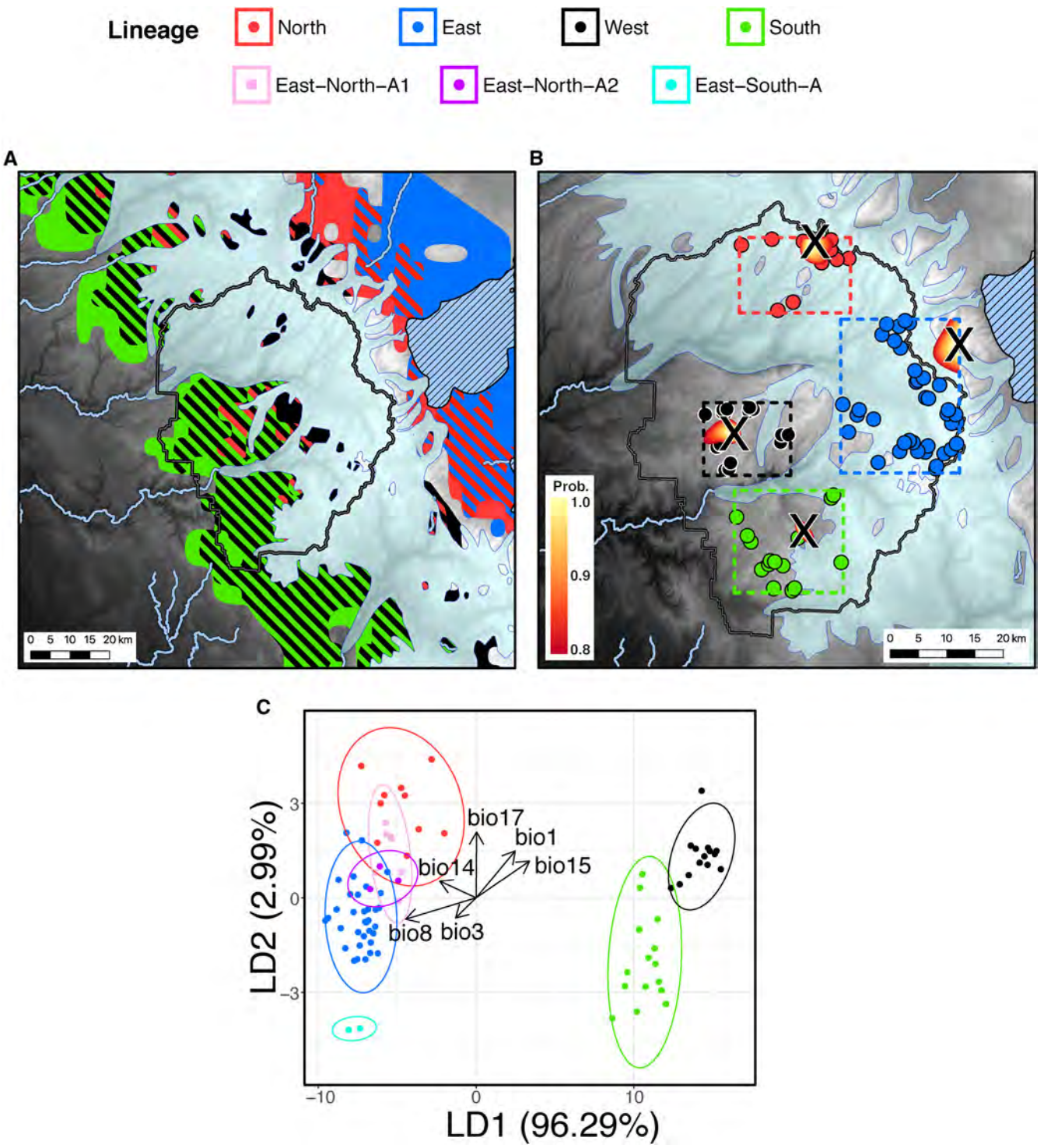

Figure 4. Climatically distinct refugia reinforced lineage divergence. (A) Potential LGM niche space for each lineage in Yosemite NP, with climatic niche suitability scores 0.8–1.0. Areas suitable for more than one lineage are indicated by diagonal hatching with multiple colors. (B) Origins of post-Pleistocene colonization events for each lineage, indicated by "X," inferred by genetic directionality index (ψ). Heatmaps underneath each "X" show its most probable location, ranging from 0.8–1.0 normalized probability. The inferred origin is limited to the area inside the dashed rectangle, so an "X" location near the rectangle boundary may suggest an origin outside of it. For (A and B), only non-admixed lineages are included due to sample size. The light blue polygon denotes the maximum extent of glaciation in the Sierra Nevada, the hatched blue polygon denotes a pluvial lake, and the blue lines denote rivers. (C) Linear discriminant biplot of six BioClim variables shows the climatic differentiation between all lineages in Yosemite NP. See Table S5 for variable definitions, and Table S6 for results of formal niche overlap and equivalency tests.

detected admixture in the East-North zone (East-North-A1 and East-North-A2 lineages) and East-South zone (East-South-A lineage). We tested a total of 17 hypothesized models for admixed lineage history in northern ($n = 10$) and southern ($n = 7$) contact zones to determine whether patterns of admixture reflect true interlineage fusion, lineage introgression, or isolation-with-migration (see Fig. S8 for all models).

The models with highest likelihood were "Hybrid 3″ (northern), and "Hybrid" (southern), both with AIC weights of ≈1.0 (Table 1). These models inferred an instantaneous origin of admixed lineages T generations ago, after a period of time with no gene flow. The Hybrid 3 model contains two fusion events: East-North-A1 was created from Y-East and Y-North, and then East-North-A2 was created from East-North-A1 and Y-East. We used the divergence date estimates and an assumed generation time of five years to calibrate those times, and estimated admixture dates (in ka) of 473 [203–610] for East-North-A1, 254 [0.055–322] for East-North-A2, and 366 [327–377] for East-South-A (Table 2). With the exception of East-North-A2, these events predate the last three glacial episodes. The East-North-A1 lineage had higher genetic input (α) from Y-North (0.44 [0.22–0.82]), whereas East-North-A2 was much closer to Y-East (0.14 [0.14–0.86]). The East-South-A lineage had higher admixture from Y-South (0.61 [0.17–0.77]). These findings were consistent with the HIest results (see below), but large 95% confidence intervals preclude extensive interpretation (e.g., whether backcrossing occurred).

REINFORCED LINEAGE DIVERGENCE FROM CLIMATICALLY DISTINCT REFUGIA

Pleistocene refugial models of the four major YOSE lineages showed largely east-of-ice-sheet distributions for Y-North and Y-East, and west-of-ice-sheet distributions for Y-South and Y-West (Fig. 4). The refugial variables with highest permutation importance were: annual mean temperature (Y-North), precipitation seasonality (Y-East), annual mean temperature (Y-South), and mean temperature of wettest quarter (Y-West; Table S5). Area under the curve (AUC) for test data was >0.996 for all models.

Fu's F_S estimates were consistent with demographic expansion (Table 3); all values were significantly negative ($P < 0.02$) except for the two young admixed lineages (East-North-A2, East-South-A). Estimates of pairwise ψ supported a pattern of spatial expansions in the pure lineages of YOSE, consistent with origins from the hypothesized refugia (Table 4; Figs. 4 and S9). Interestingly, TDOA-estimated origin points were east of the ice sheet for high-elevation Y-North and Y-East (whose current distributions are underneath the former ice extent), but low-elevation Y-South and Y-West had origin points inside their current distributions, west of the maximum distribution of Pleistocene ice sheets.

The LDA on six climatic variables showed that the two low-elevation lineages (Y-South/Y-West) are completely distinct from the others across LD1 (96.29% variance), which encompasses a complex gradient of temperature and precipitation variables (Fig. 4C). The second axis explained a small minority of the variance (LD2: 2.99% variance), based upon differing summer precipitation levels between Y-North/Y-East and Y-West/Y-South. Based on Schoener's D statistics, two pairs of lineages were found to have niche overlap while accounting for total available niche space: Y-South/Y-West (46.7% overlap), and Y-North/Y-East (10.6% overlap; Table S6). A test for niche equivalency found all climatic niches to be significantly divergent except for Y-South/Y-West ($P = 0.051$), despite not being sister lineages.

CONTACT ZONE WIDTH AND DYNAMICS

Geographic extent of admixture was greatest for the high-elevation East-North contact zone, and narrower for the two contact zones of mixed elevation (Figs. 5A and S2). Based on STRUCTURE estimates, the number of meadows with >2% mean ancestry from both lineages was: 18 (East-North), 10 (East-South), and zero (East-West). The number of meadows specifically included in fused lineages was: 10 (East-North), two (East-South), and zero (East-West). The East-North contact zone spanned an approximately 20 km section of northern YOSE, from Kerrick Canyon to Virginia Canyon, whereas the East-South contact zone spanned approximately 5 km at the headwaters of the Merced River. No predominantly admixed meadows were found in the East-West contact zone.

HIest suggested most admixed individuals are the result of more than two generations of admixture (Figs. 5B and S10). Based on simulations with $N = 50$ and no gene flow, the observed patterns are consistent with origins between five and 500 generations or more (Fig. S10), although much older admixture (as suggested by fastsimcoal; Table 2) is possible if these parameters are underestimated. In addition, the simple two-generation model was rejected in favor of advanced admixture in the majority of admixed individuals (Table S7; Fig. 5B and C).

PC1 and PC2 scores showed distinct genotyping clustering of individuals in the fused lineages, East-North-A1/A2 and East-South-A, as true-breeding recombinants would be expected to show (Fig. 5C). In addition, one meadow (2498) near Polly Dome in the East-West contact zone showed some evidence of recent (<2 generations) admixture and genotypic distinctiveness.

Discussion

Our results provide strong evidence that Yosemite toad lineages have evolved in response to repeated glacial vicariance. Lineage divergence times generally correspond to known dates of glacial maxima, spanning the Pleistocene. Our demographic and spatial demographic reconstructions support the hypothesis that toads have recently recolonized the mountains, and specifically from

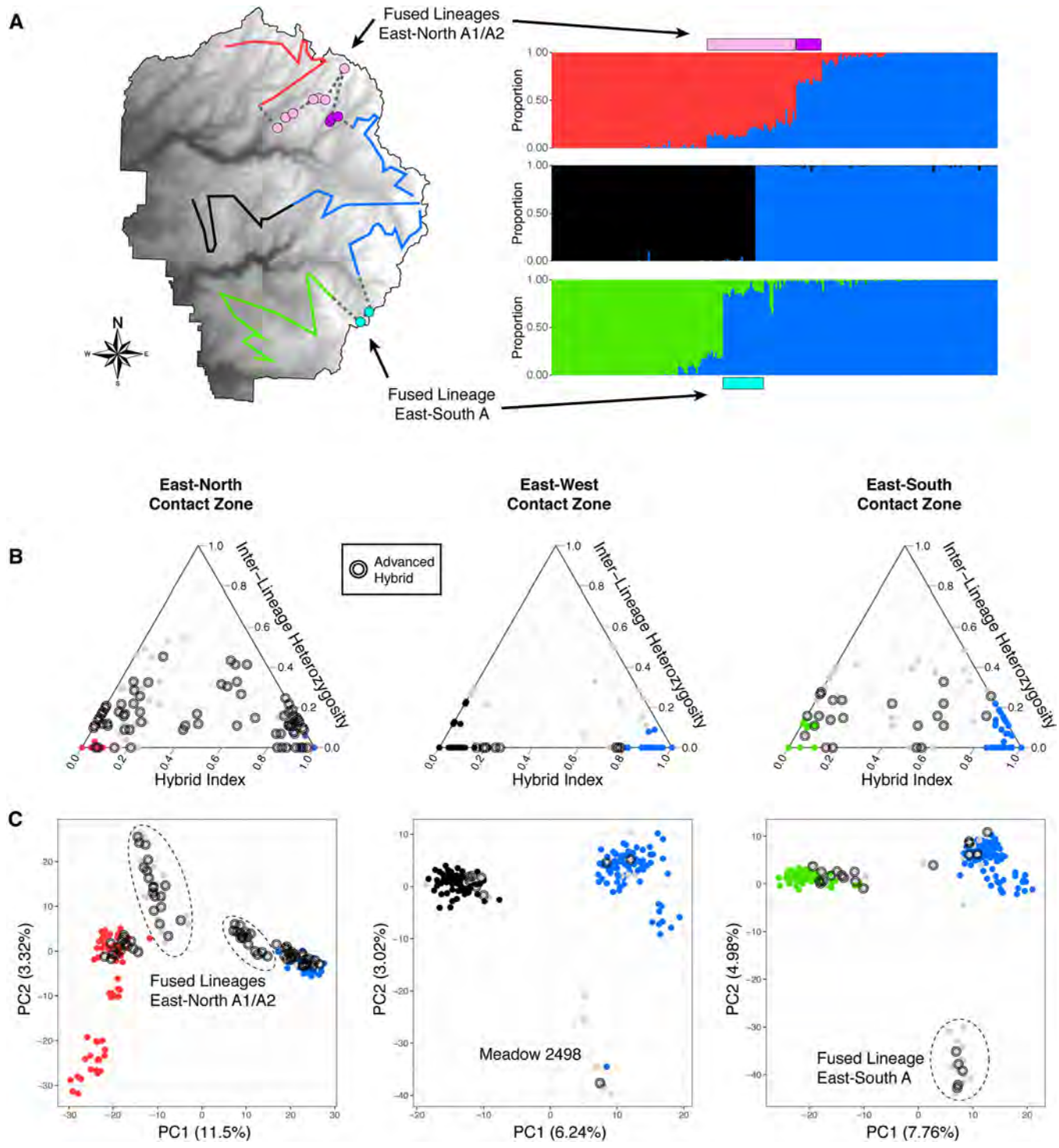

Figure 5. Contact zone width and dynamics. (A) STRUCTURE barplots ($K = 2$) and transect maps for each contact zone, showing the spatial width of each zone. Meadows from fused lineages are indicated with the same colors from Figures 3 and 4. (B) Estimation of hybrid index (S; proportion of ancestry from each lineage) and interlineage heterozygosity (H_I; heterozygosity at lineage-diagnostic markers) for three contact zones in YOSE, estimated by HIest. Circles represent individual genotypes, halos represent individuals for which two-generation hybrid classes have been rejected in favor of advanced (older) hybrid classes. Colors represent pure (non-admixed) genotypes. (C) PCA biplots of pure and admixed individuals, showing separate clustering of genotypes in fused lineages.

Table 1. Results of model testing using fastsimcoal on two admixture zones in Yosemite NP, East-North, and East-South. "Isolation" = simple isolation/divergence of lineages; "Iso./Migration" = isolation with migration; "Hybrid" = lineage fusion by hybridization; "Intro." = ongoing introgression into an admixed lineage. A graphical depiction of models and model parameters is shown in Figures 3 and S8. Each model was run independently 100 times using 100,000 coalescent simulations 40 expectation-maximization cycles each time. The most likely model is shown in bold.

Zone	Model	Maximum AIC	No. Param.	ΔAIC	AIC Weight
East-North Admix.	Isolation	−3771.12	7	−51.744	2.49×10^{-22}
	Iso./Migration	−3904.74	15	−185.37	7.75×10^{-84}
	Hybrid 1	−3729.53	9	−10.157	3.88×10^{-5}
	Hybrid 2	−3748.28	9	−28.906	2.79×10^{-13}
	Hybrid 3	**−3719.37**	**9**	**0**	**∼1.00**
	Hybrid 4	−3733.56	8	−14.185	1.88×10^{-6}
	Intro. 1	−3854.50	9	−135.131	2.06×10^{-59}
	Intro. 2	−3792.58	9	−73.206	1.61×10^{-32}
	Intro. 3	−3846.50	9	−127.124	6.18×10^{-56}
	Intro. 4	−3767.68	8	−48.302	2.86×10^{-21}
East-South Admix.	Isolation 1	−4073.765	5	−23.481	1.72×10^{-10}
	Isolation 2	−4064.046	5	−13.762	2.87×10^{-6}
	Iso./Migration 1	−5784.45	11	−1734.16	∼0.00
	Iso./Migration 2	−5700.31	11	−1650.03	∼0.00
	Hybrid	**−4050.284**	**6**	**0**	**∼1.00**
	Intro. 1	−4182.295	6	−132.011	4.66×10^{-58}
	Intro. 2	−4704.026	6	−653.742	1.21×10^{-284}

glacial refugia. Lower-elevation toads have repeatedly been isolated in situ west of Pleistocene ice sheets, while their higher-elevation brethren have been forced eastward into Owens Valley, only to recolonize later. This has resulted in a phylogenetic pattern of sister lineages residing in divergent climatic niches. Niche evolution may have reinforced lineage incompatibility at secondary contact zones. If drift alone was responsible for levels of reproductive isolation, then lineage incompatibility would increase with time. However, the most extensive admixture observed was between Y-East and Y-North, the contact zone with the oldest divergence, yet highest niche overlap. Conversely, the two narrowest contact zones are between lineages with least niche overlap. Furthermore, at least two contact zones have apparently generated novel lineages through the process of lineage fusion, the extent of which also correlates with niche overlap. These results are consistent with the model of glacial pulses (Fig. 1), which may apply to other alpine endemics.

ROLE OF NICHE DIVERGENCE IN THE GLACIAL PULSE MODEL

Recently, there has been a debate about the role of niche evolution in speciation. Proponents of niche conservatism argue that species innately have low tolerance to adapt outside their fundamental niche, meaning that climate shifts can fragment the distribution of that niche, leading to allopatric speciation (Wiens 2004; Wiens and Graham 2005; Wiens et al. 2010). Under this model, ecological divergence is the result (not the cause) of lineage formation. However, this process does not convincingly explain niche divergence for adjacent species pairs occupying steep mountainous gradients. These are commonly observed in animals (e.g., Graham et al. 2004) and plants (e.g., Chabot and Billings 1972). In contrast, proponents of ecological speciation argue that natural selection can overpower gene flow to produce local adaptation, and hence, niche divergence directly spawns new lineages (Dobzhansky 1951; Schluter 2001; Rundle and Nosil 2005). Although there are numerous examples of divergent selection driving incipient ecological speciation, advocates readily admit that the process is often incomplete (Nosil et al. 2009).

The glacial pulse model combines elements of niche divergence with the classical and widely accepted model of allopatric speciation and associated reproductive incompatibilities (Mayr 1942; Coyne and Orr 1989; Barraclough and Vogler 2000). It unifies the two principal explanations for speciation in Sierra Nevada alpine endemics: (1) colonization of mountains followed by physiological or ecological divergence (Went 1948; Chabot and Billings 1972; Billings 1974), and (2) isolation of formerly continuous species in glacial or interglacial refugia (Rovito 2010; Rubidge et al. 2014). Our results suggest these both happen, cyclically, and they are mutually reinforcing (Fig. 1). In this study, we found evidence that Yosemite toads have repeatedly become allopatric, and have diverged in climatic niche while isolated into distinct (west vs. east) refugia. The fact that high- and

Table 2. Demographic parameter estimates for models with highest weighted AIC scores from the East-North and East-South admixture zones. See Figure 3 for graphical depictions of models and parameters. Estimates are the highest maximum likelihood scores from 100 replicate fastsimcoal runs.

		Parameter[†]								
Model		N_{Anc}[‡]	N_N	N_{A1}	N_{A2}	N_E	α_{A1}	α_{A2}	T_{A1}[§]	T_{A2}
East-North Admix.	estimate	1.17×10^7	9.65×10^5	7.11×10^5	4.15×10^5	7.17×10^5	0.44	0.14	4.73×10^5	2.54×10^5
	95% CI[¶]	$[1.17 \times 10^7 – 1.77 \times 10^7]$	$[4.55 \times 10^5 – 9.75 \times 10^5]$	$[8.29 \times 10^5 – 7.11 \times 10^5]$	$[0.95 \times 10^5 – 4.29 \times 10^5]$	$[6.34 \times 10^5 – 8.10 \times 10^5]$	[0.22 – 0.82]	[0.14 – 0.86]	$[2.03 \times 10^5 – 6.10 \times 10^5]$	$[55 – 3.22 \times 10^5]$
		N_{Anc}	N_S	N_A	N_E	α_A	T_A			
East-South Admix.	estimate	1.02×10^7	3.75×10^5	3.34×10^5	6.12×10^5	0.61	3.66×10^5			
	95% CI	$[9.53 \times 10^6 – 1.21 \times 10^7]$	$[1.97 \times 10^5 – 4.05 \times 10^5]$	$[2.74 \times 10^5 – 5.50 \times 10^5]$	$[3.99 \times 10^5 – 6.92 \times 10^5]$	[0.17 – 0.77]	$[3.27 \times 10^5 – 3.77 \times 10^5]$			

[†]Parameters: population sizes for North (N_N), East-North-A1 (N_{A1}), East-North-A2 (N_{A2}), East (N_E), South (N_S), East-South-A (N_A), and ancestral (N_{Anc}) lineages; admixture proportions from East → East-North-A1 (α_{A1}), East-North-A1 → East-North-A2 (α_{A2}), and South → East-South-A (α_A); and admixture times for East-North-A1 (T_{A1}), East-North-A2 (T_{A2}), and East-South-A (T_A) lineages.

[‡]Population sizes are in haploid units.

[§]Admixture times are in units of years, with an assumed generation time of five years.

[¶]The 95% confidence intervals were estimated using 100 pseudoreplicate SFS datasets and rerunning each model 100 times, using the best model parameters as starting values.

Table 3. Results of Fu's F_S test of demographic expansion in Yosemite NP. Large negative values of Fu's F_S indicate recent demographic expansion, with significance level considered to be 0.02.

Lineage	Number of alleles	Expected number of alleles	θ_π	Fu's F_S	Fu's F_S *P*-value
North	150.00	93.54	105.26	−24.85	***
East-North-A1	116.00	78.78	106.76	−25.12	***
East-North-A2	28.00	24.93	105.02	−3.28	0.05
East	388.00	141.29	79.53	−23.97	***
East-South-A	42.00	37.07	147.45	−5.35	0.03
South	176.00	96.73	87.34	−24.50	***
West	170.00	102.20	107.34	−24.82	***

***Significance of demographic expansion at the 0.001 probability level.

Table 4. Inferred origins of post-Pleistocene colonization events in the four pure lineages of Yosemite NP. Admixed lineages were excluded due to low sample sizes.

Lineage	Longitude†	Latitude†	q‡	r_1§	r_{10}§	r_{100}§	d	R^2 ¶	*p*-value
North	−119.5173	38.11973	0.015	0.971	0.772	0.253	0.343	0.600	***
East	−119.2167	37.96289	0.008	0.985	0.869	0.398	0.669	0.273	***
South	−119.5223	37.66362	0.012	0.976	0.804	0.291	0.414	0.237	***
West	−119.6657	37.8162	0.020	0.961	0.710	0.196	0.247	0.540	***

†Inferred origin of spatial range expansion.
‡Strength of colonization, given as regression slope in km^{-1}.
§Decrease in diversity over 1, 10, and 100 km given as $N_e^{founder}/N_e$.
¶Adjusted coefficient of determination for the nonlinear model.
***Significance of spatial range expansion at the 0.001 probability level.

low-elevation niches have evolved more than once (i.e., convergence between Y-South and Y-West) suggests a strong influence of climatic niche selection. The observation that ecological divergence—not genetic divergence—is most correlated with narrow contact zones suggests that niche divergence may accelerate reproductive isolation. Although the Sierra Nevada are unique among mountain ecosystems in having a Mediterranean climate (Rundel 2011; Rundel and Millar 2016), the patterns found here may be widespread. For example, similar patterns (i.e., repeated ecological selection, glacial allopatry, and recolonization) have been observed in European grasshoppers (Hewitt 1996).

One assumption of the model is heterogeneity of refugial climates, because post-glacial recolonization must proceed into non-overlapping niches. High-Sierra and eastern desert (Owen's Valley) ecosystems have similar growing seasons (Went 1948), which may explain why the latter was a suitable refugium for high-elevation and not low-elevation Yosemite toad lineages. Climatic conditions in Owen's Valley over the past 155,000 years were also wetter and cooler than at present (Menking et al. 1997; Koehler et al. 2005), and might have supported large population sizes. This might explain the much higher genetic diversity of high-elevation lineages. Another Sierra Nevada endemic amphibian (*Hydromantes platycephalus*) reaches its highest diversity in its eastern lineage, near Owen's Valley, which seems to corroborate this pattern (Rovito 2010). Diversity patterns may also reflect current habitat: although high-elevation lineages must periodically retreat into refugia, their meadows are rejuvenated with new alluvial deposits that may positively influence hydrology for tadpoles (Wood 1975). Conversely, low-elevation lineages that remain in situ may experience little benefit from glacial action, and higher rates of conifer encroachment into meadows as trees recolonize middle elevations (Woolfenden 1996; Lubetkin et al. 2017).

PHYLOGEOGRAPHIC BOUNDARIES AND DATES OF PAST LINEAGE ISOLATION

We detected substantial phylogeographic structure within YOSE and between the two parks. Previous studies have found two major mitochondrial clades of *A. canorus*, often polyphyletic with respect to *A. boreas*, with alternate samples from Ireland Lake (in Y-East) falling into either clade (Shaffer and Fellers 2000; Stephens 2001; Goebel and Ranker 2009). Although their spatial

sampling was limited, our East-North contact zone is likely the boundary of those previously described clades. The increased resolution of our sampling revealed that two other contact zones exist within the park, and implicated both the longitudinal and transverse ice sheets of the Pleistocene as likely barriers. The Merced and Tuolumne River gorges (Fig. 4) contained formidable ice sheets, and structured lineage boundaries in other Sierra amphibians such as *Rana sierrae* (Poorten et al. 2017) and *Hydromantes* salamanders (Rovito 2010). These barriers provided two disconnected low elevation refugia, allowing multiple glacial pulses to churn out low elevation lineages (Y-West and Y-South).

Using a published molecular clock for anuran nonsynonymous nuclear DNA, we estimated that the time to most recent common ancestor (TMRCA) for the species—based on the divergence date for the two parks—was 1.96 ± 0.14 million years ago, corresponding to the approximate onset of Sierra Nevada glaciation (Calsbeek et al. 2003). The median estimates for all subsequent divergences ranged between 724 and 215 ka. Beginning in the late Pleistocene (about 900 ka), glacial periodicity switched from 41 to 100 ka cycles, with longer duration, shorter inter-glacials, and colder average temperature (Mudelsee and Schulz 1997; Tziperman and Gildor 2003). Hence, intra-park divergences could reflect stronger isolating events during this period. Numerous other arctic and alpine temperate species exhibit deep divergences dating back to the mid-Pleistocene, indicating that they retained distinctiveness over several ice ages, and that lineage diversification proceeds by repeated allopatry (i.e. "glacial pulse" mechanism) (Hewitt, 1996, 2004; Avise et al. 1998). All of our divergence estimates (1.96 million years ago to 215 ka) are much older than the five most recent glaciation events (Gillespie and Clark 2011), which is consistent with remaining distinct during interglacial time. This suggests these lineages have either survived through glacial maxima in high-elevation nunatak or peripheral refugia (Holderegger and Thiel-Egenter 2009), or remained reproductively isolated while in lowland refugia.

Although theory predicts that cold-adapted species should expand their ranges during ice ages (Haffer 1969), montane and alpine amphibians may counter this pattern by remaining in refugia within their current distributions. For example, phylogeographic and isolation by distance analyses showed that pygmy salamanders (*Desmognathus wrighti*) remained fragmented at high elevation during the Pleistocene, and this restriction was likely driven by ecological interactions (Crespi et al. 2003). Interestingly, another Sierra Nevada endemic amphibian (the sympatric *Rana sierrae*) has three gene pools with almost identical spatial extent to *A. canorus* lineages in YOSE (Poorten et al. 2017). If divergence times turn out to be similar, this would be strong support that common glacial barriers and refugia have structured each species. For our foregoing conclusions, we note the caveat that using a rate calibration from other species assumes similar rates of evolution. This assumption may be violated; for example, a relatively low historical N_e could accelerate fixation, biasing divergence estimates upward. With increasing genome-wide studies of phylogeography, genomic rates of evolution will be better assessed and calibrated across diverse taxa.

GENETIC CONSEQUENCES OF INTERLINEAGE ADMIXTURE

Our analyses suggest that secondary contact following isolation has fused together new and persistent lineages of admixed origin. Admixture tended to be asymmetrical, suggesting that backcrossing may be important during this process, although the confidence intervals of fastsimcoal estimates were too broad to corroborate this pattern. Lineage fusion presents an intriguing research opportunity for admixed fitness and conservation. Traditionally, hybridization is discussed in the context of interspecific gene flow or introgression between native and exotic species. In these cases of anthropogenic hybridization, two negative consequences are likely: outbreeding depression follows from maladaptive allele combinations and results in low hybrid vigor or fertility, or genetic assimilation erodes locally adapted populations and species boundaries (Ellstrand and Elam 1993; Weber and D'Antonio 2000). For example, introduction of an exotic ambystomatid salamander into southern California has sent a rapid influx of morphological and genetic changes across populations of *Ambystoma californiense*, where hybrids have outcompeted natives of that and other species (Ryan et al. 2009; Fitzpatrick et al. 2010). However, a more recent view of hybridization posits it is more ubiquitous and beneficial than previously assumed (Arnold et al. 1999; Mallet 2005). Many recent examples of lineage fusion have been described, due to anthropogenic (Hendry et al. 2006; Behm et al. 2010; Vonlanthen et al. 2012; Rudman et al. 2016) or natural (Vergilino et al. 2011; Webb et al. 2011; Cui et al. 2013; Talavera et al. 2013; Garrick et al. 2014; Grant and Grant 2014; Lamichhaney et al. 2018) breakdown of postmating barriers, with evidence of temporal stability in several cases (e.g., Li et al. 2016). Intraspecific lineage fusion is particularly likely when environmental heterogeneity between lineages is minimal (Seehausen 2006; Seehausen et al. 2008).

Periodic lineage fusion could be an essential source of adaptive genetic novelty and hybrid vigor in species such as the Yosemite toad, given its small average N_e of 29.13 (Table S3; consistent with Wang 2012). Preliminary analysis of Yosemite toad evolutionary rates has shown a strong negative relationship with estimated census population size, indicating genetic drift might overpower adaptation from standing variation and new mutations (Maier et al. 2016; Maier 2018). Although recombination in admixed individuals can disrupt co-adapted genotypes underlying polygenic traits, it has the advantage of generating novel adaptive alleles at an accelerated rate (Hedrick 2013). Since

admixture is a recurrent process, the continual flow of adaptive alleles can raise the initial frequency of them considerably, and lead to much faster fixation (Hedrick 2013). This process, in concert with possible heterosis experienced by F1s and other early filial individuals, can dramatically expedite adaptive evolution. For example, hybridization between several closely related species of Darwin's finches on Daphne Island has contributed at least 10% additive genetic variance in beak shape, a trait under intense and episodic selection (Grant and Grant, 2008, 2010, 2014; Grant 2015). Subsequent fluctuations in food availability during an El Niño event allowed hybrids to survive longer, and backcrossed individuals eventually formed a morphologically, ecologically, and reproductively distinct lineage.

In the present study, we detected three lineage fusions of moderate age, whose descendants appear to maintain independent evolutionary trajectories. With ongoing admixture zones involving independently evolving lineages, more extreme traits are possible, including very rapid or slow tadpole growth rates (Parris 1999; Reyer 2008). Under conditions where ponds are shallow and tend to desiccate, admixture in pond-breeding anurans is more widespread (Kingsolver et al. 2002; Pfennig 2007), and natural selection can more efficiently replace old traits with new, successful ones because they are already at high frequencies (Hedrick 2013). There are many examples of intraspecific admixture increasing the viability of translocated larvae and adults (e.g., Japanese common toads: Hase et al. 2013; European toads: Zeisset and Beebee 2013). Given the extremely short and variable hydroperiods Yosemite toads experience during larval development, it seems likely that tadpole physiology would be under strong selection. Thus, any heritable Yosemite toad fitness traits that have diverged between lineages may be studied for conservation value, to ascertain whether (and in what environmental context) pure versus admixed individuals would make superior stock for translocation efforts (Hamilton and Miller 2016). Although the longevity and number of lineage fusions hints at their population fitness, our evidence does not directly suggest hybrid advantage, a subject that future studies should examine at the phenotypic level.

Conclusions

In this study, we have provided evidence that pulses of glacial action bisect lineages into divergent climatic niches, which then can form further lineages by fusion. This mechanism is unique from other described mechanisms for lineage diversification, and should be considered in phylogeographic hypothesis testing for other alpine systems. The process of lineage fusion in secondary contact zones is particularly intriguing. Given that Yosemite toads are federally threatened and particularly susceptible to climatic fluctuations (USFWS 2014), it may be beneficial to elucidate any adaptive or deleterious effects of interlineage admixture before attempting conservation measures such as translocations. We suggest further research into the possibility that such a zone is a crucible for valuable adaptive diversity to combat stressors such as disease and periodic climatic extremes, such as intense drought. All nine lineages in our study area may be considered potential evolutionarily significant units (ESUs; sensu Moritz 1994), since they appear to be evolving independently, and occupy distinct climatic niches in most cases. The future for alpine endemics is grim; one study estimated that up to 66% of California endemic plants will experience large (>80%) range reductions by year 2100 (Loarie et al. 2008). However, our results are promising in that lineages have evolved differing climatic optima, and hence should have a diversified response to climate change. Future studies may expand upon our results by examining the fitness differences between pure/admixed, and low-/high-elevation lineages, to anticipate future changes.

AUTHOR CONTRIBUTIONS

P.A.M., S.M.O., A.A., A.G.V., and A.J.B. designed the study; P.A.M. and S.M.O. collected tissue samples; P.A.M. performed the laboratory work and conducted the analyses, with guidance from A.J.B., A.G.V., and A.A. P.A.M. wrote the manuscript, with input from A.G.V., A.J.B., S.M.O., and A.A.

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DATA ARCHIVING

Demultiplexed fastq files of double-digest RADseq data are deposited at NCBI GenBank SRA under BioProject PRJNA558546 (https://www.ncbi.nlm.nih.gov/sra/PRJNA558546). The python program fasta2genotype.py, user manual, and example dataset are available for download online: https://github.com/paulmaier/fasta2genotype. R scripts and genotype/GIS data necessary for reproducing phylogenetic, demographic, niche overlap, and hybrid ancestry analyses are available at Dryad (https://doi.org/10.5061/dryad.xsj3tx99h). Information about all

samples used in this study, in addition to supplemental tables, figures, and methods/results, are available in the online Supporting Information.

JOURNAL CLUB SLIDES

Journal club slides for presenting the article have been posted on FigShare (https://www.doi.org/10.6084/m9.figshare.10260362).

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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ológicas, Universidad Nacional, Apt. 86-3000 Heredia, Costa Rica (e-mail: kpsa89@gmail.com); **JOSE A. CAMBRONERO-GRANADOS,** Laboratorio de Análisis Genómico, Escuela de Ciencias Biológicas, Universidad Nacional, Apt. 86-3000 Heredia, Costa Rica (e-mail: josea._cg@hotmail.com).

***ALCALUS BALUENSIS* (Dwarf Mountain Frog). PREDATION.** *Alcalus baluensis* is a small, stream-associated frog endemic to the island of Borneo. This species is found along rocky, fast-flowing streams, but little else is known of its natural history (Inger et al. 2017. A Field Guide to the Frogs of Borneo. Natural History Publications. Kota Kinabalu. Malaysia. 228 pp.). The arachnid family Sparassidae (huntsman spiders) are globally distributed throughout warm tropical regions. This family predates a wide range of small vertebrates, with two Bornean *Heteropoda* sp. known to prey upon large anuran tadpoles (Airamé and Sierwald 2000. J. Arachnol. 28:251–253). Here, we document the predation of an *A. baluensis* froglet by a spider (*Heteropoda* sp.). At 2048 h on 6 March 2018 we found a froglet that had been recently caught by a large, female *Heteropoda* sp. (Fig. 1) within the Deramakot Forest Reserve, Borneo, Malaysia (5.33859°N, 117.48147°E, WGS 84; 159 m elev.). The spider and prey were found adjacent to a 3.4-m wide, fast-flowing stream within a previously logged forest. The spider appeared to have spread several web strands over the deceased *A. baluensis,* and stood motionless over the froglet. After several minutes of observations, the observers left the area but the spider had yet to begin feeding.

We thank the Sabah Forestry Department for allowing us to conduct research within the Deramakot Forest Reserve. Additionally, we thank Siti Salihahfarhain Saidin for identification of the arachnid.

FIG. 1. Recent metamorph *Alcalus baluensis* froglet predated by a large *Heteropoda* sp. within the Deramakot Forest Reserve, Borneo, Malaysia.

SAMI ASAD, Museum für Naturkunde Berlin, Leibniz Institute for Evolution and Biodiversity Science, Invalidenstraße 43, 10115, Berlin, Germany (e-mail: Sami.Asad@mfn.berlin); **JOSEPH SIKU,** Forest Research Centre, Sabah Forestry Department, 90009 Sandakan, Sabah, Malaysia; **ROSHAN GUHARAJAN**, **ANDREAS WILTING**, Leibniz Institute for Zoo and Wildlife Research, Alfred-Kowalke-Str. 17, 10315 Berlin, Germany; **MARK-OLIVER RÖDEL**, Museum für Naturkunde Berlin, Leibniz Institute for Evolution and Biodiversity Science, Invalidenstraße 43, 10115, Berlin, Germany.

***ANAXYRUS CANORUS* (Yosemite Toad). BREEDING BEHAVIOR.** *Anaxyrus canorus* is a bufonid endemic to California that breeds in ephemeral snowmelt-fed meadow ponds at high elevation in the Sierra Nevada. Sex ratios during breeding are typically male-dominated, with operational sex ratios between 9.9–37.9:1 (Sherman 1980. A Comparison of the Natural History and Mating System of Two Anurans: Yosemite toads (*Bufo canorus*) and black toads (*Bufo exsul*). Ph.D. Dissertation, University of Michigan, Ann Arbor, Michigan. 394 pp.). Females must accrue sufficient gonadal and liver fat stores for hibernation and reproduction, and hence skip one or more consecutive breeding years (Morton 1981. Copeia 1981:234–238). Therefore, breeding females almost always have unpaired males to choose from, which they select directly (by approaching trilling males) or indirectly (by allowing faster males to approach and clasp them), which they do in roughly equal proportions (Sherman 1980, *op. cit.*). Male attacks on amplectant pairs are common (Sherman 1980, *op. cit.*), but to my knowledge, no record exists of females attacking amplectant pairs, and records of female-dominated breeding aggregations are rare.

These observations occurred between 1715 h and 1805 h on 18 May 2016 within a small montane meadow (0.98 ha) in Yosemite National Park, Tuolumne County, California (37.84619°N, 119.68439°W, WGS 84; 2445 m elev.). The focal meadow and five other meadows within 1.6 km comprise a cluster of meadows that toads occupy. The dominant vegetation surrounding meadows is Red Fir (*Abies magnifica*) mixed with Lodgepole Pine (*Pinus contorta* ssp. *murrayana*). The temperature at a nearby weather station (3.1 km E, 37 m lower in elev.) ranged from 0.67–17.78°C that day, and -1.67–17.78°C the previous five days. A late spring storm 11 days earlier had deposited 22 mm of snow, during which time the average temperature was 10°C colder. The focal meadow was ca. 50% covered in snow during the observation.

No male breeding chorus was heard upon approaching the meadow or during the observation. While surveying the meadow, 16 toads were found: five amplectant pairs, one unpaired male, and five unpaired females. One of the unpaired females was found entrenched inside a snowdrift crevasse, caused by the fracturing of one edge into the breeding pond, and she was apparently too cold to continue movement during the observation. Two of the other unpaired females (hereafter denoted "UPF1" and "UPF2") actively hopped throughout the pond, and the remaining two females sat buried in vegetation around the pond edge. At 1724 h, UPF1 approached UPF2, and UPF2 aggressively attacked UPF1, by tongue-flicking and bumping into her. Between 1740 and 1744 h, three amplectant pairs were approached and harassed by UPF1 (once) and UPF2 (five times). UPF1 ceased these behaviors at 1741 h when the unpaired male approached and amplexed her, thus forming a 6th amplectant pair. However, UPF2 never obtained a mate, and continued to harass amplectant pairs. The unpaired females exhibited a variety of behaviors: (1) approaching the pair, (2) bumping into the pair, (3) pushing against the amplectant male with her head, (4) pressing down on the amplectant female with her forelimbs, and (5) hopping on top of the amplectant pair. In response, the amplectant males usually emitted a release call. Footage of this observation is available at https://youtu.be/EspmwdPasBE.

To my knowledge, such competition among females has never been observed in pond-breeding anurans, with the exception of midwife toads (*Alytes*), which display male parental care (Verrell and Brown 1993. Ethology 93:247–257). At least two hypotheses can account for these observations. One possible explanation is that intrasexual competition is natural for highly gravid females,

but breeding aggregations are almost never male-limited, and hence this behavior is almost never displayed. Female-biased sex ratios have only been recorded in the declining Tioga Pass population during the 1980s, due to a faster extirpation rate of males than females (Sherman and Morton 1993. J. Herpetol. 27:186–198). Another possibility is that some "female" individuals are sex-reversed or intersex males exhibiting both male and female secondary sexual characteristics. Extreme temperatures and exposure to steroid hormones are known to override genetic sex determination in amphibians (Norris and Lopez 2011. Hormones and Reproduction of Vertebrates, Volume 2: Amphibians. Elsevier Academic Press, San Diego, California. 219 pp.). Bufonids are particularly susceptible, because males retain müllerian ducts (oviducts) and a Bidder's organ (rudimentary ovaries) during development that can become functional if the testes are damaged (Witschi 1933. Am. J. Anat. 52:461–515). *Anaxyrus canorus* has the most well developed Bidder's organ of any bufonid examined (Witschi 1933, *op. cit.*). Feminized males with hermaphroditic characters have been found in natural populations of other toads, including *Bufotes viridis*, *Rhinella marina*, and *Anaxyrus microscaphus* × *woodhousii* (Witschi 1933, *op. cit.*; Sullivan et al. 1996. Copeia 1996:470–472; McCoy et al. 2008. Environ. Health Persp. 116:1526–1532). More work should be done to further explore these hypotheses.

PAUL A. MAIER, Department of Biology, San Diego State University, 5500 Campanile Drive San Diego, California 92182, USA; e-mail: maier-pa@gmail.com.

***ANAXYRUS PUNCTATUS* (Red-spotted Toad). CANNIBALISM.** Among amphibians, cannibalism takes one of several forms: adults or larvae feeding on eggs (oophagy), adults or larvae feeding on larvae, and adults or larvae feeding on adults (Kuzmin 1991. J. Bengal Nat. Hist. Soc. 10:11–27). Although cannibalism is known from a variety of amphibian taxa, it seems to be more commonly exhibited by some groups than others. Additionally, some types of cannibalism appear to be more common than others, with larva on adult cannibalism exhibited least often (Kuzmin 1991, *op. cit.*). Hence the value of our report. We are documenting, for what we believe to be the first time, the cannibalism of adults by larvae within the family Bufonidae.

FIG. 1. Adult *Anaxyrus punctatus* being consumed by conspecific larvae, 21 June 2017.

At 2030 h on 20 June 2017, along the Burr Trail in the Grand Staircase Escalante National Monument, Garfield County, Utah, USA (37.84845°N, 111.37381°W, WGS 84; 2083 m elev.) we found two ephemeral pools containing larval *Anaxyrus punctatus*. As the sun set for the day we left the site. Later we returned to the site on 21 June 2017 at 0050 h hoping to document adult amphibians. Upon reexamining one of the pools we discovered three dead adult *A. punctatus* being rapidly consumed by larvae of the same species (Fig. 1). Due to the unusual observation, we returned the following night, 22 June 2017 at 0030 h, where a fourth toad was found dead and being devoured. The remains of the three previous adult toads were still present. At this time multiple aquatic macroinvertebrates, including dragonfly nymphs and fly larvae, were also found to be feeding on the carcasses. In these small, closed aquatic systems, even a single toad carcass represents a tremendous input of nutrients, let alone four simultaneously.

It was unclear whether this was an instance of active or passive cannibalism (i.e., scavenging) as the toads were already dead when we encountered them. However, as was noted above, the adults were clearly not present during the first encounter, but were present approximately 4.5 h later. It seems there are three likely explanations for the observed phenomenon. First, the adult toads entered the water, were overtaken by the larvae, killed and then consumed. Second, some other type of animal killed the toads and left them in the water. Third, the toads were injured, entered the water after passage of the observers, and were then overtaken by the larvae and consumed.

Regardless of the means by which the adults were killed, this still constitutes a unique observation. Secondarily, a review of the literature has shown adult cannibalism by larvae to be exceedingly rare among the Amphibia, with the possible exception of the Gymnophiona (Kuzmin 1991, *op. cit.*).

WILLIAM H. HEYBORNE (e-mail: williamheyborne@suu.edu), **CORAL E. GARDNER**, and **IAN W. SHIPLEY** Department of Biology, Southern Utah University, Cedar City, Utah 84720, USA.

***AROMOBATES CANNATELLAI* (Cannatella frog). PREDATION.** *Aromobates cannatellai* is a recently described small frog in the family Aromobatidae, with an Andean distribution from Estado Táchira, Venezuela, to Norte de Santander department, Colombia, with an altitudinal distribution from 750 to 1140 m (Barrio-Amorós and Santos 2012. Zootaxa 3422:1–31). It is diurnal and terrestrial

FIG. 1. *Ancylometes bogotensis* predating *Aromobates cannatellai* in the tropical dry forest of northeastern Colombia.

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Gene Pool Boundaries for the Yosemite Toad (*Anaxyrus canorus*) Reveal Asymmetrical Migration Within Meadow Neighborhoods

Paul A. Maier[1,2*†], *Amy G. Vandergast*[3†], *Steven M. Ostoja*[4†], *Andres Aguilar*[5†] *and Andrew J. Bohonak*[1†]

[1] Department of Biology, San Diego State University, San Diego, CA, United States, [2] FamilyTreeDNA, Gene by Gene, Houston, TX, United States, [3] U.S. Geological Survey, Western Ecological Research Center, San Diego Field Station, San Diego, CA, United States, [4] U.S. Department of Agriculture (USDA) California Climate Hub, Agricultural Research Service, John Muir Institute of the Environment, University of California, Davis, Davis, CA, United States, [5] Department of Biological Sciences, California State University, Los Angeles, Los Angeles, CA, United States

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Cristiano Vernesi,
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Belma Kalamujic Stroil,
University of Sarajevo-Institute for Genetic Engineering and Biotechnology, Bosnia and Herzegovina

***Correspondence:**
Paul A. Maier
paulm@genebygene.com

†ORCID:
Paul A. Maier
orcid.org/0000-0003-0851-8827
Amy G. Vandergast
orcid.org/0000-0002-7835-6571
Steven M. Ostoja
orcid.org/0000-0002-9182-4413
Andres Aguilar
orcid.org/0000-0002-4409-9597
Andrew J. Bohonak
orcid.org/0000-0002-5429-2331

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The Yosemite toad (*Anaxyrus* [*Bufo*] *canorus*) is a federally threatened species of meadow-specializing amphibian endemic to the high-elevation Sierra Nevada Mountains of California. The species is one of the first amphibians to undergo a large demographic collapse that was well-documented, and is reputed to remain in low abundance throughout its range. Recent phylogeographic work has demonstrated that Pleistocene toad lineages diverged and then admixed to differing extents across an elevational gradient. Although lineage divisions may have significant effects on evolutionary trajectories over large spatial and temporal scales, present-day population dynamics must be delineated in order to manage and conserve the species effectively. In this study, we used a double-digest RADseq dataset to address three primary questions: (1) Are single meadows or neighborhoods of nearby meadows most correlated with population boundaries? (2) Does asymmetrical migration occur among neighborhoods of nearby meadows? (3) What topographic or hydrological variables predict such asymmetrical migration in these meadow neighborhoods? Hierarchical STRUCTURE and AMOVA analyses suggested that populations are typically circumscribed by a single meadow, although 84% of meadows exist in neighborhoods of at least two meadows connected by low levels of migration, and over half (53%) of neighborhoods examined display strong asymmetrical migration. Meadow neighborhoods often contain one or more large and flat "hub" meadows that experience net immigration, surrounded by smaller and topographically rugged "satellite" meadows with net emigration. Hubs tend to contain more genetic diversity and could be prioritized for conservation and habitat management and as potential sources for reestablishment efforts.

Keywords: population genetics, conservation, asymmetrical migration, source-sink dynamics, isolation-by-distance, amphibian conservation, meadows, RADseq

INTRODUCTION

Identifying the unit at which a population is ecologically and evolutionarily independent is important because this forms the basis for many conservation and management actions, and for monitoring species status. Often, two types of conservation units are delineated: Management Units (MUs; Dizon et al., 1992; Moritz, 1994; Palsbøll et al., 2007) and Evolutionarily Significant Units (ESUs; Ryder, 1986; Avise, 1994; Moritz, 1994). Present-day independence is captured by MUs, defined as demographically independent populations with sufficiently high growth rates and low connectivity to neighboring units (Palsbøll et al., 2007). Conceptually, MUs should be panmictic units that can persist in spite of low immigration rates (e.g., $m < 10\%$) or genetic migration rates (e.g., $N_e m < 1$; Waples and Gaggiotti, 2006). The category of MUs is used to reflect present-day population boundaries, and contrasts with ESUs, which are lineages reflecting long-term or ancient isolation sufficient to create fixed genetic or morphological differences, and perhaps even reproductive isolation. In practice, MUs are delineated based on genetic discontinuity or local adaptation to unique environmental conditions (Dizon et al., 1992). Moritz (1994) defined MUs as having significant nuclear or mitochondrial allele frequency divergence, representing present-day genetic or demographic cohesion. Advances in genomics have allowed an unprecedented level of precision to delimit population boundaries, and manage adaptive evolution (Funk et al., 2012; Shafer et al., 2015; Peters et al., 2016; Hendricks et al., 2018; Waples and Lindley, 2018; Waters et al., 2018).

There are still many technological challenges involved in accurately delineating MU boundaries. For example, it has been acknowledged that different processes underlie demographic and genetic connectivity (Lowe and Allendorf, 2010). The number of migrants ($N_e m$) is solely responsible for genetic connectivity, while demographic connectivity is influenced by m relative to birth and death rates. Additionally, genetic connectivity may be disproportionately impacted by rare and unobservable dispersal events, or historical colonization followed by disequilibrium of drift and gene flow (i.e., Slatkin's Paradox; Slatkin, 1985, 1987; Mallet, 2001; Yu et al., 2010). Extrapolating the number of migrants from estimates of genetic structure using $F_{ST} \approx 1/(1+4N_e m)$ is therefore non-trivial, particularly under the strict assumptions of the island model (McCauley and Whitlock, 1999). Despite these caveats, dispersal ability is still highly correlated with genetic structure estimates such as F_{ST} (Bohonak et al., 1998; Bohonak, 1999), and population genomic datasets have proven very effective compared with small or single-locus datasets for delineating population structure. For example, population genomic approaches have been successfully used in delineating reproductive isolation amongst salmonids (Waples et al., 2020), tracing complex admixture in gray wolf populations (VonHoldt et al., 2016), and identifying invasive introgression in California tiger salamanders (Fitzpatrick et al., 2010).

The Yosemite toad (*Anaxyrus* [*Bufo*] *canorus*) is a federally threatened species of meadow-specializing amphibian that is in need of MU delineation (U.S. Fish Wildlife Service, 2014; Brown et al., 2015). The species is an endemic to the Sierra Nevada Mountains of California, where it underwent a 10-fold demographic decline at multiple localities during the 1970s−1990s, and remains in low abundance today (Sherman and Morton, 1993; Green and Sherman, 2001). Recent phylogeographic work has demonstrated that Pleistocene toad lineages diverged and then admixed to differing extents across an elevational gradient (Maier et al., 2019); however, present-day population boundaries have only been assessed using several markers (Shaffer et al., 2000), and with limited spatial sampling (Wang, 2012). In this study, we aimed to delineate population boundaries for the Yosemite toad (*Anaxyrus canorus*) that can be used for management within two national parks (Yosemite and Kings Canyon). We used thousands of targeted nuclear markers generated using double-digest restriction-site associated DNA sequencing (ddRADseq), and a sampling scheme that densely covers all known occupied locations, based on a recent 6-year survey (Lee et al.[1]).

Given the previously identified pattern of isolation-by-distance (IBD), and the statistical issues caused by stepping-stone migration likely taken by toads between meadows (Meirmans, 2012; Perez et al., 2018), we used a hypothesis-driven approach to identify which biologically plausible unit of population best explains gene pool boundaries. Evidence exists for at least three possible levels of population structure: (1) single meadows (mean radius in Yosemite National Park: 266 m), since on average toads travel short yearly distances (275–279 m), have small home ranges (radius: 92–166 m), and display high rates of philopatry (Sherman, 1980; Martin, 2008; Liang, 2010); (2) neighborhoods of nearby meadows, since previous survey and census efforts have found toad meadows to be spatially aggregated (Brown et al., 2012; Berlow et al., 2013; Matchett et al., 2015); and (3) phylogenetically distinct lineages (Maier, 2018; Maier et al., 2019; **Figures 1A,B**). We used several tests to determine which hierarchical level best matches the population definition of Waples and Gaggiotti (2006), i.e., panmictic units that are demographically or genetically independent from other populations.

Next, we examined potential asymmetrical migration among meadows. Occupancy and breeding frequency of Yosemite toads is known to partly depend on the quality of other meadows in a local neighborhood (Berlow et al., 2013), and a previous microsatellite study attributed 42.6% of genetic structure between meadows to topography and moist climate (Wang, 2012). We therefore hypothesized that neighborhoods of nearby meadows consist of "hubs" with high quality breeding area, minimal topographic complexity, and high site fidelity, resulting in a pattern of net genetic immigration from poor quality "satellite" meadows. We avoid the terminology of "source" and "sink" habitats, because populations may be demographically viable and independent, yet have a net influx of migrants that makes them sinks relative to nearby populations (i.e., "pseudo-sinks;" Watkinson and Sutherland, 1995; Thomas et al., 1996; Kawecki and Holt, 2002). Asymmetrical migration has been detected in many organisms, including fish (Pinhal et al., 2020), wind pollinated trees (Kling and Ackerly, 2021), sea stars (Iguchi

[1] Lee, S. L., Ostoja, S.M.,Maier, P. A.,Matchett, J. R.,McKenny, H. C., Brooks,M. L., et al. (in preparation). Distribution and spatio-temporal variation of Yosemite toad populations in Sierra Nevada national parks.

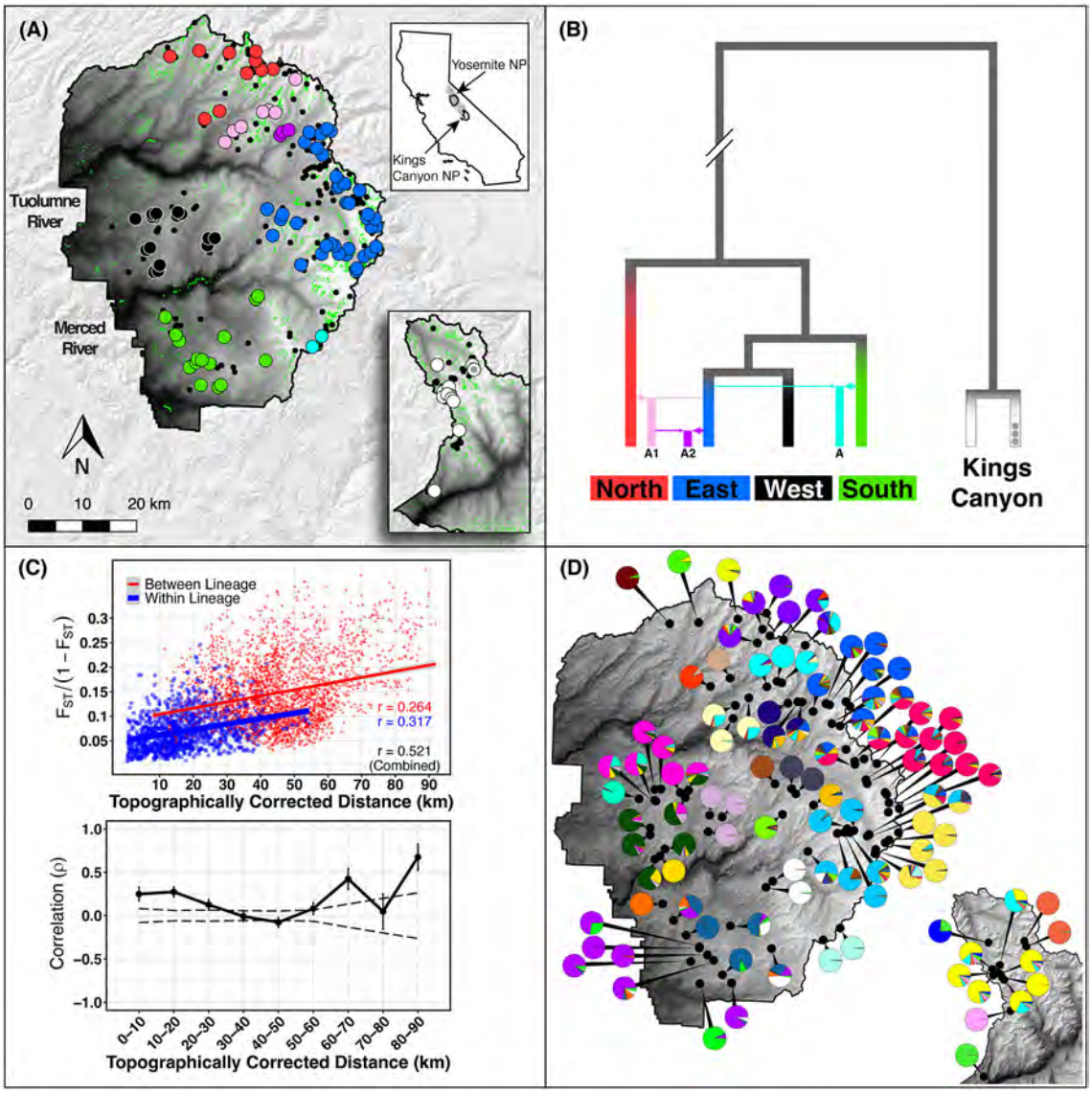

FIGURE 1 | Study area. **(A)** Study area in Yosemite NP (YOSE) and Kings Canyon NP (KICA), California. Top right inset shows the range of Yosemite toads in gray, and the boundaries of YOSE and KICA in black. Green polygons are all meadows within the parks. Small black circles indicate all known Yosemite toad meadows identified between 1915 and the present. Random noise is added to locations in order to protect the locations of this threatened species. Large circles indicate the meadows with data available in the present study, in YOSE ($n = 90$) and KICA ($n = 12$). Colors correspond to phylogenetic lineages, shown in **(B)**, reproduced from Maier et al. (2019). **(C)** Isolation by distance result based on $\overline{F}_{ST}/(1 - \overline{F}_{ST})$ and topographically corrected distances between meadows. Mantel correlogram shows Mantel correlation coefficients for successive 10 km distance categories. Solid lines are actual correlations, error bars represent bootstrapped confidence intervals, and stippled lines represent permuted confidence intervals (null distribution). **(D)** Meadow neighborhoods defined by $K = 28$ (YOSE) and $K = 6$ (KICA) gene pools from ADMIXTURE cross-validation. Each pie chart represents individual ancestry (i.e., q-values) from each meadow neighborhood, aggregated and displayed at the meadow scale.

et al., 2021), and amphibians (Cortázar-Chinarro et al., 2017; Hantzschmann et al., 2021). Such migrational dynamics may play an important role in population persistence, as it has been shown that demographic stability is influenced by the long-term persistence of hubs, and continued genetic input from satellite populations (Dias, 1996; Gaggiotti and Smouse, 1996).

Our results provide information that can be used to plan and develop effective mitigation for habitat and climate related disturbance. Identifying hub-satellite dynamics may pinpoint hub meadows that will be more robust to ongoing declines, and help inform specific conservation actions, such as relocations.

MATERIALS AND METHODS

Spatial Extent of Sample Collection

Sites (=meadows) within Yosemite National Park (YOSE) and Kings Canyon National Park (KICA) were chosen to maximize

representation across all known breeding locations from a recent 6-year survey effort (Lee et al., see text footnote 1, respectively), and overlap with previous studies (Shaffer et al., 2000; Wang, 2012; Berlow et al., 2013; Maier, 2018; Maier et al., 2019). YOSE includes ∼33% of known Yosemite toad meadows, whereas KICA includes the southern-most 4% of toad meadows. Tadpoles were sampled across all available egg clutches, ponds, meadows, and two separate years to maximize inclusion of available genetic diversity and reduce potential bias of oversampling close relatives relative to the total local population. A minimum of five samples was used per meadow if additional meadows were included within 1 km, otherwise 10 samples per meadow were used, unless insufficient samples were available. This scheme maximized intra- and inter-meadow sampling representation across the study area.

We collected tissue samples during the summers of 2011–2013 in YOSE and KICA, and delimited sampling meadows using a park-wide vegetation map with 0.5 ha resolution (Keeler-Wolf et al., 2012; Berlow et al., 2013). Tail tissue was collected from larval toads using a sterilized razor blade.

Molecular Methods, ddRAD Sequencing, and Bioinformatics

We used a ddRADseq haplotype dataset (previously described in Maier, 2018; Maier et al., 2019) for all analyses of genetic differentiation and structure. Details about the library preparation, sequencing, and bioinformatic parameters used to identify variable loci are described therein, and in the **Supplementary Materials**. Briefly, genomic DNA was extracted using a combination of 96-well glass fiber plate (Ivanova et al., 2006) and DNeasy blood and tissue spin column (Qiagen) protocols. A total of 535 individual Yosemite toad (*Anaxyrus canorus*) tadpoles sampled from 90 meadows across YOSE, and 109 individual tadpoles sampled from 12 meadows in KICA, were prepared using a double-digest RADseq protocol (Peterson et al., 2012; S1 Protocol), then sequenced using 2 × 100 bp sequencing on an Illumina HiSeq 2500.

Stringent quality thresholds were used in the Stacks v1.19 pipeline (Catchen et al., 2011, 2013) to avoid recovering markers from paralogous sequences. Filtering thresholds were: minimum 10× locus coverage, 75% complete loci, and minor allele frequency of 0.05. SNPs were called using the multinomial likelihood algorithm of Stacks, which calculates the likelihood of the observed genotypes given the per-base sequencing error rate. Two datasets were generated from a total of 3,261 loci (2,318 YOSE-polymorphic loci, and 1,914 KICA-polymorphic loci): (1) SNPs (one SNP kept per locus), and (2) full RAD-locus haplotypes (concatenated paired-end reads were used where possible, otherwise Read 1 was used). Some analyses required SNP data, whereas others could accommodate the full diversity present among multiple SNPs at a locus due to recombination. Therefore, we used a custom python script previously described in Maier et al. (2019) to output RAD haplotypes in addition to SNPs (fasta2genotype.py; https://github.com/paulmaier/fasta2genotype).

Addressing Potential Sampling Bias

Removing close relatives from population genetic datasets is often a standard practice (Peterman et al., 2016), although it may introduce biases if the original sampling was random. Small and/or inbred populations naturally contain many close relatives, and artificially distorting this composition can bias results toward a pattern of higher genetic diversity (Waples and Anderson, 2017). Removing data inevitably reduces precision and statistical power. Also, kinship estimators such as COLONY (Wang, 2004; Jones and Wang, 2010) and KING (Manichaikul et al., 2010) cannot accurately distinguish between close relatives and unrelated individuals from inbred populations, especially if the markers are low-density, unmapped SNPs (Chen, Personal Communication). To assess the impact of data removal, we used COLONY to estimate full-sib relationships, and calculated pairwise F_{ST} with PLINK (Purcell et al., 2007) pre- and post-removal of putative siblings. We used the SNP dataset with YOSE individuals only.

Delineating Population Boundaries

We initially checked all loci for deviations from Hardy-Weinberg expectations at the meadow scale, using the adegenet v2.1.5 package (Jombart, 2008) in R v4.1.2 (R Core Team, 2021). We then used the ade4 v1.7.18 package (Dray and Dufour, 2007) to test for isolation-by-distance (IBD) between meadows with a Mantel test. We used the F_{ST} dataset derived from YOSE individual as described above. F_{ST} values were linearized into $F_{ST}/(1 - F_{ST})$ as recommended by Rousset (1997). Since a pattern of IBD or hierarchical structure can confound population delineation algorithms that attempt to assign individuals into a set of clearly differentiated Hardy-Weinberg populations (Meirmans, 2012; Perez et al., 2018), we delineated current population boundaries in three distinct ways.

First, we asked which level of population structure is generally the smallest detectable level: meadows or neighborhoods of nearby meadows. We used a hierarchical STRUCTURE analysis (Vähä et al., 2007), which accounts for IBD by re-running each clustering analysis recursively until no further sub-structure is found. We ran STRUCTURE v2.3.4 (Pritchard et al., 2000) three times for 4.0×10^5 steps and 1.0×10^5 burn-in with K (number of ancestral populations) ranging from 1 to 10. The optimal K was chosen using the ΔK method of Evanno et al. (2005), and individual runs were combined using CLUMPP (Jakobsson and Rosenberg, 2007). This method can only test optimal K values greater than one, so the hypothesis that $K = 1$ was tested using a paired Wilcoxon test on log-likelihood values (Rosenberg et al., 2001; Emanuelli et al., 2013), to address inherent bias of ΔK toward finding $K = 2$ when no further substructure exists in reality (Janes et al., 2017). We used the haplotype dataset with YOSE individuals only for this analysis, so as to focus on the general pattern rather than finding every unit.

Second, we estimated which number of ancestral populations most reliably partitions the data. We used ADMIXTURE v1.3.0, which can efficiently apply the STRUCTURE algorithm for multi-locus SNP genotypes at large values of K (Alexander et al., 2009). The cross-validation procedure employed in ADMIXTURE determines which K has the most predictive accuracy, while

withholding data points (Alexander and Lange, 2011). We ran ADMIXTURE with 10-fold cross-validation on K ranging from one to the total number of meadows 1–90 (YOSE) or 1–12 (KICA). Whereas, the hierarchical STRUCTURE analysis was used to recursively find the smallest possible unit of population (to account for IBD), this analysis was used to find population units that best describe the entire dataset, and thus, likely an intermediate unit.

Finally, we took a hypothesis-driven approach to population delineation. Given the hierarchical nature of population structure previously described (Shaffer et al., 2000; Wang, 2012), there may be no single "correct" level. Consequently, we hypothesized that one level has a disproportionately large effect on partitioning toads into genetically/demographically independent gene pools. We used a hierarchical analysis of molecular variance (AMOVA) on haplotype data to quantify the relative contribution of meadows, meadow neighborhoods, and lineages to population differentiation. Four distinct phylogenetic lineages with median coalescent ages spanning 296–724 kya, as well as three "fused" lineages formed by inter-lineage hybridization 254–473 kya, were spawned by glacial pulses during the Pleistocene (**Figure 1B**; Maier et al., 2019). "Meadow neighborhoods" were defined as a group of nearby meadows with >50% assignment to the genetic clusters derived by ADMIXTURE. We used the poppr v2.6.1 function "poppr.amova" with 100 permutations to test for significance. In order to correctly partition the variance components of interest, we included all known levels: individuals, meadows, meadow neighborhoods, lineages, and parks. We compared the ϕ-statistics to values expected under Wright's island model (Wright, 1931), i.e., $F_{ST} \approx 1/(1 + 4N_e m)$, using values of N_e calculated by the single-sample linkage disequilibrium method of NeEstimator v2.01 (Do et al., 2014). We assessed population independence with the 10% migration rate (m) demographic guideline (Hastings, 1993) and one migrant per generation (OMPG; i.e., $N_e m = 1$) genetic guideline (Wright, 1951; Mills and Allendorf, 1996).

Environmental Drivers of Asymmetrical Migration

We hypothesized that meadow neighborhoods (see "Delineating Population Boundaries") included "hub" meadows that receive and retain the majority of migrants, and lower quality "satellite" meadows with net emigration. We tested this hypothesis by estimating directional migration rates between meadows using the method of Sundqvist et al. (2016). This method calculates geometric means of allele frequencies for a theoretical pool of migrants between each pair of meadows using alleles present in both meadows. Then asymmetrical G_{ST} values (Nei and Chesser, 1983) are calculated by comparing each meadow to the migrant pool. Finally, migration rates are estimated from G_{ST} values: $N_e m \approx (\left(\frac{1}{G_{ST}}\right) - 1)/4$ (Wright, 1931). We extracted pairwise differences between emigration and immigration to yield a unitless measure of net relative migration δM. Relative values are less sensitive to assumptions of the island model, such as drift-migration equilibrium, because they only infer differential migration without explicitly modeling any parameter. For any comparison between two meadows, the meadow with $\delta M < 0$ has net immigration, and meadows with $\delta M > 0$ have net emigration. For each meadow neighborhood we examined, δM estimates were mapped onto igraph (Csárdi and Nepusz, 2006) objects to display the extent of asymmetrical migration in each neighborhood of meadows.

From previous research, Yosemite toads are most likely to occupy meadows based on a network of environmental attributes at nearby meadows (Berlow et al., 2013). Topographic relief also is known to have a large impact on meadow-to-meadow migration (Wang, 2012). Based on those two likely environmental drivers, we evaluated 10 meadow-scale environmental attributes as potential correlates of hubs and satellites (**Table 1**). We used ArcGIS 10 to extract four topographic variables derived from the Shuttle Radar Topography Mission (SRTM; Rabus et al., 2003), and five meadow network attributes derived from a LiDAR-based vegetation map from YOSE (Keeler-Wolf et al., 2012). The last variable was a network-boosted probability of toad breeding from previous work (Berlow et al., 2013). Any variables that did not approximate normality were transformed using either logarithmic, exponential, or root transformations. We identified environmental correlates of net migration (δM) individually, using Mantel correlations as implemented by the ncf v1.2.9 package (Bjørnstad, 2019), with 1,000 permutations for significance. We then identified correlations collectively for all variables using a multiple regression on distance matrices (MRDM; Legendre et al., 1994; Lichstein, 2007), using the method of Wang (2013), and 1,000 permutations.

We also gave "hubs" and "satellites" formal definitions based on extreme values of net migration. Hubs were defined as meadows with average δM that is negative, and at least one standard deviation (SD) less than zero. Satellites were defined as meadows with average δM that is positive, and at least one SD greater than zero. We performed a principal components analysis (PCA) and a linear discriminant analysis (LDA) using the MASS v7.3.54 package (Venables and Ripley, 2002) to identify environmental predictors of the two types. In order to determine the most important discriminatory variables, we performed stepwise variable selection to optimize the accuracy of predictors using the stepclass function of the klaR v0.6.15 package (Weihs et al., 2005). The process uses 10-fold cross-validated accuracy of the LDA to add or remove variables until improvement is <1%.

RESULTS

Addressing Potential Sampling Bias

We found high levels of inbreeding in the final dataset. Using 2,318 un-linked SNP markers variable across YOSE, we estimated that in any given meadow an average of 551 are polymorphic, and an individual is heterozygous for an average of 233 due to meadow-level inbreeding, with average $F_{IS} = 0.221$. COLONY estimated 173 first-degree relative pairs. Matrices of pairwise F_{ST} calculated with and without 173 putative siblings were highly correlated ($\rho = 0.948$), and therefore, should have little impact on landscape-level results. Based on this result and the fact that close relatives can be overestimated in systems with high inbreeding,

TABLE 1 | Hub-satellite predictive variables.

Category	Abbreviation	Source	Definition	GIS summary
Meadow network	BP	(Berlow et al., 2013)	Network-boosted breeding probability	Value
Meadow network	A	YNP LiDAR	Area of meadow	Value
Meadow network	BWA	YNP LiDAR	Breeding wet area	Value in 1 km radius
Meadow network	MA	YNP LiDAR	Area of meadows	Value in 1 km radius
Meadow network	P	YNP LiDAR	Length of meadow perimeter	Value
Meadow network	WAC	YNP LiDAR	Wet area of closest meadow	Value
Topography	ESD	SRTM	Elevation	SD in 500 m radius
Topography	R	SRTM	Roughness index	Mean in 500 m radius
Topography	S	SRTM	Slope	Mean in 500 m radius
Topography	SPI	SRTM	Slope position index	Mean in 500 m radius

we elected to keep all individuals in the dataset to retain a robust sample size for subsequent analyses.

Delineating Population Boundaries

Our suite of analyses supported meadows as the smallest distinguishable genetic and demographic population unit, and that populations were further structured by IBD among meadows. We found significant IBD up to 30 km distances (**Figure 1C**), suggesting that population structure might be heavily influenced by stepping-stone migration at multiple spatial scales. The hierarchical structure analysis revealed that 63 out of 90 (70.0%) individual meadows in YOSE are the smallest detectable population unit (**Figure 2**). The remaining units consisted of two meadows ($n = 7$), three meadows ($n = 1$), or 10 meadows ($n = 1$; Tioga). Seven phylogenetic lineages—four pure, three of admixed origin (Maier et al., 2019)—were distinct at high levels in the hierarchy (underlined in **Figure 2**). The ADMIXTURE analysis delineated units of genetic cohesion intermediate between meadow and lineage (**Figure 1D**). The lowest ADMIXTURE cross-validation error for YOSE was found at K=28, and for KICA was K=6, although subsequent K values elicited only gradual increases in cross-validation error (**Supplementary Figures S1, S2**). Most meadows (84.3%) were contained in neighborhoods of two or more meadows, with a mean size of 3.0 meadows, and a maximum of 12 meadows (Tioga). Out of 34 total meadow neighborhoods across both parks, 16 (47.1%) contained only one meadow. In most cases, these singleton "neighborhoods" were in terrain separated by canyons (e.g., Rancheria, Thompson, Wells, Tilden, and Twin Lakes in the Y-North lineage). Names and summary statistics for each neighborhood are in **Supplementary Table S1**.

The hierarchical AMOVA found a large proportion of total variance between parks (30.46%; $\phi_{PT} = 0.305$) as expected (**Table 2**). Meadows within neighborhoods showed the next highest variance (23.54%) and had the highest ϕ-statistic ($\phi_{MN} = 0.406$), supporting the idea that much more of the genetic variation is partitioned among meadows than meadow neighborhoods (3.71%; $\phi_{NL} = 0.06$). Mean pairwise ϕ_{MN} for meadows within each neighborhood had comparable levels (mean: 0.409; sd: 0.08; **Supplementary Table S1**). Further, we estimated meadows to be demographically independent ($m < 10\%$) based on average observed meadow N_e of 29.13 (**Supplementary Table S1**), and $F_{ST} \geq 0.079$ ($\phi_{MN} = 0.406$). In contrast, we estimated neighborhoods to have average N_e of 23.33 and require $F_{ST} \geq 0.097$ for demographic independence, a value greater than the observed statistic $\phi_{NL} = 0.06$. The estimated threshold for genetic independence among either unit regardless of population size ($N_e m \leq 1$) is $F_{ST} \geq 0.2$, which is consistent with meadows but not meadow neighborhoods being genetically independent. Patterns of conformity to Hardy Weinberg expectations at the meadow and meadow neighborhood scales further supported meadow distinctiveness, with meadows deviating at 2.48% of genotypes, compared to 4.86% for meadow neighborhoods, a nearly two-fold difference (**Supplementary Figure S3**).

Environmental Drivers of Asymmetrical Migration

Out of 34 total meadow neighborhoods across both parks, nine contained a moderate sample size ($n \geq 5$) of meadows. We found that asymmetrical migration was strong in six (67%) based on the presence of at least one hub or satellite meadow, i.e., with migration greater than one standard deviation from symmetrical (**Supplementary Table S2**; **Figure 3**). Hub meadows showed high relative H_E (**Supplementary Table S1**) and much stronger genetic immigration than emigration. Out of these nine neighborhoods initially examined, three had a single hub meadow, and another three had two to three hubs. Distinct satellite meadows were only identified in three (33%) of these neighborhoods. A detailed example is depicted in **Supplementary Figure S4**.

We found environmental patterns characteristic of all 18 hubs and satellites more broadly (**Figure 4**), regardless of meadow count (i.e., $n \geq 2$). Generally, we found that hub meadows are significantly larger, and less topographically complex, than satellite meadows (**Figures 4A–D**). The first two principal components of the PCA accounted for 76.3% of the variance, and this variance was orthogonally split into the two categories of variables: meadow network attributes, and topography (**Figure 4E**). However, topographic variables had a much smaller boost to discriminatory power compared with meadow network variables. The LDA function based on all 10

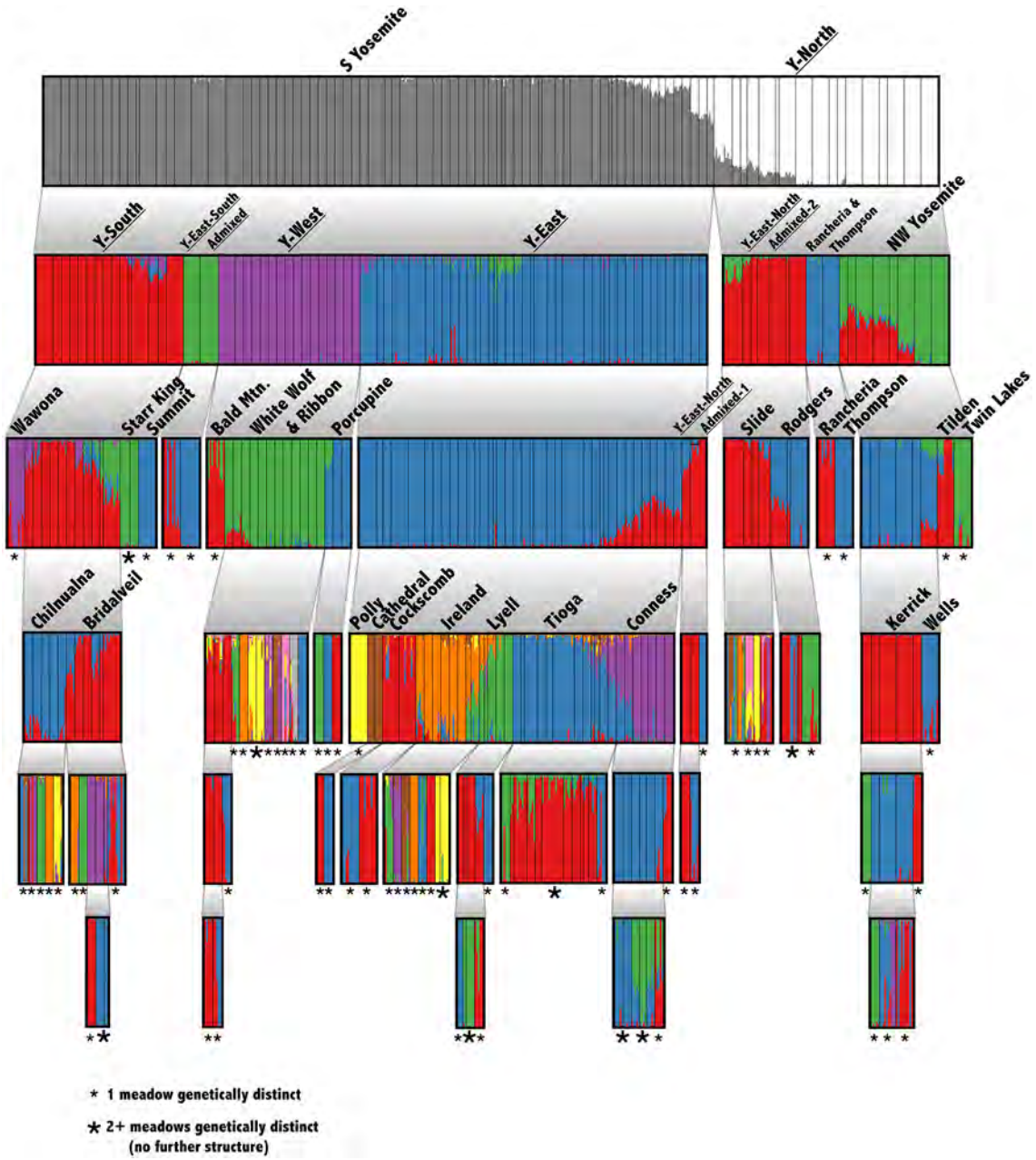

FIGURE 2 | Hierarchical genetic structure in Yosemite NP. Barplots of recursive STRUCTURE analyses down to the smallest detectable unit. Thin, black, vertical bars indicate meadow boundaries. Each analysis considered a range of *K* from 1 to 10, and the optimal K was chosen following Evanno et al. (2005). The hypothesis that $K = 1$ was tested using a paired Wilcoxon test. Each cluster was rerun until reaching the meadow level or finding no further structure. The smallest detectable unit is labeled: single meadow (small *) or multiple meadows (large *). Phylogenetic lineages from Maier et al. (2019) are underlined.

variables had a 100.0% predictive accuracy rate, and an 83.5% cross-validated accuracy rate (**Figure 4F**). The stepwise variable selection for LDA identified four variables that significantly improved discrimination between hubs and satellites: meadow area, breeding wet area, wet area of the closest meadow, and SD of elevation (within 500 m of the sampled location).

Individual *t*-tests confirmed that hubs are significantly larger, and less topographically complex, than satellite meadows. Compared with satellites, hub meadows (defined as having δM values ≤ 1 SD below zero) have significantly larger mean areas ($t = 3.10$, $df = 10.1$, $p = 0.006$), perimeters ($t = 3.56$, $df = 11.3$, $p = 0.002$), and breeding wet area within 1 km ($t = 2.35$, $df = 13.1$, $p = 0.017$). Satellites have (within 500 m of the sampled location): higher slope ($t = -2.51$, $df = 8.06$, $p = 0.081$), elevation SD ($t = -2.1$, $df = 7.65$, $p = 0.035$), and roughness index ($t = -3.03$, $df = 10.7$, $p = 0.006$). Hubs also had lower mean slope within

TABLE 2 | Analysis of Molecular Variance (AMOVA) results based on five hierarchical levels: park, lineage, meadow neighborhoods (defined by ADMIXTURE cross-validation), meadows, and individuals. Significance is based on 100 random permutations with one-tailed test.

Variance component	[a]df	[b]SS	[c]MS	[d]σ	[e]% Total	[f]ϕ-Statistic	[g]*P*-value
Between parks (P)	1	50745.20	50745.20	116.94	30.46	$\phi_{PT} = 0.305$	**
Between lineages (L) within parks (P)	7	41768.02	5966.86	30.16	7.86	$\phi_{LP} = 0.113$	**
Between neighborhoods (N) within lineages (L)	25	53314.90	2132.60	14.25	3.71	$\phi_{NL} = 0.060$	**
Between meadows (M) within neighborhoods (N)	68	78941.58	1160.91	90.35	23.54	$\phi_{MN} = 0.406$	**
Between individuals (I) within meadows (M)	542	95376.63	175.97	43.78	11.41	$\phi_{IM} = 0.331$	**
Within individuals (I)	644	56931.50	88.40	88.40	23.03	$\phi_{IT} = 0.770$	**
Total	1287	377077.82	292.99	383.89	100.00		

[a]*df = degrees of freedom.*
[b]*SS = sums of squares.*
[c]*MS = mean squares.*
[d]σ *= variance.*
[e]*% = proportion of total of variance.*
[f]ϕ*-statistic = ratio of variances.*
[g]*p-value = permuted probability of the observed σ by chance; **p < 0.01.*

500 m of the sampled location ($t = -2.15$, $df = 9.11$, $p = 0.03$). Interestingly, although hubs had larger areas and larger nearby wet areas, their nearest neighboring meadow had significantly less wet area ($t = -2.37$, $df = 6.01$, $p = 0.028$). All tests remained significant after correcting for multiple comparisons with the FDR method (Benjamini and Hochberg, 1995) with a maximum p-value of 0.035.

We also found significant relationships between pairwise differences in meadow environment (δ *environment*) and net asymmetrical migration (δM) using an MRDM (**Supplementary Table S3**; **Supplementary Figure S5**). For pairwise regression analyses, we considered all meadows in a neighborhood, regardless of whether they were extreme hubs or satellites. The general result can be summarized as follows: for any two meadows in a neighborhood, the meadow with larger area and less topographic ruggedness tends to have net immigration (influx of gene copies). The five significant variables in the model were: meadow area, breeding wet area, wet area of the closest meadow, total area of meadows within 1 km, and percent slope (within 500 m of the sampled location). The MRDM results supported the above pattern of meadow area strongly influencing hub-satellite dynamics, and meadow ruggedness having a small to moderate influence (**Figures 4A–D**). We found that meadow area explained the largest percentage of the variance (30.0%), followed by wet area of the closest meadow (10.3%), while the remaining variables collectively only accounted for 5.1% of the variance [$R^2_{adj} = 0.43$, $F_{(10,399)} = 31.79$, $p < 0.001$].

We performed a *post-hoc* test of Mantel correlations (with 1,000 permutations) for each variable and found each to be significant after correcting for multiple comparisons with the FDR method. Interestingly, this included a small but significant positive correlation between δM and δ(slope position index) meaning that meadows closer to hilltops have net genetic influx ($\rho = 0.11$, $p = 0.013$). We also found a small but significant positive correlation between δM and δ (breeding probability), indicating that meadows with higher probability of breeding have net genetic influx ($\rho = 0.14$, $p = 0.007$).

DISCUSSION

Are Meadows a Useful Unit for Population Management?

We found that individual toad meadows are genetically distinguishable in 70% of cases, and that almost half (47.1%; $n = 16$) of meadow neighborhoods contain one meadow (**Figures 1D**, **2**). Moreover, we found that meadows are the unit contributing most to population subdivision ($\phi_{MN} = 0.406$) compared with meadow neighborhoods ($\phi_{NL} = 0.06$) and lineages ($\phi_{LP} = 0.113$) (**Table 2**). Our results are broadly consistent with previous findings of significant among-"pond" (=meadow) variation (Shaffer et al., 2000); however, they are informed by substantially expanded sample size ($n = 102$; $n = 28$), marker set ($n = 3{,}261$; $n = 1$), and number of hierarchical levels ($n = 5$; $n = 3$). Our estimates of average meadow migration rate ($m \ll 10\%$) and number of migrants ($N_e m \ll 1$) are based on island model assumptions; however, our result (meadows are the most distinct unit) is robust to those assumptions.

Meadow distinctness makes sense given that toad-occupied meadows in YOSE have a mean radius of 266 m (Keeler-Wolf et al., 2012), and are typically surrounded by more xeric vegetation. Yosemite toads are observed to have small average home range size (radius: 92–166 m) and high rates of philopatry in short-term mark-recapture studies (Sherman, 1980; Martin, 2008; Liang, 2010). A sample of five other Nearctic toads (formerly "*Bufo*") have comparable average home ranges, with radius between 15 and 390 m (Denton and Beebee, 1993; Kusano et al., 1995; Muths, 2003; Forester et al., 2006). Yosemite toads may occasionally travel long distances (maximum 1,261 m; Martin, 2008; Liang, 2010), but this may be infrequent enough for most meadows to remain independent population units.

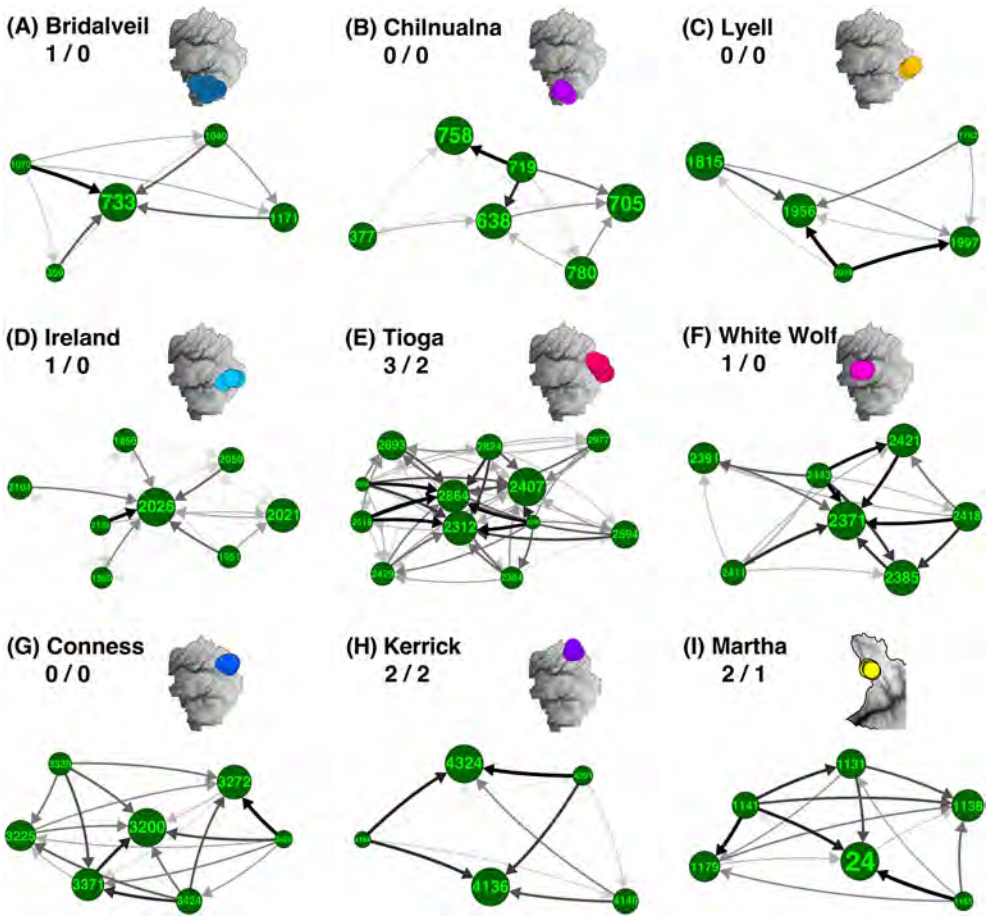

FIGURE 3 | Asymmetrical migration in meadow neighborhoods. Most of the meadow neighborhoods with five or more meadows are groups of closely related meadows with one or a few highly admixed "hubs" surrounded by more genetically distinct "satellites." For each neighborhood, net asymmetry in migration rates (difference between emigration and immigration) is summarized by direction and shade of arrow. Meadow IDs and associated neighborhood names are labeled for all nine neighborhoods in YOSE and KICA that contain five or more meadows. Meadow node sizes are weighted by expected heterozygosity (H_E; see **Supplementary Table S1**). Inset maps denote location of each meadow neighborhood **(A–I)** and have identical colors to **Figure 1D**. Numbers following neighborhood names indicate number of identified hubs/satellites (i.e., δM more than one standard deviation from zero).

Although most meadows are genetically distinct, 84.3% of meadows are members of multi-meadow neighborhoods, and inter-meadow genetic rescue may be important over longer time scales. Also, several exceptions to this pattern exist: e.g., Tioga, Conness, Ireland, and White Wolf meadow neighborhoods appear undifferentiated, due to high gene flow or recent colonization (**Figure 2**). Two out of four of these undifferentiated neighborhoods (Tioga and White Wolf) are bisected by a major highway (CA-120), which has been identified as a barrier to connectivity (Maier, 2018). Future work should try to precisely estimate migration relative to demographic stability of these meadows, for example by using parentage analysis, genetic assignment, and simulations (Peery et al., 2008, 2010).

Meadow Attributes Impact Network Connectivity

Despite the distinctness of most meadows, we found low-level migration amongst meadows in neighborhoods. Strong asymmetrical migration was found in over half (53%) of the neighborhoods containing two or more meadows. Our asymmetrical migration analysis found that larger and topographically flatter meadows predictably (with 83.5% cross-validated accuracy) act as regional genetic hubs (**Figures 3**, **4**), and often these meadows are centrally positioned in the spatial arrangement of these meadow neighborhoods (e.g., **Supplementary Figure S4**). This means that one or several meadows within each neighborhood tend to receive a disproportionately large amount of genetic input and send a disproportionately small amount of genetic output. Hubs tended to be not only bigger and flatter, but have more wet area nearby, and be positioned closer to hilltops than satellites. Aside from large meadow area, the second-best discriminator of hubs was that they neighbored a meadow with minimal wet area. This may underscore the importance of juxtaposing breeding habitat with more xeric upland meadow habitat, which plays a vital role in Yosemite toad foraging and hibernation (Sherman, 1980;

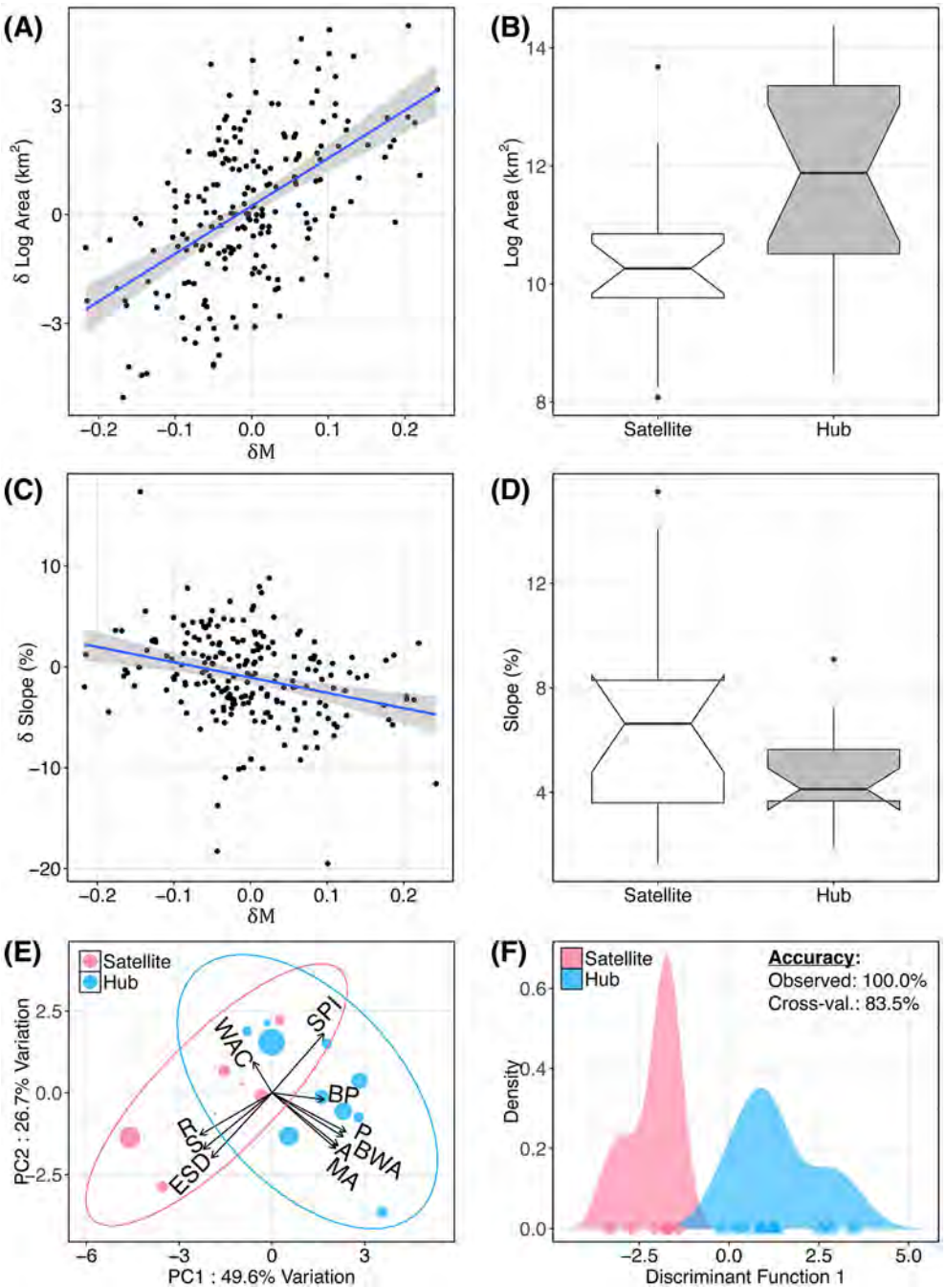

FIGURE 4 | Attributes of hub and satellite meadows. Hub (exceptional immigration rate) and satellite (exceptional emigration rate) meadows from **Figure 3** are related to several environmental variables. Relationship between net relative migration (δ*M*) and relative difference in pairwise meadow area **(A)** and slope **(C)** are shown. In **(B,D)**, these pairwise differences are aggregated by meadow to show mean meadow area and slope for hubs and satellites (i.e., meadows having δ*M* more than one standard deviation from zero). **(E)** Principal components analysis (PCA) of meadow environment. Variables are described in **Table 1**. **(F)** Linear discriminant analysis (LDA) showing the predictive accuracy of these 10 variables to discriminate between hubs and satellites.

Morton, 1981; Martin, 2008). It is important to note that due to collinearity, it is also possible that big, wet meadows necessarily exist adjacent to relatively dry neighbor meadows, but without a larger dataset these two variables are difficult to disentangle.

Contrasting environmental correlates have previously been found for persistent vs. intermittent meadows; proximity to fire perimeters and timber harvest were predictors of intermittently occupied meadows in one study (Liang and Stohlgren, 2011).

However, the present study offered the first insight into genetic hub-satellite structure, with 10 m resolution of meadow network attributes that predict hubs and satellites. High hub genetic diversity appears to reflect genetic admixture; multiple satellite meadows surround them and promote the mixing of genetically diverse toads in a central area. The ultimate cause for this is unclear: perhaps temporally fluctuating habitat quality or low carrying capacity in satellite meadows periodically sends migrants seeking refuge in hub meadows (Holt et al., 2004). Our result is consistent with the discovery that toad breeding detection in YOSE has increased at higher quality meadows, between two survey efforts spaced one decade apart (Lee et al., see text footnote 1, respectively). If climate change or other stressors are degrading marginal habitat in satellites, then toads may be consolidating at hubs in response.

By the same token, large hub meadows may act as genetic (pseudo-)sinks because breeding toads show higher rates of philopatry within superior breeding conditions. Populations below carrying capacity may be demographically independent if they do not require immigration to persist (Watkinson and Sutherland, 1995). For example, the pseudo-sink populations of the butterfly *Euphydryas editha* survived a severe frost in nearby Sequoia National Forest, after which they thrived and became sources (Thomas et al., 1996; Boughton, 1999). Thus, net immigration in hubs could reflect recent environmental disturbance. We also cannot rule out the possibility that hubs are actually source populations, but with excess private alleles. The premise of the private allele method used in this study is that populations with more unique alleles are more isolated. However, hubs may simply be larger and more stable populations that have accumulated more diversity, and the homogeneity of satellite populations may be due to recent founder effects (Sundqvist et al., 2016). This alternative is not easily disentangled using a single genetic dataset and is better tested by tracking studies. Regardless, hub admixture is a common pattern in our study. Since admixture is pervasive on a larger scale (i.e., between lineages; Maier, 2018; Maier et al., 2019; **Figures 1A,B**), it is unsurprising to find admixture plays an important role at a smaller scale. This result comes with the caveat that many neighborhoods have few meadows ($\overline{n} = 3.0$). Therefore, there are also many examples of isolated meadows and meadow pairs existing without a large, admixed meadow nearby.

Conclusions and Conservation Implications

Meadows are the most genetically distinct unit of population for Yosemite toads. However, our fine-scale sampling and environmental analysis showed that this is not the entire story. Most (84.3%) of toad meadows exhibit low levels of gene flow with neighborhood meadows, in many cases displaying hub-satellite structure. Genetic distinctness is consistent with the MU definition; however, recent demographic declines (Sherman and Morton, 1993; Green and Sherman, 2001; N_e estimates in **Supplementary Table S1**) suggest that present and future population viability of Yosemite toads may depend on connectivity between meadows.

Hub meadows may be robust to climate change and fluctuations, given their pattern of higher immigration and genetic diversity. Therefore, hub meadows may be important refugia for nearby meadows with environmental instability, although this assumes hub meadows are not also in danger of demographic decline. Climate change (Brown et al., 2015; Maier, 2018), disease (Lindauer, 2018; Lindauer and Voyles, 2019), or synergistic effects between the two (Lindauer et al., 2020) may continue to reduce carrying capacity and growth rate, while reducing gene flow from satellites as well as foreign meadow neighborhoods, which could eventually force all meadows toward an extinction vortex.

Mitigation efforts in the short term could take advantage of the higher genetic diversity of hubs for translocation efforts or captive breeding programs. Although hubs are a potentially useful resource for medium to large meadow neighborhoods, many meadows exist in isolation. Out of 102 meadows in our study, 16 were singleton "neighborhoods" and a further eight were neighborhoods of only two. Isolated meadows could also be prioritized for protection efforts due to their potentially unique genotypes, which may play a role in future adaptation to climate change and/or disease.

Future research could investigate the population dynamics of hub and satellite meadows over multiple generations, to determine parameters such as growth rate and net migration rate. We found that hubs are identifiable 100% of the time in our dataset, and with 83.5% cross-validated accuracy, based primarily on meadow size, proximity to upland habitat, and gentle topography, to a lesser extent. Those variables may be useful proxies for genetic hubs in Yosemite toad meadow complexes across the species distribution.

DATA AVAILABILITY STATEMENT

No original genetic data were produced in this study. Demultiplexed fastq files of double-digest RADseq data are available at NCBI GenBank SRA under BioProject PRJNA558546 (https://www.ncbi.nlm.nih.gov/sra/PRJNA558546). Scripts and genotype data used to perform analyses in this study are deposited at Dryad (https://doi.org/10.5061/dryad.xsj3tx99h). The U.S. Geological Survey metadata record associated with this study can be found at the USGS Science Data Catalog (https://doi.org/10.5066/P9KABYPU).

ETHICS STATEMENT

This animal study was reviewed and approved by San Diego State University Animal Care and use protocol #13-03-001B.

AUTHOR CONTRIBUTIONS

PM, SO, AA, AV, and AB designed the study. PM and SO collected tissue samples. PM performed the laboratory work and conducted the analyses, with guidance from AB, AV, and AA. PM wrote the manuscript, with input from AV, AB, SO, and AA. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcosc.2022.851676/full#supplementary-material

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Population Declines of Yosemite Toads in the Eastern Sierra Nevada of California

CYNTHIA KAGARISE SHERMAN[1] AND MARTIN L. MORTON[2]

[1]*42 Sparrow Crest, Ithaca, New York 14850, USA, and*
[2]*Department of Biology, Occidental College, Los Angeles, California 90041, USA*

ABSTRACT.—**This paper documents changes in the size of a breeding population of Yosemite toads, *Bufo canorus*, over 20 years at Tioga Pass, California. Surveys of *B. canorus* numbers in breeding aggregations were made yearly from 1971 to 1982, and less systematic observations were made from 1983 to 1991. Six other populations in the eastern Sierra Nevada were surveyed occasionally from 1973 to 1990. The total number of marked males entering the largest breeding pools at Tioga Pass declined nine-fold from 1974 to 1982. The mean number of toads found in daily searches during breeding also dropped over the 20 year study. Similar declines occurred at smaller breeding sites throughout Tioga Pass Meadow and at the six other populations. In 1990 we found evidence for continued reproduction by *B. canorus* at all but one location (Sylvester Meadow), although reproduction was minimal at Tioga Pass. No single source of mortality was responsible for all the declines. We interpret the decline in our study populations as caused primarily by drought, disease, and predation. Spring snow depths in 1976, 1977 and 1987–1991 were below the 62 year average, resulting in low tadpole survival. The death of adults from disease at Tioga Pass, and from predation at another site (Mildred Lake) also contributed to the declines. Although habitat destruction and localized human activities were not major factors, some natural variables responsible for the declines may have had anthropogenic components.**

In February 1990, the National Research Council's Board on Biology sponsored a workshop to examine the evidence for a recent widespread decline in amphibian populations (Barinaga, 1990; Blaustein and Wake, 1990; Wake and Morowitz, 1990). Although the participants concluded that many populations are declining, they found little evidence for a single global cause. Possible reasons for the declines included habitat destruction, land use changes, introduction of exotic species, pesticide pollution, pathogens, acid rain, and predation by humans. These local factors may have acted synergistically with global effects, such as increased ultraviolet radiation exposure or changes in climate, to cause population declines (Blaustein and Wake, 1990). The workshop concluded that long-term studies are needed to separate natural population fluctuations from declines caused by human activities. They recommended that amphibian biologists reexamine their data from work done in the 1970s and 1980s (e.g., Bradford, 1991; Pechmann et al., 1991), and return to former study sites to evaluate current population sizes (e.g., Schuierer and Anderson, 1990).

Recent publications support several of the workshop's findings. First, mass mortality of adults and/or larvae, resulting in population size fluctuations, has been documented in various amphibians (Bradford, 1983, 1991; Pechmann et al., 1991; Olson, *in press*). However, yearly fluctuations did not always correlate with an overall decline in numbers, reemphasizing the need for long-term studies to detect directional changes (Pechmann et al., 1991; Wissinger and Whiteman, 1992). Second, many of the declines apparently had multiple causes, which sometimes varied between populations of a species (Beebee, 1977; Beebee et al., 1990; Carey, *in press*; Olson, *in press*). Both natural and man-made factors were implicated. In some cases the declines were localized (Corn and Fogleman, 1984; Harte and Hoffman, 1989; Bradford, 1991; Wissinger and Whiteman, 1992) and in others they were widespread (Bradford, 1983). Several investigators suggested that apparently natural causes of decline may have had underlying anthropogenic components (Carey, *in press*; Olson, *in press*). For example, Carey (*in press*) hypothesized that acid precipitation or some other environmental factor had stressed populations of *B. boreas* in Colorado, resulting in immunosuppression and an outbreak of disease.

Anecdotal information suggests that the Yosemite toad, *Bufo canorus*, is one of the species which has declined (Blaustein and Wake, 1990). We studied the behavior and physiology of *B. canorus* intensively from 1971 to 1982 (Morton and Sokolski, 1978; Kagarise Sherman, 1980; Morton, 1981, 1982). Incidental to our main studies, we gathered information about the size of breeding populations at Tioga Pass, California. Six other populations within 53 km of our main study area were also surveyed during this period. In light of the current interest in am-

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phibian numbers, and because our research spanned the period during which other populations declined, we reexamined our demographic data and resurveyed our study populations in 1990. This paper presents the trends in population abundance over a 20 yr period and identifies naturally-occurring factors contributing to losses in several populations. Our results provide a database for future studies of *B. canorus*, and comparative data for the analysis of amphibian population trends.

Yosemite toads inhabit an area of 240 km × 60 km in the central Sierra Nevada at elevations of 1950–3444 m (Karlstrom, 1962). They are sexually dichromatic (Karlstrom, 1962), diurnal (Mullally, 1953; Mullally and Cunningham, 1956; Karlstrom, 1962), and active above ground for only about four months each year (Karlstrom, 1962; Morton, 1981). Kagarise Sherman (1980) found that at Tioga Pass Meadow, adults emerge from hibernation in May or June and breed for 2–4 wk in May–July, depending on the depth of spring snowpack and time of its melt; most females spawn during a 2–3 d peak each year. Oviposition sites are the shallow edges (≤5 cm deep) of pools or slow moving runoff streams (Mullally, 1953; Karlstrom, 1962; Kagarise Sherman, 1980). Tadpoles transform in 50–63 d; some breeding sites are ephemeral and dry up before tadpoles metamorphose (Karlstrom, 1962; Cunningham, 1963; Kagarise Sherman, 1980).

Methods

Study Areas and Techniques.—Our study area was Tioga Pass Meadow (TPM), a 0.5 × 1.0 km subalpine meadow near Tioga Pass, Mono County, California (119°E, 38°N, elevation 3030 m, Fig. 1). We made most of our observations within the main study pools, a 60 × 75 m area near Tioga Lake (#1 in Fig. 1, elevation 2950 m), where pairs spawned in four small tarns and several grassy depressions filled by melting snow. Breeding aggregations also formed at nine other sites in TPM.

Morton and his assistants studied *B. canorus* from June to August 1971–1976. Kagarise Sherman and 1–4 assistants gathered data during: 8 May–30 August 1976, 21 April–7 August 1977, 12 May–17 August 1978, 8 June–27 June 1979, 13 May–18 July 1981, and 12 June–29 July 1982. In 1983–1991 Morton was at TPM nearly daily from May or June through August, and he made unsystematic observations of *B. canorus*. In 1990 we resurveyed all breeding sites in TPM on 8 and 12 June, when, based on the snowmelt, toads should have been breeding. Morton searched for toads or signs of breeding again on 10 and 20 July 1990.

Beginning in 1973–1977, six other *B. canorus*

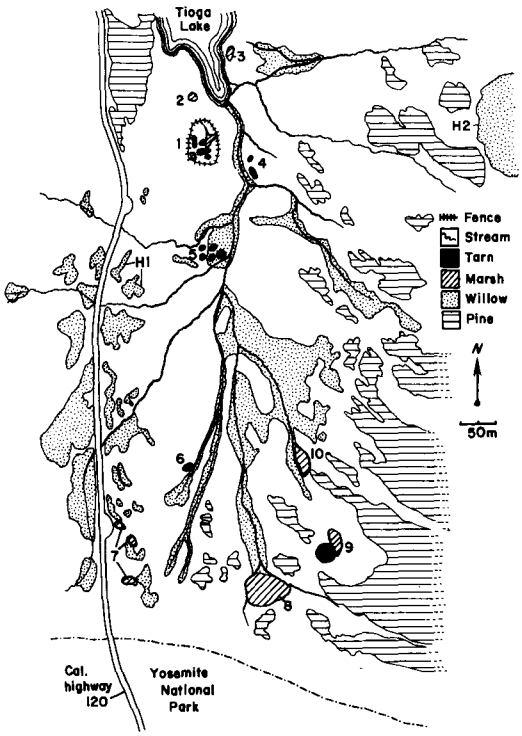

FIG. 1. Tioga Pass Meadow, California, showing location of main study pools (#1), small breeding sites (#2–10), and one hibernation site (H1). The edge of ca. 100 × 300 m willow thicket (H2) used by nonbreeding females and immatures for hibernation and summer habitat is indicated. Tarns were small, steep-banked pools; details of the meadow's vegetation in Karlstrom (1962).

populations located between 1.6 km and 53.1 km from TPM (Fig. 2) were canvassed around breeding areas from June to early September. From 9 to 11 June 1990 we rechecked these six populations; Morton resurveyed three of the populations (Saddlebag Lake NW, Frog Lakes, and Hoover Lake) on 7–8 July 1990.

We marked Yosemite toads using a modified version of Martof's (1953) system. Each toad was given an identifying number by clipping off no more than one toe per forefoot and two toes per hindfoot; after 1976 we did not remove males' thumbs to avoid affecting their abilities to amplex females. We returned each toad to its capture location after marking. From 1971 to 1982 we toe-clipped males, females, and immatures (probably 2–3 yr old) throughout TPM, and in 1974, 1976–1979, 1981 and 1982, we marked all adult toads found breeding at the main study pools. Toads were also marked at Saddlebag Lake NW in 1976–1981, and at Sylvester Meadow in 1975 and 1976.

Unless otherwise indicated, the descriptive

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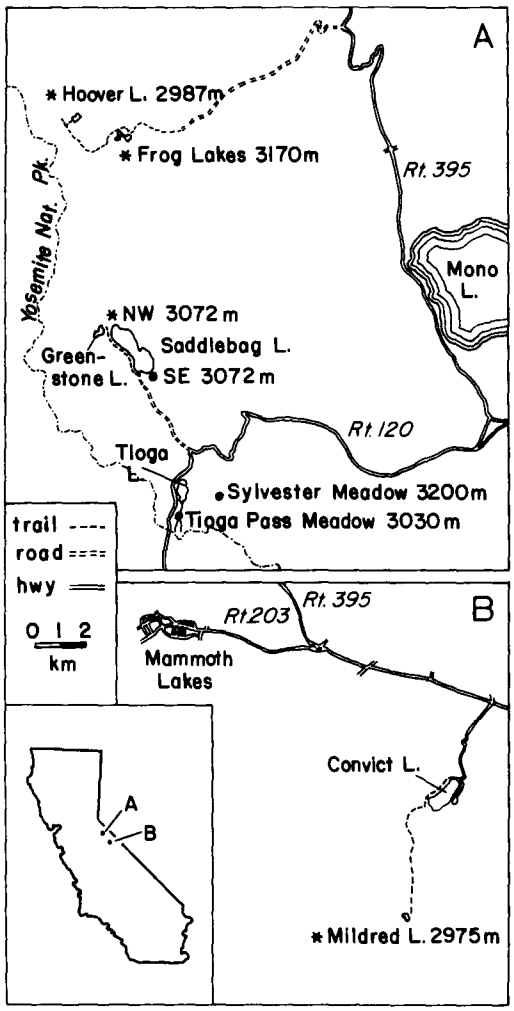

FIG. 2. Location of *Bufo canorus* populations surveyed in eastern Sierra Nevada, Mono Co., California. Sites indicated with an asterisk are located near permanent lakes.

statistics given are mean values ± one standard deviation.

Variation in Survey Procedures.—We determined toad population sizes by five methods involving direct enumeration. We did not use mark-recapture models (e.g., Jolly-Seber) because several critical assumptions of these models were violated by our study techniques.

First, we counted the total number of marked adults that gathered at the main study pools during breeding in a given year by: a) making repeated searches of the entire area, catching all toads seen, marking any unmarked animals, and recording toe-clip numbers (in 1974, 1979–1982); and b) encircling the pools with a 0.6 m high wire mesh fence with pairs of pitfall traps sunk in the ground at approximately 12 m intervals (in 1976–1978). Toads were not able to get over or under the fence; buckets and the fence's perimeter were checked 3–6 times daily. These methods enabled us to make a nearly complete count of the *B. canorus* that entered the pools during a breeding season.

Second, we calculated the mean number of toads (± standard error) found per survey in the main study pools during breeding in 1971–1975, 1977–1982, and 1990. We systematically walked throughout all of the main study pools and recorded the number of males, females, unsexable immatures, and 1 yr olds captured or seen. (Toads were marked with visible tags in 1976–1982 and did not have to be recaptured to be identified; Kagarise Sherman, 1980.) Surveys were made around midday at the height of breeding activity. In 1977 and 1978 surveys were made throughout the breeding period. However, because surveys in earlier years were biased toward days of peak activity, to achieve equivalence in the 1977 and 1978 means we used surveys from the day on which the largest number of females spawned, ± four days.

Third, in 1976 we did not conduct daily surveys of the main study pools. Instead, we computed the mean number of males and females found per survey by modifying 1976 fence data with a conversion factor based on the 1978 surveys. This was necessary because although we knew how many toads were inside the fence each day (Kagarise Sherman, 1980), some may have remained in their nighttime retreats in burrows or under objects (Karlstrom, 1962; Kagarise Sherman, 1980), and would not have been seen. The conversion factor was the mean percentage of males and females inside the fence that were actually found during the nine 1978 surveys described above. For example, on 1 July 1978, 135 males and 26 females were inside the fence (fence data), but only 40 males (30%) and 6 females (23%) were found during our survey that day. The conversion factors were thus 32 ± 11% for males and 26 ± 24% for females; these factors were multiplied by the 1976 fence data from nine days around the peak of female spawning. The adjusted values were then used to determine the mean number of males and females found per survey in 1976 at the main pools.

We feel justified in using 1978 data to generate the conversion factors for the 1976 data for two reasons. First, the amount of cover in the main study pools did not change between years, suggesting that the visibility of toads did not change. Second, we checked the procedure on the 1977 data. We compared the mean number of males and females found per survey to mean values computed from the fence data us-

ing 1978 conversion factors. The differences were not significant for either sex (male mean for survey data = 20.0 ± 11.6, modified fence data = 21.6 ± 11.3; female mean for survey data = 2.6 ± 1.8, modified fence data = 2.2 ± 2.9; Mann Whitney U, $P > 0.05$, $n = 9$).

Fourth, we made less systematic checks of the main study pools each spring when *B. canorus* should have been breeding in 1983–1989 and 1991. We walked through breeding habitat, looked for toads, eggs, and tadpoles, and listened for calling males. Numbers of breeding females cannot be accurately determined by counting clutches because eggs are often laid in communal masses. In addition, beginning in 1971 we monitored other sites in TPM (Fig. 1) for breeding activity. Breeding toads were occasionally counted to determine if similar changes in numbers were occurring at these sites. We also periodically searched for toads in non-breeding habitat and known hibernation sites (e.g., H1 and H2, Fig. 1).

Fifth, systematic surveys were infrequently made at *B. canorus* populations outside of TPM (Fig. 2) during breeding, and afterwards in the surrounding habitat. We recorded the number of adult, immature (2–3 yr old, and 1 yr old), and newly-transformed toads found during each survey. The level of effort varied among surveys, so we compared relative abundance (number of toads found/person hour of searching). Surveys were not made often enough to permit an analysis of differences in male and female numbers; therefore we combined adult males, adult females, and immatures (≥2 yr old) to calculate yearly means.

Adverse weather may cause a decrease in *B. canorus* breeding activity (Kagarise Sherman, 1980). However, we did not note the weather conditions during each survey we made, but assumed that the variation introduced into our results by differences in weather was random with respect to year.

Results and Discussion

Numbers of B. canorus Marked.—From 1971 to 1982 we individually marked 2270 *B. canorus* at TPM: 1259 males, 779 females, and 232 unsexable immatures (2–3 yr old). Smaller numbers of toads were marked at Saddlebag Lake NW (101 males, 76 females, 27 immatures in 1976–1981) and at Sylvester Meadow (two males, five females, eight immatures in 1975–1976).

Population Declines in TPM.—From 1974 to 1978 the total number of marked males entering the main study pools each year varied between 162 and 342 (Fig. 3). However, only 75 males appeared in 1979 and by 1982 the number of males had fallen to 28, a nine-fold decline from the 1974–1978 mean (257.5 ± 83.1). The drop in the

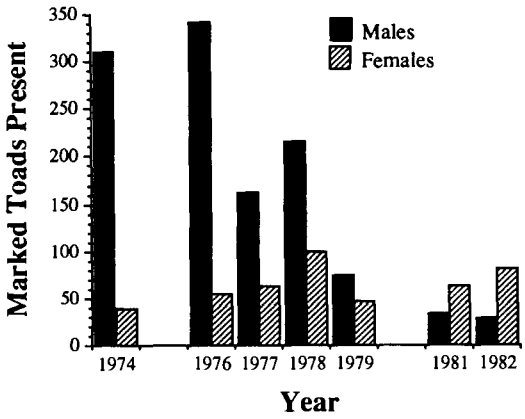

FIG. 3. Total number of marked *B. canorus* males and females present in main study pools at TPM each year. In 1974 and 1979–1982 toads were found in pools; in 1976–1978 toads were captured at fence encircling pools. Total numbers not determined in 1975 and 1980.

number of males cannot be attributed to movements to other breeding sites; only 1.5% (8/522) of the males that were seen at the main study pools in 1976–1979 were ever found breeding in nearby pools (#2–5 in Fig. 1; Kagarise Sherman, 1980). In contrast to males, the total number of marked females entering the main pools varied between 45 and 100, but showed no obvious decline from 1974 to 1982 (Fig. 3).

The mean number of males found per survey at the main study pools declined during 1979–1982; the mean number of females varied but did not decline until after 1982 (Fig. 4). Periodic checks of the main study pools in May–August 1983–1991 suggested that male numbers continued to decline, female numbers also fell, and breeding activity became sporadic. From 1983 to 1986 we heard or saw only 2–4 toads on any given day at the pools. Several males were heard calling in 1987–1988; two males were found in 1988. No calling males were heard in 1989. We found clutches in the main pools during 1983–1986, but did not find any females or eggs in 1987–1989. During two thorough searches of the pools in 1990 we found one female, two calling males and 4–6 egg masses. In 1991 we found only two egg masses and heard a single male calling on only two days.

At other breeding areas in TPM during 1973–1979 (#2–10 in Fig. 1), we regularly saw calling males, amplexed pairs, egg masses, tadpoles, new metamorphs, and 1 yr old toads. Around 1980 the maximum number of males counted during a single day began to decline, and by 1990 we did not find any toads or hear males calling, and located only one egg mass (at Area #10). The drop in male numbers from 1973 to 1990

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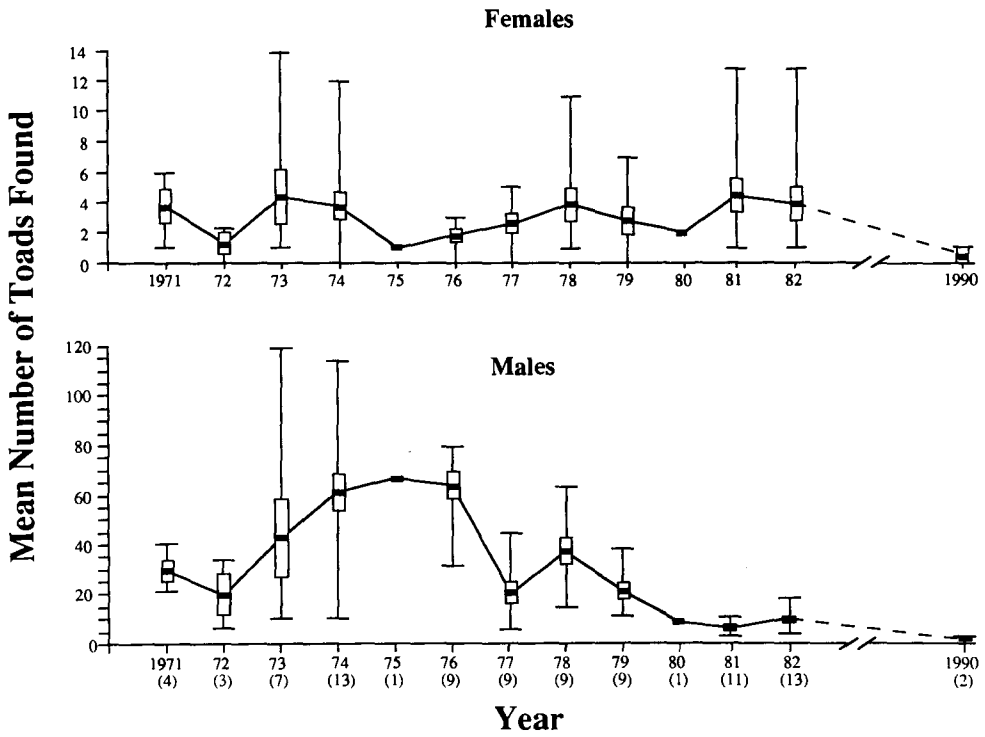

FIG. 4. Mean number of *B. canorus* males (lower) and females (upper) found during surveys of main study pools at TPM. Standard error (open box) and range (bar) shown; number of surveys indicated in parentheses below year. Data from 1976 are adjusted fence data (see text).

was significant at three of four areas where counts were made most frequently (Table 1). In contrast, the maximum number of females seen in these areas, while low, did not decline until sometime after 1982 (Table 1). We found no signs that *B. canorus* bred in any of these sites in 1991.

On 23 June 1991 E. L. Karlstrom visited his study area of 1954–1958 just south of TPM, within Yosemite National Park. He reported (pers. comm.) that there were no toads or signs of breeding in his former study area. The toads may have stopped breeding at his study site before our research began in 1971, because we never heard toads calling beyond the southern edge of TPM, or found signs of breeding in that area.

The number of *B. canorus* captured in non-breeding habitat in TPM also declined from 1971 to 1991. In the 1970s toads were abundant around willows and on hillsides. For example, on 10 July 1977, two people searching for three hours found 15 *B. canorus*. In contrast, Kagarise Sherman saw no toads in two hours of searching on 8 June and one hour on 12 June 1990. In June and July 1991, Morton found only two toads (one adult female and one 2–3 yr old immature) in non-breeding habitat despite frequent searches.

The number of *B. canorus* found during systematic surveys of a large 100 × 300 m willow thicket east of TPM (H2 in Fig. 1) also declined during the study. In 1976 the mean number of toads (≥2 yr old) caught/person h was 5.3 ± 3.2 (n = 11, range = 3–48); 1977 results were 8.0 ± 3.0 toads/person h (n = 10, range = 3–23). However, three surveys in 1990 produced a mean of only 0.5 ± 0.5 toads/person h (range = 0–1).

Population Declines Elsewhere.—The six other populations we monitored differed in size when we began our work (Table 2). For example, a maximum of 18 toads were found in the tarns at Saddlebag Lake SE, compared to a maximum of 216 toads captured at Mildred Lake during one search in 1976. However, nearly all of these populations apparently decreased in size sometime between 1978 and 1981 (Table 2). Only the Saddlebag Lake NW population apparently remained steady from 1973 to 1982. Our surveys in 1990 suggest that this population may have also declined since 1982. Yet, with the exception of Sylvester Meadow, *B. canorus* continues to breed in all these locations. In 1990 we found

TABLE 1. Yearly maximum number of males and females seen at any one time at four small breeding areas in TPM. n = number of times area was checked during breeding. Spearman's rank correlations for males, $P < 0.01$ at Area 4 ($r_s = -0.854$), Area 5 ($r_s = -0.964$) and Area 8 ($r_s = -0.804$); $P > 0.05$ at Area 10 ($r_s = -0.545$). For females in all areas, $P > 0.05$.

	1973	1974	1976	1977	1978	1979	1980	1981	1982	1990
Area 4										
n		(1)	(3)	(5)	(1)	(3)	(1)	(7)	(5)	(2)
Males		10	9	4	4	2	5	3	1	0
Females		2	3	1	0	2	2	1	2	0
Area 5										
n			(2)	(4)	(5)	(3)		(9)	(4)	(1)
Males			12	15	8	6		5	3	0
Females			1	1	3	0		1	3	0
Area 8										
n	(1)	(1)	(2)	(3)	(2)	(1)		(5)	(2)	(2)
Males	11	17	2	6	8	2		3	1	0
Females	0	1	1	4	1	2		2	0	0
Area 10										
n			(3)	(3)	(4)	(1)		(3)	(4)	(2)
Males			3	3	9	2		2	3	0
Females			1	1	3	2		2	2	0

the following numbers of egg masses at each location: Sylvester Meadow—0; Saddlebag Lake NW—14; Saddlebag Lake SE—20; Frog Lakes—2; Hoover Lake—3; Mildred Lake—45. Successful reproduction in 1989 was indicated by the number of 1 yr old toads we found in 1990 at: Saddlebag Lake NW—6; Frog Lakes—25; Hoover Lake—2; Mildred Lake—2. Finally, E. L.

TABLE 2. Mean number ± SD of *B. canorus* (≥2 yr old) caught/person h during surveys at six populations in eastern Sierra Nevada, California, from 1973 to 1990. n = number of surveys; Range = actual number of toads caught/survey.

	1973	1976	1977	1981	1982	1990
Sylvester Meadow						
n		(2)	(3)	(1)		(1)
$\bar{x} \pm SD$		12.0 ± 11.3	4.6 ± 3.9	2 ± -		0 ± -
Range		(2–20)	(2–9)	(2–)		(0–)
Saddlebag Lake NW						
n	(4)	(8)	(2)	(3)	(2)	(2)
$\bar{x} \pm SD$	9.0 ± 4.8	6.4 ± 5.1	9.7 ± 6.2	6.8 ± 1.2	11.0 ± 4.2	2.9 ± 0.8
Range	(8–31)	(5–38)	(28–33)	(15–32)	(4–14)	(6–7)
Saddlebag Lake SE						
n			(1)			(1)
$\bar{x} \pm SD$			9 ± -			1 ± -
Range			(18–)			(1–)
Frog Lakes						
n		(6)	(2)	(1)	(1)	(2)
$\bar{x} \pm SD$		6.7 ± 4.0	11.5 ± 4.0	1 ± -	0 ± -	1.8 ± 2.5
Range		(4–67)	(43–143)	(5–)	(0–)	(0–7)
Hoover Lake						
n		(2)	(2)	(1)		(2)
$\bar{x} \pm SD$		9.5 ± 4.6	10.2 ± 6.9	2.8 ± -		2.3 ± 1.0
Range		(25–85)	(16–60)	(21–)		(4–6)
Mildred Lake						
n		(5)	(3)			(1)
$\bar{x} \pm SD$		20.4 ± 20.7	17.3 ± 7.6			1.7 ± -
Range		(13–216)	(37–97)			(10–)

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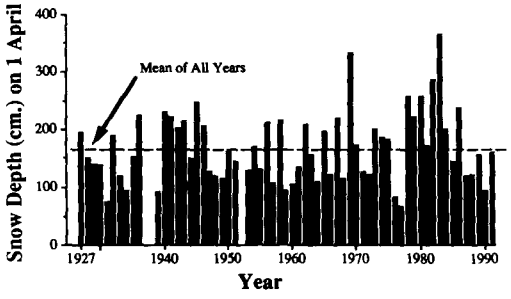

FIG. 5. Snow depth, in cm, on 1 April at Tioga Pass. Mean ± SD of all years (n = 62) was 169.4 ± 64.9 cm. Source: State of California, Department of Water Resources, Bulletin 120.

Karlstrom and D. Martin reported (pers. comm.) that on 23 June 1991 they found considerable breeding activity at the Saddlebag Lake SE population, including 6–8 amplexed pairs, and numerous adults and egg masses at the Saddlebag Lake NW population.

The number of *B. canorus* found at a breeding site on a given day varied considerably (Fig. 4, Table 2), reinforcing the need for repeated censuses over many years to detect directional changes in population size. Daily survey results are affected by factors such as the time of day, experience of the searchers, weather conditions that day, and stage in the breeding season.

Nevertheless, in general our observations indicate that numbers of breeding *B. canorus* have declined at TPM and other locations in the eastern Sierra Nevada. Although we did not directly determine total population sizes because we did not census adults that skipped breeding, and did not count immatures in TPM or immatures 1 yr old or less at other populations, our measures are probably indicative of total population size. Yearly counts of the number of adults breeding are likely to vary more than total population counts (Pechmann et al., 1991; Crump et al., 1992; Wissinger and Whiteman, 1992; Olson, *in press*).

Effects of Weather.—The spring snow depth at TPM was highly variable (Fig. 5). Snow depths ranged from a low of 62.7 cm in 1977 to a high of 375.7 cm in 1983. In low snow years few tadpoles had transformed when all water in the main study pools evaporated. For example, the 1976 spring snow depth was one of the three lowest on record, and only 20–30 tadpoles out of ca. 56,800 eggs laid (#clutches × mean clutch size) transformed before the pools dried up on 12 July (Kagarise Sherman, 1980). Snow depths have been below average at TPM since 1987 (Fig. 5), reflecting a widespread drought in California. Any tadpoles in the main study pools in 1987–1991 were probably unable to complete their development, since all the snow in TPM usually melted by the end of June and the pools in the main study area dried up sometime in July. All embryos in egg masses found in the main study pools in 1990 and 1991 were killed by desiccation.

Deeper snows resulted in greater numbers of tadpoles transforming but delayed breeding (Kagarise Sherman, 1980). In 1976 the first males entered the main study pools on 14 May, while in 1978 breeding onset was delayed until 15 June by deep snow (Fig. 5). Many new metamorphs were found on 15 August 1978 near the pools, which contained water until at least mid-September. However, the later-maturing tadpoles may not have completed their development before cold fall weather set in.

The effects of spring snow depths on the success of reproduction may also be indicated by the maximum number of 1 yr old immatures found in surveys of the main study pools, since some metamorphs hibernated near the breeding site during their first winter (Kagarise Sherman, 1980). In 1972 the snow depth was below average (Fig. 5), and in 1973 the greatest number of such immatures found in a single survey was one. Similarly, after the record low snows of 1976 and 1977, a single 1 yr old was located in 1977, and none were found in 1978. By contrast, 21 of the immatures were found in a 1974 survey, 2 in 1975, 6 in 1976, and ca. 10–15 in 1979 following years of above average snow depths (1973, 1974, 1975 and 1978, respectively, Fig. 5). In recent years we have found no 1 yr old or newly transformed toads at the main study pools, suggesting that little successful reproduction has occurred.

A spring storm in 1977 allowed us to document the combined effects of drought and weather during breeding. After the lowest spring snow depth on record (Fig. 5), the main study pools were snow-free and some toads had emerged from hibernation in late April. Then a 27 d storm deposited 60 cm of snow on TPM and delayed breeding until 30 May. Despite the additional snowfall, only a few tadpoles had transformed by 1 August when the pools dried up. Adult toads were also affected by spring storms. In 1977 males that emerged from hibernation before the April storm lost more weight, were less likely to breed, and were less likely to be recaptured than males that emerged from hibernation after the storm (Kagarise Sherman, 1980).

These results suggest that several weather variables interact to affect *B. canorus* hatching success and survival to metamorphosis at TPM. The depth and water content of the spring snowpack determine how much water will be available to fill the pools. The amount of snow

covering the pools and hibernacula affects when breeding begins. Spring snow storms interrupt breeding and may kill eggs and tadpoles by freezing, but also add water to the pools, thereby increasing the number of tadpoles that transform. Rain or snow storms after breeding may also increase tadpole survival by adding water to pools. Warm temperatures after spawning may speed tadpole development (e.g., Waldman, 1982), but cause faster evaporation of the pools.

The effects of weather on the outcome of *B. canorus* breeding were illustrated by Morton's additional observations in 1992. After a low winter snowfall (108.2 cm) and warm April, all snow had melted in TPM by 5 June; the toads bred sometime in May. However, four major storms in June and July replenished the main study pools, and some tadpoles likely transformed before the pools dried up on 2 August.

Populations of *B. canorus* may be less affected by spring snow depths if their breeding areas are partially filled by water from nearby lakes. At Saddlebag Lake NW, Frog Lakes, Hoover Lake, and Mildred Lake, toads breed in shallow marshes and pools adjacent to lakes, but whether water from these lakes flows into breeding habitat is unknown. The breeding area at Saddlebag Lake NW, located between two lakes (Fig. 2), seems most likely to be partially filled by lake water. Interestingly, the Saddlebag NW population seems to have declined less than the others we surveyed (Table 2). In addition, despite very low snowfall in 1976 we found new metamorphs at Frog Lakes, Hoover Lake and Mildred Lake (maximum in a single survey = 12 at Frog Lakes, 1 at Hoover Lake, and 12 at Mildred Lake), suggesting that these populations were less affected by spring snow depths than those breeding in exclusively snow-melt fed pools.

Among years, the variability in spring snow depths may have contributed to breeding population fluctuations at TPM. For example, a large number of tadpoles likely survived to transform in 1969, a year of unusually deep snow (Fig. 5). When the 1969 cohort of toads became sexually mature and began breeding 3–6 yr later (Kagarise Sherman, 1980) they probably comprised the large numbers of toads found at the main study pools in 1973–1975 (Figs. 3, 4). By contrast, below average snow depths in 1976, 1977, and 1987–1991, resulting in nearly total reproductive failure likely contributed to the decline in breeding toad numbers 3–6 yr later in 1979–1982 and 1990 (Figs. 3, 4). Drought may have also contributed to population declines at our other study sites.

The complete failure of reproduction and loss of a year-class in some years, with excellent tadpole survival and recruitment in other years, is characteristic of amphibians dependent on ephemeral water for breeding and may contribute to variation in adult numbers (e.g., Bragg, 1960; Pechmann et al., 1991; Crump et al., 1992; Wissinger and Whiteman, 1992; Olson, *in press*). Drought has been implicated in the decline of other amphibian populations (Corn and Fogleman, 1984; Pounds, 1991; Crump et al., 1992). Interestingly, drought-related declines in *Rana pipiens* in Colorado occurred in 1976 and 1977 (Corn and Fogelman, 1984), coincident with two years of record low snows in the Sierra Nevada.

Weather conditions before and during breeding may also affect how many adults attempt to breed (Pechmann et al., 1991; Wissinger and Whiteman, 1992; Crump et al., 1992). The combination of low winter snow depths and the spring storm at TPM may have caused the reduced numbers of *B. canorus* males entering the main study pools in 1977 (Fig. 3). Crump et al. (1992) suggested that the failure of *B. periglenes* to breed in recent years may be explained either by catastrophic mortality, or by adults remaining underground because weather conditions are inappropriate for breeding.

Mortality Unrelated to Predation.—During 1971–1975 we sometimes caught adult *B. canorus* with missing or deformed extremities, and in 1974 we found four toads with discolored growths on their bodies. All these toads appeared healthy when recaptured in later years. We did not find toads with other signs of illness. Except for an occasional toad that had been killed on California Highway 120, or a dead female in the breeding pools, we did not find dead *B. canorus* in TPM.

In contrast, from 1976 to 1982 we found 36 dead toads in the main study pools and throughout TPM during and after breeding. Three of the dead males and five of the females were weak, sluggish and bloated before dying, or were found dead with reddened ventral surfaces and toe membranes; 21 others (16 males, 5 females) were found with similar symptoms. Six of the affected males and two of the females recovered and were recaptured in subsequent years; the remainder were never seen again.

The deaths of other individuals during 1976–1982 may have also been related to illness. Four males and two females died while crossing a large snowdrift near the main study pools, perhaps because they were weakened by illness. One of three females that died after being amplexed by several males had sores on her dorsal and ventral sides. If she were ill she may have been less able to avoid being amplexed by multiple males. An additional 19 *B. canorus* were found dead, without any obvious signs of illness.

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We found the majority of the dead or ill toads in 1977 (10/36 = 27.8% dead; 7/21 = 33.3% ill) and 1978 (13/36 = 36.1% dead; 8/21 = 38.1% ill), just before the population began to decline (Figs. 3, 4). Similar numbers of males (17/36 = 47.2%) and females (18/36 = 50%) were found dead (1/36 of unknown sex = 2.8%), but more apparently sick males than females were seen (16/21 = 76.2% vs. 5/21 = 23.8%).

Probably illness in 1977 and 1978 caused extensive adult mortality and contributed to the population decline at TPM. Similar disease-related mortality of adults and/or larvae in wild populations has been reported in salamanders (Hunsaker and Potter, 1960; Nyman, 1986; Worthylake and Hovingh, 1989; Pfennig et al., 1991), frogs (Hunsaker and Potter, 1960; Glorioso et al., 1974; Nyman, 1986; Bradford, 1991; Carey, *in press*), and toads (Dusi, 1949; Carey, *in press*). The bacteria *Acinetobacter* was implicated in the die-off of one salamander (*A. tigrinum*; Worthylake and Hovingh, 1989), *Aeromonas hydrophila* and two *Enterobacter* species were cultured from two dead *R. muscosa* (Bradford, 1991), and *A. hydrophila* was implicated in the other cases. The symptoms we observed in *B. canorus* were suggestive of the anuran septicemia "red-leg," caused by *A. hydrophila* (Reichenbach-Klinke and Elkan, 1965; Shotts, 1984; Hayes and Jennings, 1986; Bradford, 1991). However, because the symptoms of several infections are similar and multiple bacteria may be present in sick animals (Glorioso et al., 1974; Shotts, 1984; Worthylake and Hovingh, 1989), identifying the causative agent is not possible without bacteriological analyses (Hayes and Jennings, 1986).

Aeromonas hydrophila is ubiquitous in fresh water and has been isolated from healthy adult and larval *R. pipiens* (Hird et al., 1981). The bacteria may become pathogenic when animals are stressed in some way (Glorioso et al., 1974; Shotts 1984; Hird et al., 1981; Nyman, 1986; Carey, *in press*). Several possible stressors may have made the toads at TPM more vulnerable to pathogens.

First, low temperatures favor the growth of *A. hydrophila* and other potentially pathogenic bacteria in captive frogs (Carr et al., 1976), and reduce the ability of ectothermic animals to respond to infections (Carey, *in press*). Amphibians may be especially susceptible while hibernating and in the spring after emerging (Hird et al., 1981; Carey, *in press*). At TPM the 27 d spring storm in 1977 and the unusually deep snow and long hibernation period in 1978 may have contributed to the disease outbreak we observed in 1977 and 1978. Second, Carey (*in press*) described physiological evidence suggesting that even brief handling causes stress in ectotherms. Our capture, measurement, and toe-clipping techniques may have made the toads more vulnerable to disease. However, except for the use of the fence and pitfall traps in 1976–1978, we did not change our techniques during the study. Toe-clipping began in 1971, and we walked around the pools daily each year, either capturing or visually locating toads. We attempted to minimize negative effects of the fence by checking the traps frequently and covering the pitfall traps at night. However, we may have inadvertently contributed to the spread of pathogens between toads and breeding sites by using the same marking and measuring equipment throughout the season.

Avian Predation.—On five occasions in 1976 and 1977 we saw American robins (*Turdus migratorius*) eating tadpoles from the main study pools when they were nearly dry. Insects also occasionally killed tadpoles (Kagarise Sherman, 1980; Morton, unpubl.). Robin predation on stranded tadpoles occurred at other breeding sites in TPM (K. Uemura, pers. comm.), and was reported for larval *B. boreas halophilus* in Yosemite National Park (Karlstrom, 1954). Brewer's blackbirds (*Euphagus cyanocephalus*) ate all transforming *R. muscosa* tadpoles in 1979 at Ridge Lake in King's Canyon National Park (Bradford, 1991). During the same summer this population also suffered mass mortality of adults due to disease, and was extinct when rechecked in 1989. However, our observations indicate that avian predation on *B. canorus* tadpoles probably does not greatly affect the population size, because only tadpoles in pools that were nearly dry were taken.

Karlstrom (1962) suggested that California gulls (*Larus californicus*) and Clark's nutcrackers (*Nucifraga columbiana*) might prey on adult *B. canorus*. From 1976 to 1982 we observed both species attacking the toads 22 times (Table 3), as they crossed a snowdrift near the main study pools (12 times), while in the breeding area (7 times), and near hibernacula (3 times). Of the 22 attacks, 9 were on males, 3 on females, and 10 on toads of unknown sex, suggesting that males were attacked more often. Observations of predation varied between years but did not increase during the study (Table 3).

We found considerable evidence of avian predation when we canvassed the *B. canorus* population at Mildred Lake on 11 June 1990. Twelve female and 10 male carcasses were discovered in the breeding area. Female remains consisted of the bones and skin of the head and back, eggs and oviducts, and occasionally a hind leg; male carcasses usually included only the bones and skin from the upper half of the head and back. We saw two common ravens (*Corvus corax*) foraging along the edges of the pools and marshes but did not see them attack any toads. Observations of ravens preying on other toad species and leaving similar remains (Kagarise

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TABLE 3. Frequency of predation by Clark's nutcrackers and California gulls on *B. canorus* at TPM. During unsuccessful attacks (U), toads were left uninjured; during "successful" attacks (S), toads were carried off, or killed and left by the bird. * = includes 1 female found eviscerated in main study pools, attributed to Clark's nutcracker predation; n = number of observations.

	1976	1977	1978	1979	1981	1982
n	(2)	(6)	(2)	(6)	(4)	(2)
Clark's nutcracker						
#U	2	1	0	2	1	0
#S	0	5	1	4	3*	0
California gull						
#U	0	0	1	0	0	1
#S	0	0	0	0	0	1
Percent of total observations	9.1%	27.3%	9.1%	27.3%	18.2%	9.1%

Sherman, 1980; Olson, 1989) implicate ravens in the deaths of toads at Mildred Lake.

Sightings of common ravens have increased in the Sierra Nevada at a rate of 9.5%/yr over the 24 yr period from 1966 to 1989; during 1980–1989 the rate was an even greater 19.6%/yr (USFW Breeding Bird Survey, unpubl. data). The increase in raven numbers may be related to increasing human activities, since ravens appear to be commensal with humans (see also Olson, *in press*). We occasionally saw ravens at TPM but never observed them hunting in toad breeding sites. However, ravens may have contributed to *B. canorus* population declines at Mildred Lake and elsewhere in the Sierra Nevada.

Predation on adult toads in breeding aggregations has been reported for four species: *B. americanus* (Schaaf and Garton, 1970; Groves, 1980), *B. boreas* (Olson, 1989, *in press*), *B. canorus* (Mulder et al., 1978; Kagarise Sherman, 1980), and *B. exsul* (Kagarise Sherman, 1980). Despite the irritating, toxic secretions of toads' skin glands (e.g., Low, 1972; Hayes, 1989), some predators are able to consume unprotected body parts while avoiding glandular areas. Raccoons (*Procyon lotor*) and striped skunks (*Mephitis mephitis*) were suggested as likely predators of *B. americanus* (Schaaf and Garton, 1970; Groves, 1980). Corvids were responsible for most predation in the other three species. Clark's nutcrackers were responsible for nearly all the attacks on *B. canorus* we witnessed. Black-billed magpies (*Pica pica*) killed many of the 96 *B. exsul* whose carcasses were found during a two year study at Deep Springs, California (Kagarise Sherman, 1980). Common ravens were also seen killing several *B. exsul* and may have left the piles of dismembered toads found at Deep Springs (Kagarise Sherman, 1980). Olson (1989) also reported raven predation in three of 15 *B. boreas* breeding aggregations in Oregon. Between 7 and 59 carcasses were found at each aggregation, and between 1.7 and 23.6% of the aggregated toads were killed.

Despite the presence of potential mammalian predators (see Karlstom, 1962) we never saw any attack *B. canorus*, and we found only one western garter snake (*Thamnophis elegans*) in 20 yr.

Effects of Adult Mortality.—Our data indicate that *B. canorus* is a late maturing, long-lived species. Male toads first entered breeding aggregations when they were 3–5 yr old, while females first bred at 4–6 yr (Kagarise Sherman, 1980). Reported ages at sexual maturity are similar in *B. boreas* (Carey, 1976; Olson, *in press*). Recaptures of marked *B. canorus* in 1981 and 1982 indicate that individuals may live a long time. Two females were first marked as adults (≥4 yr old) in 1971, making them at least 15 yr old; eight other marked females were at least 9–13 yr old when last recaptured. Assuming that breeding males were at least 3 yr old when first captured, five males were a minimum of 10–12 yr old when last recaptured. Recapture or phalangeal growth ring data revealed similar maximum ages in other toads (Hemelaar and van Gelder, 1980; Gittins et al., 1982; Olson, *in press*).

Crump et al. (1992) suggested that long life spans may be selected in species like *B. periglenes* that inhabit unpredictable environments and experience variable recruitment success, and that after periods of low recruitment or poor breeding conditions, populations will become biased toward aging adults and may be unable to recover. Mass mortality of adults due to disease or predation may also have a serious impact on long-lived anurans that mature slowly (see also Olson, *in press*). When many breeding adults die in these species, there may be years in which no breeding occurs because none of the younger toads are mature enough to breed. When

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combined with episodic juvenile recruitment, such populations may continue to decline.

Timing of Decline in Male and Female Numbers.—Male numbers dropped before female numbers in the main study pools (Figs. 3, 4) and probably at other breeding sites in TPM (Table 1). This sexual asymmetry in the timing of the decline is likely related to three differences in behavior between males and females. First, males spent more time in the breeding pools than females each year. The mean number of days spent in the main study pools was 2.1, 1.5, and 1.8 times greater for males than females in 1976, 1977 and 1978, respectively (Kagarise Sherman, 1980). Second, males attempted to breed more often than females. Of 522 marked males that entered the pools from 1976 to 1979, 66% were present once, while 34% were present in 2, 3 or 4 yr. Of 197 marked females, 86% were present once, compared to 14% that were present in 2, 3, or 4 yr (Kagarise Sherman, 1980). The dimorphism in breeding frequency was also reflected in the larger percentage of previously unmarked females, compared to males, that entered the main pools each year (1976 = 81.8% vs. 58.2%; 1977 = 65.1% vs. 30.9%; 1978 = 65% vs. 17.1%; 1979 = 54.3% vs. 13.3%; 1981 = 46% vs. 30.3%; 1982 = 48.1% vs. 21.4%). Third, males and females tended to inhabit different areas in TPM when not breeding (Morton, unpubl. data). Males stayed in the central meadow after breeding and hibernated there, whereas many females (and immatures) spent the years between breeding in the large willow thicket east of TPM (H2 in Fig. 1).

Such differences may expose males more to pathogens or predators, thereby causing a more rapid decline in male numbers. Males were probably more exposed to aquatic pathogens like *A. hydrophila* because they spent more time in the pools and returned to breed each year. By remaining in the willows at the periphery of TPM, non-breeding females and immatures may have reduced their exposure to diseased conspecifics. Breeding males may also have been more vulnerable to predation, because they spent more time in breeding aggregations and vocalized, which might have attracted predators. We observed more avian attacks on males than females during our studies (but found similar numbers of male and female carcasses at Mildred Lake).

A similar sexually dimorphic pattern of breeding attendance and population decline was reported for *B. boreas* (Olson, *in press*). Interestingly, the decline at one *B. boreas* population in 1991 was caused by a drop in male numbers while female numbers "... were not unusual" (Olson, *in press*). Olson suggested that female *B. boreas* might be less affected, at least initially, by mass predation on adults during breeding because most females do not breed every year.

Habitat Changes and Human Disturbance.—Habitat destruction has been frequently implicated in amphibian population declines (e.g., Barinaga, 1990; Blaustein and Wake, 1990). However, habitat changes in all areas we surveyed in the eastern Sierra Nevada have been minimal in the last 20 yr. Only minor natural changes in the breeding habitat of *B. canorus* in TPM have occurred since 1971, including the silting in of one tarn at Area #5 (Fig. 1), and the increased growth of willows on the western side of the main study pools. No livestock grazing, logging, road construction or other major disturbances have occurred; our study populations are all in national forest or wilderness areas.

Known local human influences have been limited to the effects of backpackers, tourists, and fishermen. The potential for human disturbance may vary with the ease of access to each breeding area. The main study pools are less than 200 m from Highway 120 and beside Tioga Lake, which is a popular fishing spot. Similarly, Saddlebag Lake is used by many fishermen. The SE tarns are 0.4 km from a road and campground; the NW breeding habitat is 2.4 km from the road but accessible by boat and level hiking trail. The other populations we surveyed are farther from roads and can be reached only by steep hiking trails (Sylvester Meadow—1.6 km to nearest road, Frog Lakes—2 km, Hoover Lake—4 km, Mildred Lake—5.6 km). The lack of relationship between the distance from the nearest road and the declines in our study populations suggests that localized human activities were not the main cause of the decreases.

In summary, there was a decline in the numbers of breeding *B. canorus* at Tioga Pass Meadow and elsewhere in the eastern Sierra Nevada from 1971 to 1991. The combined effects of drought-induced reproductive failure in at least seven years since 1971 and the death of many breeding adults due to disease probably caused the decrease in toad numbers at TPM. Drought may have also affected the other populations we surveyed, and raven predation likely added to the decline in the population at Mildred Lake. Our data suggest that a widespread factor like drought can interact with more localized effects, perhaps differing between populations, to cause population declines. In addition, all three contributors to the declines (drought, disease, and predation) may have had anthropogenic components, including global climate changes and an increase in numbers of common ravens. Unfortunately, our research techniques may have made toads more susceptible to disease, or increased the transmission of pathogens be-

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tween sites in TPM. We hope to continue our study for the next decade to check these conclusions.

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Original Research Article

Climate's cascading effects on disease, predation, and hatching success in *Anaxyrus canorus*, the threatened Yosemite toad

Walt Sadinski [a, *], Alisa L. Gallant [b], James E. Cleaver [c]

[a] U.S. Geological Survey, Upper Midwest Environmental Sciences Center, 2630 Fanta Reed Road, La Crosse, WI, 54603, USA
[b] U.S. Geological Survey (Retired), Earth Resources Observation and Science (EROS) Center, 47914 252nd Street, Sioux Falls, SD, 57198, USA
[c] University of California San Francisco, Department of Dermatology, 1701 Divisadero Street, San Francisco, CA, 94115, USA

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ABSTRACT

The U.S. Fish and Wildlife Service listed *Anaxyrus canorus*, the Yosemite toad, as federally threatened in 2014 based upon reported population declines and vulnerability to global-change factors. *A. canorus* lives only in California's central Sierra Nevada at medium to sub-alpine elevations. Lands throughout its range are protected from development, but climate and other global-change factors potentially can limit populations. *A. canorus* reproduces in ultra-shallow wetlands that typically hydrate seasonally via melting of the winter snowpack. Lesser snowpacks in drier years can render wetland water volumes and hydroperiods insufficient to allow for successful breeding and reproduction. Additionally, breeding and embryogenesis occur very soon after wetlands thaw when overnight temperatures can be below freezing. Diseases, such as chytridiomycosis, which recently decimated regional populations of ranid species, also might cause declines of *A. canorus* populations. However, reported studies focused on whether climate interacts with any pathogens to affect fitness in *A. canorus* have been scarce. We investigated effects of these factors on *A. canorus* near Tioga Pass from 1996 to 2001. We found breeding subpopulations were distributed widely but inconsistently among potentially suitable wetlands and frequently consisted of small numbers of adults. We occasionally observed small but not alarming numbers of dead adults at breeding sites. In contrast, embryo mortality often was notably high, with the majority of embryos dead in some egg masses while mortality among coincidental *Pseudacris regilla* (Pacific treefrog) embryos in deeper water was lower. After sampling and experimentation, we concluded that freezing killed *A. canorus* embryos, especially near the tops of egg masses, which enabled *Saprolegnia diclina* (a water mold [Oomycota]) to infect and then spread through egg masses and kill more embryos, often in conjunction with predatory flatworms (*Turbellaria* spp.). We also concluded exposure to ultraviolet-B radiation did not play a role. Based upon our assessments of daily minimum temperatures recorded around snow-off during years before and after our field study, the freezing potential we observed at field sites during embryogenesis might have been commonplace beyond the years of our field study. However, interactions among snow quantity, the timing of snow-off, and coincidental air temperatures that determine such freezing potential make projections of future conditions highly uncertain, despite overall warming trends. Our results describe important effects from ongoing threats to the fitness and abundance of *A. canorus* via reduced reproduction success and

* Corresponding author. U.S. Geological Survey, USA.
E-mail address: wsadinski@usgs.gov (W. Sadinski).

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demonstrate how climate conditions can exacerbate effects from pathogens to threaten the persistence of amphibian populations.

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1. Background

Coincident with amphibian declines in other regions of the world, populations of *Rana sierrae* (Sierra Nevada yellow-legged frog), *R. muscosa* (mountain yellow-legged frog), and *Anaxyrus canorus* (Yosemite toad) endemic to California's Sierra Nevada have declined dramatically in distribution and abundance over recent decades (Kagarise Sherman and Morton, 1993; Drost and Fellers, 1996; Stuart et al., 2004; Wake, 2012; FWS, 2014, but see Knapp et al., 2016). After assessing all information available on the statuses of remaining populations and the risks to their persistence, the U.S. Fish and Wildlife Service in 2014 designated both ranids as endangered and *A. canorus* as threatened throughout their entire ranges, under authorities granted by the U.S. Endangered Species Act (FWS, 2014).

Historical and ongoing habitat loss, alone or in concert with other factors, is a principal cause of amphibian declines globally (Stuart et al., 2004; Hof et al., 2011). However, the central Sierra Nevada consists almost entirely of national parks and national forests, areas largely protected from habitat loss caused by urban and commercial development, crop, oil, and gas production, or mining, for example. As a result, scientists hypothesized that outbreaks of an amphibian chytrid fungus, *Batrachochytrium dendrobatidis*, predation by introduced fish, climate change, pesticide drift from agricultural production in the Central Valley to the west, and ultraviolet-B radiation (UV-B) could have been the principal causes of the declines observed in the Sierra Nevada (FWS, 2014). Researchers proceeded to demonstrate that *B. dendrobatidis* (Vredenburg et al., 2010; Knapp et al., 2011; FWS, 2014) and trout introduced into montane lakes to promote sport fishing (Bradford et al., 1993; Knapp and Matthews, 2000; FWS, 2014) primarily caused declines among the ranid populations. Similarly, the U.S. Fish and Wildlife Service reported initial study results that indicated infection patterns and prevalence of *B. dendrobatidis* were consistent with past declines of *A. canorus* populations (FWS, 2014). Furthermore, this fungus was present in 17–26% of samples swabbed from individuals during 2006–2011, especially samples from juveniles (FWS, 2014).

However, the potential long-term impacts of risk factors on extant populations of *A. canorus,* and thus on the future conservation status of the species, remain unclear (FWS, 2014). These relatively long-lived toads reside from approximately 1460 to 3630 m in elevation in the central Sierra Nevada (FWS, 2014). Droughts are common across the montane landscapes where *A. canorus* dwells as wetland surface-water availability is mostly a function of melting snow from winter snowpacks, with much more limited contributions from snow and rain during the spring and summer (FWS, 2014). Because *A. canorus* requires notably shallow wetlands or wetland edges to reproduce, their reproduction success is vulnerable to dry winters that cause early desiccation of breeding sites. Such linked phenomena might increase in frequency under future climate dynamics and could cause further declines (FWS, 2014; Polade et al., 2017). Moreover, as we learned during this study, typically cold overnight air temperatures during breeding and embryogenesis can expose embryos to freezing in such shallow breeding waters, substantially reducing reproduction success singly or in concert with other factors, even when surface water is not limiting. Based upon climate alone, the future persistence of *A. canorus* populations fundamentally depends upon their risky reproduction strategy (breeding in very shallow waters soon after snowmelt) being successful frequently enough to sustain populations. Despite considerable uncertainty, this could become riskier than in the past, given projected climate dynamics likely will continue to become more extreme and non-stationary, including longer droughts amid extraordinary precipitation events (Gershunov et al., 2017, 2019; Polade et al., 2017). Thus, predicting the long-term persistence of *A. canorus* populations relative to prevailing risk factors is difficult at best.

We initiated research in the mid-1990s to assess the distribution and relative abundance of *A. canorus* among breeding wetlands within a high-elevation portion of Yosemite National Park (California), to investigate any evidence of effects on fitness that could be related to population declines, and to determine mechanisms underlying such effects. Results from our field and laboratory research (which was not part of the work of the U.S. Geological Survey at the time) were reported to staff at the National Park Service after completion of the field study. Since then, the federal listing of *A. canorus* in 2014 under the U.S. Endangered Species Act (FWS, 2014) prompted us to revisit the results from our past research in terms of its relevance to the current understanding of factors that threaten the persistence of *A. canorus* populations. We concluded that results from our work regarding the intertwined dynamics of climate, disease, and mortality among *A. canorus* embryos are especially germane to questions and management considerations that are important today. Thus, we re-assessed our data and conducted additional analyses so we could comprehensively report our results here in today's context of global change. Our overarching goal is to communicate our results to a broad audience of resource managers, researchers, and other stakeholders who are working on matters related to the conservation of *A. canorus* or on the threats that climate, pathogens, and other factors pose more broadly to amphibian populations in the Sierra Nevada and elsewhere.

1.1. Objectives

We based our objectives for the work we describe here upon our recurring observations of widespread and often substantial embryo mortality among *A. canorus* egg masses across breeding sites and our efforts to document this mortality and determine its causes. Such mortality was the most obvious and consistent effect on individual fitness, with the potential to reduce the abundance or persistence of populations, that we observed throughout our study from 1996 to 2001. As we continually improved our understanding of the physical and biological context for such mortality across years, we modified or added to our field-sampling efforts while conducting manipulative field and laboratory experiments in parallel.

We developed specific objectives that would allow us to test for relations among biotic and abiotic variables potentially relevant to the embryo mortality we observed. In essentially the chronological order that we developed them, our objectives were to (1) measure annual embryo mortality in individual *A. canorus* egg masses across a set of intensive study sites that spanned the elevational gradient within our study area, (2) determine if such mortality was species-specific by comparing mortality in *A. canorus* with mortality in *Pseudacris regilla* (Pacific treefrog) at breeding sites they shared, (3) measure ambient UV-B radiation, air and water temperature, and basic water chemistry and determine the potential for overnight freezing at our study sites, (4) conduct manipulative experiments *in situ* to test for effects of potential exposure to UV-B on *A. canorus* and *P. regilla* embryos and of freezing on *A. canorus* embryos, (5) conduct a laboratory experiment to test for effects of exposure to ice on *A. canorus* embryos, (6) sample for the presence of water mold and predatory flatworms on *A. canorus* egg masses at our study sites, and (7) analyze historical temperature data from a nearby weather station to assess the potential that the temperature conditions we observed during our field study were unique relative to years before 1996 and after 2001.

2. Materials and methods

Including the supplemental information we linked to this paper, we report here on integrated field and laboratory research we conducted from 1996 to 2001. The supplemental information includes results from field measurements of ambient UV-B and *in-situ* experiments using enclosures to test for effects of UV-B on hatching success and DNA damage (Appendix A). These UV-B data resulted from our necessary assessments of the potential causes of the embryo mortality we observed. Thus, they are directly relevant to the work we describe in the main body of this paper. We also present results from our recent assessment of climate conditions in our study area for years before and after our field study, which we tailored to hypothetical annual breeding intervals for *A. canorus* based upon our field data.

2.1. Study area and study wetlands

We conducted field work primarily within a portion of Yosemite National Park near Tioga Pass on the park's eastern boundary (Fig. 1). We also surveyed wetlands in nearby portions of the contiguous Inyo National Forest (Fig. 2). Among mountain ranges, lakes, tarns, and streams, this area overall included large to small patches of sub-alpine meadows, which contained the interconnected wetlands and uplands that constituted the primary habitat for *A. canorus*. Elevations ranged from approximately 2800 to 3200 m above mean sea level (World Geodetic System of 1984).

Highway 120 (Fig. 2) provided road access into this area. Relatively straightforward access to our study wetlands was critical because *A. canorus* bred explosively immediately after warming spring temperatures caused sufficient snowmelt to occur and also because subsequent embryogenesis was short in duration. We chose this specific study area non-randomly due to the combination of road access and *A. canorus* reproducing in multiple wetlands within it. Thus, our results apply only to this area and to our study wetlands and should not be extrapolated to *A. canorus* breeding wetlands elsewhere.

Guided by the U.S. Geological Survey's topographic maps, we conducted extensive ground searches of our study area to locate wetlands from 1996 to 2001. To identify the actual breeding wetlands for *A. canorus* that we describe here, we surveyed all potentially suitable wetlands we found within the intermountain portion of our study area along Highway 120 during annual periods from breeding to metamorphosis. These efforts included call surveys, which we conducted via the naked ear for at least 10 min while positioned out of sight near each wetland during breeding periods, and visual-encounter surveys, during which we walked contiguous transects throughout each typically shallow wetland coincident with and after potential or observed breeding.

To provide consistent information, we used all the same site names here that were provided to staff at the National Park Service after we had completed the field study. Because *A. canorus* is a federally listed and protected species, we have not mapped or supplied coordinates for each breeding site in this article. We expect those maps and coordinates are on file with the National Park Service in Yosemite National Park.

2.2. Surveys

2.2.1. Breeding phenology

We determined specific dates for annual peak breeding for *A. canorus*. This enabled us to describe the proximity of breeding to snowmelt and the temperature conditions during embryogenesis for the years of our field study and to project

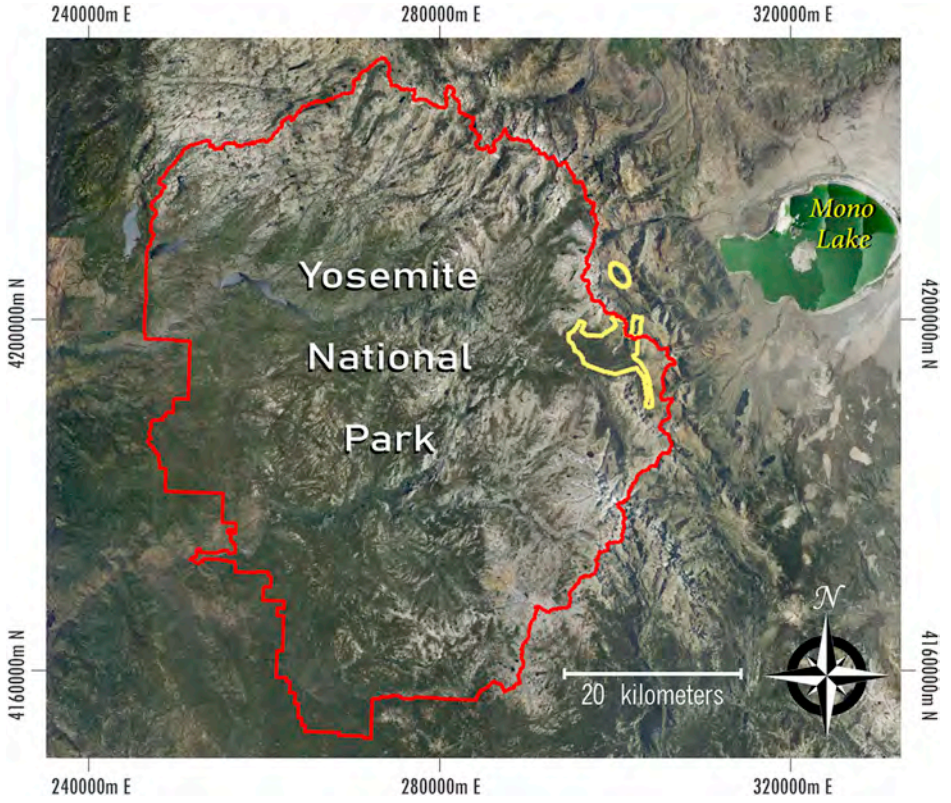

Fig. 1. All of Yosemite National Park (bounded by red) in relation to where we conducted field studies (bounded by yellow). Background is 2016 orthoimagery from the U.S. National Agriculture Imagery Program. Map coordinates are in the Universal Transverse Mercator system, Zone 11 North, North American Datum of 1927. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

such breeding dates and temperature conditions for years prior to and following our study based upon historical data from a local weather station (§ 2.6). We surveyed the numbers of egg masses deposited by date at various breeding sites and determined peak deposition dates in 1996, 1998, 1999, 2000, and 2001. We typically conducted these visual-encounter surveys daily during annual breeding periods by walking slowly along contiguous transects throughout the entire potential breeding portions of each wetland, regardless of how much time was required. The very shallow, clear water and overall lack of early season emergent vegetation allowed us to see egg masses relatively easily. When we found egg masses after the day they were deposited, we back-calculated to assign them deposition dates based upon the relatively consistent number of hours or days embryos typically required to pass through each development stage at our study sites (Gosner, 1960), given the weather conditions.

2.2.2. Depths of egg masses (Anaxyrus canorus and Pseudacris regilla)

When we found an *A. canorus* breeding wetland in our study area, the egg masses typically were deposited on the bottom in very shallow water. This resulted in the embryos lying close to the water's surface, especially those in the uppermost layers of the egg mass. In contrast, we observed that *P. regilla* usually attached their egg masses to residual vegetation farther from the surface in deeper water than existed at most *A. canorus* breeding sites and that mortality among *P. regilla* embryos appeared to be considerably less than for *A. canorus*. Thus, hypothesizing that the substantial mortality we often observed among *A. canorus* embryos was associated with overnight freezing or exposure to UV-B, or both, due to the shallow water was straightforward. To assess and document the distances of *A. canorus* and *P. regilla* egg masses from the water's surface, we measured water depths at masses of both species at the limited number of our study sites where they both bred. We used a meter stick to measure the depth (nearest mm) where female *A. canorus* deposited individual egg masses, and the distance from the water's surface to the tops of those masses, at several breeding sites across 1996, 1998, 1999, and 2000. We did the same for egg masses of *P. regilla* during 1996 and 1998.

Boxplots of the resultant data (§ 3.2.2) indicated differences in depths between the egg masses of *A. canorus* and *P. regilla* at practically all sites such that we did not conduct any further statistical analyses.

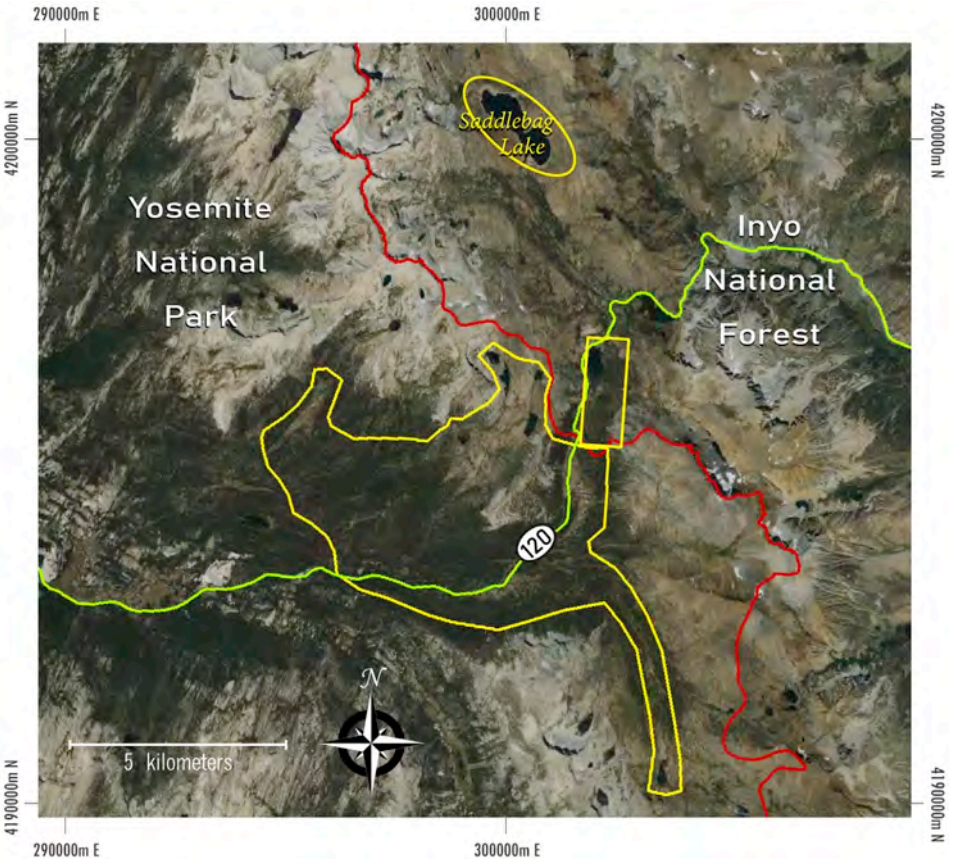

Fig. 2. The area (as shown in Fig. 1) where we conducted our field studies in more detail. The Tioga Pass entry station to Yosemite National Park is at the intersection of Highway 120 and the park boundary (red line). The Tioga Lake basin lies within the yellow rectangle adjacent to the entry station in the Inyo National Forest. Our intensive study sites were inside the park along Highway 120 from near the Tioga Pass entry station to before where the road turns sharply left. Background is 2016 orthoimagery from the U.S. National Agriculture Imagery Program. Map coordinates are in the Universal Transverse Mercator system, Zone 11 North, North American Datum of 1927. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

2.2.3. Hatching success (Anaxyrus canorus)

To assess the extent of annual mortality among *A. canorus* embryos across our study sites, we measured hatching success in as many individual egg masses as possible, given logistical constraints, at sites we surveyed annually from 1996 to 2000. We visually evaluated each individual embryo in an egg mass *in situ* while kneeling alongside it immediately before, at, or very soon after hatching (when individual capsules remained from hatched embryos and when any remnants of dead embryos typically still were visible). We did not assess mortality in any egg masses that had deteriorated too far to evaluate embryos. In 2001, a limited number of field personnel caused us to estimate the proportion dead in most egg masses instead of examining each embryo individually. We did so by visually dividing each egg mass into standard-sized groups of embryos and closely estimating the number alive and the number dead. The same person conducted all assessments of hatching success for all egg masses across sites in 2001. All told, our hatching-success data enabled us to address hypotheses related to temperature, elevation, UV-B, water mold, and predatory flatworms as causes of embryo mortality.

Analysis — We tested whether hatching success was different at lower-elevation breeding sites (<2900 m) than higher-elevation sites via a Mann-Whitney test in Origin Pro software (OriginLab Corporation; Northampton, Massachusetts, USA). We did not consider embryo-mortality data from any site in 1998 because it was a notable outlier due to an *El Nino* event (Chavez et al., 2002; § 3.6.1) that caused remarkably late breeding and widespread warmer daily minimum air temperatures throughout our study area. We also only considered sites in our statistical analysis for which we had mortality data for more than one year after we removed 1998 data from the dataset. The resultant data were not normally distributed and the variances among lower and higher sites were not homogeneous according to tests we conducted in Origin Pro. We were unable to normalize the raw data via transformations. However, a square-root transformation we applied prior to conducting the Mann-Whitney test corrected the heteroscedasticity sufficiently according to a Levene's test (squared deviations; $\alpha = 0.05$; Origin Pro).

2.2.4. Hatching success (Pseudacris regilla)

Some of our *A. canorus* study sites contained sections with deeper water where *P. regilla* females deposited their egg masses. We were able to measure hatching success among egg masses of both species (at the same site) at three such breeding sites in 1996 and two of those same three plus another in 1998 to determine the extent, if any, to which hatching success differed. We also measured hatching success among *P. regilla* at two different sites in 1997 where *A. canorus* did not breed. We measured hatching success for *P. regilla* embryos similar to how we did for *A. canorus*, except in some cases we had to raise *P. regilla* egg masses closer to the water's surface to see the embryos clearly.

Analysis – The resultant data for hatching success for *A. canorus* and *P. regilla* at sites where they both bred were not distributed normally and were heteroscedastic according to tests we conducted via options in Origin Pro. We were unable to normalize the data via any transformations. However, an arcsine transformation of the square root of the raw data adequately reduced the heteroscedasticity according to a Levene's test (squared deviations; $\alpha = 0.05$; Origin Pro). To further assess any likely differences in hatching success among the two species in lieu of a straightforward, more sophisticated nonparametric test, and to complement the information contained in a boxplot, we calculated approximate 95% confidence intervals for the medians (Bland, 2000) on the transformed data.

2.2.5. Presence and relative abundance of Saprolegnia diclina and predatory flatworms on Anaxyrus canorus egg masses

While visually examining individual egg masses and estimating embryo mortality during 2001, we also estimated the extent to which an unknown (at the time) presumed species of *Saprolegnia* (a pathogenic water mold [Oomycetes]) and a still unknown species of predatory flatworm (*Turbellaria* spp.) were present and feeding on embryos in each egg mass. We assessed each egg-mass *in situ* at nine breeding sites (TC, C1, C3, C5, C9, C9a, C10, C15, and C16) that ranged in elevation from relatively low to relatively high within our study area. We qualitatively categorized presence/abundance as none observed, low to moderate (present on or within 0–50% of the egg mass), or high (present on or within >50% of the egg mass). The same person conducted all such evaluations. These data enabled us to address questions regarding any relations of the presence and relative abundance of the pathogen and the predator to embryo mortality and site elevation/daily minimum air temperatures.

We were unable to have samples of the water mold analyzed to identify it to species during the principal years of this study. However, we did collect portions of two egg masses of *A. canorus* from site C3 and portions of two masses from C5 in 2004 that were infected with the pathogen and sent them on ice overnight to Abbey Lane Laboratories in Philomath, Oregon, USA, for species identification. Scientists there followed standard protocols for isolating and culturing water molds through zoospore discharge and for observing subsequent motility. They identified this species as *S. diclina*.

We similarly collected and preserved samples of the predatory flatworms that were present on egg masses in 2004. Despite our best efforts and those of experts we contacted in various countries, we were unable to identify these worms to the species level.

Analysis – The resultant embryo mortality data for 2001 were intractably non-normal and heteroscedastic. None of the transformations we applied solved these violations of the assumptions for using parametric statistical methods to analyze the results. Furthermore, site elevation, median daily minimum air temperatures, and the relative abundances of *S. diclina* and the flatworms, the factors we measured to assess relations with embryo mortality, were associated with each other to varying extents. Ultimately, we decided to simply use the Spearman rank test to assess associations among these factors and between each one and embryo mortality, which we did using Origin Pro.

2.3. Field test of effects of enclosing embryos on hatching success – 1999

We conducted a field experiment in 1999 to test for effects of enclosing embryos of *A. canorus* and moving them to slightly deeper water, thereby reducing the potential for exposure to ice and freezing temperatures, on hatching success at five breeding sites (C3, C9, C9a, C15, and C16). We split freshly laid egg masses approximately into halves. We left one indiscriminately chosen half of each mass where it was deposited originally (thus, replicates were scattered among the shallow waters where egg masses were deposited) and placed the other half in an enclosure covered with transparent plastic (enclosures and plastic as described in detail in Appendix A) in slightly deeper water near the original deposition site. Upon hatching, we measured hatching success among enclosed and unenclosed portions of each egg mass.

We loosely secured each of these enclosures to wooden dowels driven into the sediments so that the enclosures floated in place with their tops just below the surface of the water. Based upon the availability of freshly deposited egg masses, we had the following different numbers of egg masses and enclosures at each site: C3 (one egg mass split – one enclosure), C9 (five egg masses split – five enclosures), C9a (five egg masses split – five enclosures), C15 (four egg masses split – four enclosures), and C16 (one egg mass split – one enclosure).

Analysis – We used options in Origin Pro and Minitab (Minitab Incorporated; State College, Pennsylvania, USA) to conduct exploratory and final statistical analyses of the resultant data. Due to non-normality and unequal error variances, both tested at $\alpha = 0.05$, we performed a square-root transformation on the raw data which did not correct the non-normality but did reduce the heteroscedasticity sufficiently according to a Levene's test (squared deviations; $\alpha = 0.05$; Origin Pro). We then conducted a Mann-Whitney *U* test (Origin Pro) on the transformed data at $\alpha = 0.05$ to assess whether mortality was the same among embryos that were enclosed or unenclosed across test sites.

2.4. Egg-mass translocation experiment – 2000

In 2000, we tested whether hatching success for *A. canorus* embryos was greater in portions of egg masses we moved to moderately deeper locations within natal sites, where embryos were less likely to be exposed to freezing, compared with portions of the same masses we left in the locations where toads had deposited them. We split freshly laid egg masses roughly into two portions. We then chose one of the portions indiscriminately from each mass and moved it to a deeper location we chose haphazardly within the same site based upon the contour of the wetland basin and depths available, such that all translocated portions at each site lie on the bottom in the same approximate depth of water (Table S1).

Analysis – Exploratory analyses in Origin Pro showed our raw data were not distributed normally and were heteroscedastic. No transformations corrected both conditions. However, an arcsine transformation of the square root of the raw data reduced the heteroscedasticity sufficiently according to a Levene's test (squared deviations; $\alpha = 0.05$; Origin Pro). We conducted a Mann-Whitney *U* test on the transformed data to assess differences in hatching success between embryos left in their original positions and those we moved to slightly deeper water ($\alpha = 0.05$; Origin Pro).

2.5. Laboratory test of effects of exposure to ice on hatching success

In 2000, we conducted a laboratory experiment to test the effects of varying levels of exposure to ice on embryos of *A. canorus* and to determine the extent to which our laboratory results were similar to mortality we observed in the field. Our exposure levels were 0 min, 15 min of exposure to water containing ice particles but not frozen fully (slush), 30 min water fully frozen, and 60 min water fully frozen. We executed this experiment at the University of California's Sierra Nevada Aquatic Research Laboratory (Mammoth Lakes, California, USA) using a freezer (−20 °C) and insulated coolers (capacity = 51 L), the latter of which we filled with water and used as water baths. We installed a chiller, a heater core, and a programmable thermostat in each cooler and programmed the thermostats to adjust and maintain water temperatures between 2 °C and 28 °C over the course of 24-h cycles according to daily water-temperature profiles we had measured next to egg masses *in situ* (§ 2.6.3) using Optic StowAway Temperature loggers (Onset Computer Corporation; Bourne, Massachusetts, USA). We maintained water temperatures in all coolers according to these daily temperature profiles, from the start of the experiment through hatching, and monitored water temperatures via the temperature loggers. We placed a grid made of wooden dowels with square cells over the top of each cooler and inserted lipped, polyethylene 1-L beakers into individual cells in the grid such that beakers were submerged in the cooler's water column to near their tops. We assigned individual experimental units to cells randomly to avoid any unknown biases associated with positions in the coolers.

We collected embryos from four *A. canorus* egg masses from C15 and one from nearby C18 soon after they were deposited (embryos in early to mid-cleavage; Gosner, 1960) and transported them to the laboratory on ice in polyethylene bags filled with water from the embryos' natal wetlands. We pooled the embryos from each egg mass according to the methods described for the field-enclosure experiments (Appendix A). We also blocked the treatments on individual egg mass (five replicates per treatment), with each treatment having a replicate experimental unit consisting of 50 embryos from each egg mass. We maintained water volumes at 700 mL in each beaker (natal wetland water) and lowered water temperatures in all water baths to 2 °C overnight according to the same field-simulated temperature profiles. We replaced some of the water in each beaker during the experiment with natal wetland water stored in polyethylene bags at 2 °C–3 °C (see below).

During the first night of the experiment, we removed those beakers containing embryos assigned to be exposed to ice from the water baths at a time (0615 h) by which ice typically had formed at breeding sites. The water baths were at or just below 2 °C at that time. We placed these beakers in a freezer at −20 °C and left them there for the length of time required to induce slush and maintain it for 15 min, solid ice for 30 min, or solid ice for 60 min. We returned each beaker to the water bath (which still was at approximately 2 °C) after the beaker's water had reached the appropriate ice level. Experimental units we did not expose to ice remained in the water baths during exposure times. After the first night, we left all experimental units in the water baths on the same temperature profiles until hatching occurred. During the fourth day of the experiment, we replaced 350 mL of the water in each beaker with an equal amount of water from the original site, after we had adjusted the fresh water to the temperature of the bath at the time of replacement. We scored hatching success by counting the number of hatched and dead embryos in each beaker at hatching and returned hatchlings to their natal site.

Analysis – Exploratory analyses of the resultant data showed clear and relatively consistent separation among mortality related to exposure levels such that we did not conduct further analyses beyond graphing the results.

2.6. Measurements of climate variables during Anaxyrus canorus breeding and embryogenesis

To assess relations between the timing of snow-off, breeding phenology for *A. canorus*, daily minimum air temperature, and embryo mortality for *A. canorus,* we obtained snow and temperature data collected at the automated weather station in Dana Meadows (DAN) from archives at the Western Regional Climate Center (2018). Data from DAN were available for most years from 1996 to 2001, as well as for years prior to and after our study. For reference, DAN was approximately 500 m from our nearest (mid-elevation) study wetland and approximately 3.5 km northeast of our farthest (lower-elevation) study wetland. Another weather station at Gaylor Meadow was closer to our lower-elevation intensive study sites, but relevant data were not available from that station for most years of our field study.

2.6.1. Measurements of snow-off 1981 to 2018

We determined the annual date of snow-off near our study sites based upon data collected by a snow-pillow sensor at DAN. This sensor had a relevant period of record dating back to 1981 and was part of the California Cooperator Snow Sensors network. This record was missing sensor data for some individual dates and contained a three-year period of unreliable sensor data due to interference from vegetation (2007–2009) that Lundquist et al. (2014) had identified. We used a set of quality-controlled data for snow-water equivalents from the DAN station posted by Lundquist et al. (2016a, b) for 1981 to 2015 to determine annual dates of snow-off when data were available. We acquired DAN snow data for 2016 to 2017 from the California Data Exchange Center ("adjusted snow water content"; California Department of Water Resources, 2018). To estimate snow-off dates for 2007 to 2009, we used a product representing fractional snow cover at a spatial resolution of 500 m developed from data from the Terra sensor on the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite (MOD10A1.005; Riggs et al., 2006). We used a similar product to estimate snow-off for 2018 (MOD10A1.006; Riggs et al., 2016). For all sources of snow data we defined snow-off as the first date in spring/summer when snow no longer was apparent (snow water equivalent = 0 or fractional snow cover = 0) and subsequently remained absent.

2.6.2. Relation of the timing of snow-off to the timing of peak egg-mass deposition

Analysis – We calculated a statistical relation between the timing of snow-off and the timing of peak deposition of egg masses that occurred during the years of our field study. We determined the median difference in the number of days between snow-off and the date of peak egg-mass deposition at individual study sites across years per the equation $S_n = \text{Med}(ED_y - DS_y)$, for $n = 1 \ldots N$ and $y = 1 \ldots Y_n$, where S_n represented the median (Med) difference in days between peak egg-mass deposition (ED) and snow-off dates (DS) for site n among the set of sites (N) and year y in the set of years (Y) observed in the field. We stratified these results by three elevation classes for sites (lower, mid, and higher) to derive the median difference in the number of days between snow-off and peak breeding by elevation class using $ES_e = \text{Med}(S_n)_e$, where ES_e was the median S_n of elevation class e and e was the elevation class of site n. We then used that relation to estimate when the timing of peak egg-mass deposition occurred during years before and following our field study. This information enabled us to broadly estimate the potential for *A. canorus* embryos to have been exposed to surface ice or freezing air temperatures before and after our field study based upon daily minimum air temperatures recorded at DAN and adjusted by differentials for site-elevation category (§ 2.6.4).

2.6.3. Measurements of temperatures at individual study sites

From 1999 to 2001, we used the aforementioned Optic StowAway Temperature loggers to measure water and daily minimum air temperatures at various breeding sites during embryogenesis for *A. canorus*. These measurements enabled us to determine relations between air temperatures at individual breeding sites relative to air temperatures measured at DAN and to assess water temperatures alongside egg masses. We measured water temperatures via loggers attached to wooden dowels that we drove into the sediments alongside egg masses in their original locations. We measured air temperatures via loggers we suspended 45–49 cm above the surface of the breeding site by attaching them to wooden dowels driven into the sediments or ground. We programmed each logger to record the temperature every 6 or 15 min, depending upon the year. The loggers had the capacity to measure temperature over a range of −4 to −5 °C (actual limit varied with the individual logger) to 38 °C with an error rate of approximately 0.12 °C. We typically deployed loggers at a site on the first day we discovered freshly laid *A. canorus* egg masses and left the loggers in place at least through hatching. The loggers we deployed in the water column near the tops of egg masses proved to be ineffective for detecting the formation of ice on a wetland's surface. This appeared to be due primarily to the ice forming over the tops of the loggers and pushing them downward such that they remained suspended in the water column just below the ice, rather than being captured in the ice, which was of limited thickness. Thus, we relied on daily minimum air temperatures as indicators of the potential for the formation of ice.

Due to a limited number of loggers and the timing of breeding activity across sites, we were not able to measure temperatures *in situ* at all our intensive study sites from 1999 to 2001, nor were we able to ensure we measured temperatures on peak breeding dates at individual sites. However, taking these measurements during embryogenesis at different sites across years enabled us to determine differences in air temperatures *in situ* relative to those recorded at DAN during such periods and then to adjust the DAN temperatures to more accurately estimate what coincident minimum air temperatures were at individual sites (§ 2.6.4). Thus, we were able to assess daily minimum air temperatures across our intensive study sites during embryogenesis in a standardized manner relative to embryo mortality in all years of this study and to evaluate the potential for such mortality during years before and after this study.

2.6.4. Calibrations of DAN temperature data using in-situ measurements of air temperature

To calibrate the daily minimum air temperatures recorded at DAN so they more accurately reflected the daily minimum air temperatures at our individual study sites, we calculated the differences between the daily minimum air temperatures recorded at DAN and those we sampled at individual breeding sites during the same 24-h period. For these calculations, we used data we collected *in situ* for 1996 (2 sites) and from 1998 to 2001 (9 sites) for five consecutive days that began the day we deployed temperature loggers at each site in association with the laying that day of one or more *A. canorus* egg masses. We excluded any dates from this analysis when a temperature logger recorded its minimum detection limit (§ 2.6.3) because we could not be certain of the actual difference between the minimum air temperature at the site that day and the minimum air temperature recorded coincidentally at DAN. Our resultant modest number of *in-situ* air-temperature measurements limited

our ability to differentiate adequately between daily minimum temperatures we measured *in-situ* and those recorded at DAN according to categories of relative site elevation. We ultimately calculated the median difference between *in-situ* measurements and DAN measurements for the entire set across sites and years to obtain an adjustment constant. We used this constant to estimate daily minimum temperatures at individual study sites for the actual dates of embryogenesis for *A. canorus* during our field study and for the estimated dates for embryogenesis during years outside our field study.

2.6.5. Relations of observed Anaxyrus canorus embryo mortality to daily minimum air temperatures from 1998 through 2001

Analysis — For our study sites where we assessed dates when *A. canorus* deposited the most egg masses across years and where we also measured embryo mortality among masses, we conducted a Spearman rank test using Origin Pro to test whether the median mortality across sites was associated with the median daily minimum air temperature for a standardized five-night embryo-development period across sites. This resulted in us assessing these relations across lower-, mid-, and higher-elevation sites from 1998 through 2001. We adjusted the daily minimum temperatures measured at the DAN station (based upon our algorithm described in § 2.6.4) for this analysis.

2.6.6. Estimated freezing potential for Anaxyrus canorus embryos (1986–2015)

To evaluate whether our field observations of freezing potential and effects from 1996 to 2001 might have been unusual in a broader temporal context, we estimated the freezing potential for *A. canorus* embryos during years before and after our field study.

Analysis — Snow-off data were available from 1986 to 2015, although not for 1988 and 1995. We used the relation we had calculated between the timing of snow-off and peak egg-mass deposition (§ 2.6.2 and 3.6.2) to estimate annual peak deposition dates for the years outside our field observations. We obtained the snow-off dates from quality-controlled measurements made at DAN and supplemented them with satellite-derived snow-off data when DAN data were not available (2007–2009; § 2.6.1). We then used the estimated dates (and actual dates for the years for which we had field observations) to extract minimum air temperatures from the DAN data archive for a standardized five-night period of embryogenesis, beginning one day prior to the date we estimated for peak deposition. We adjusted the daily minimum DAN temperatures per the constant we derived from coincidental differences in such temperatures between DAN and what we measured *in-situ* during our field study (§ 2.6.4 and 3.6.4).

3. Results

3.1. Study area and study wetlands

Snowmelt and subsequent *A. canorus* breeding typically began earliest at wetlands that were lowest in elevation within our study area, followed sequentially by such events at wetlands at mid- and then the highest elevations. Due mostly to the year when we discovered individual breeding sites and their locations relative to other sites, not due to a randomized selection process, we studied nine such wetlands more repeatedly than others within and across seasons. As a result, we report more results pertaining to sites C1, TC, C3, C5 (2862–2882 m [lower elevation]), C9, C9a, C10 (2991–2997 m [mid-elevation]), and C15 and C16 (3020–3023 m [higher elevation]) than to other sites. These nine sites largely spanned the elevation range across our intensive study area.

3.2. Surveys

3.2.1. Breeding phenology

During our field study, *A. canorus* bred in May, June, and July very soon after snow melted (Fig. 3). Snow melted soonest at the lower-elevation sites and, in turn, breeding occurred earliest at those sites compared with the mid- and upper-elevation sites (Fig. 3). Our breeding-phenology data suggest a potential trend of snow-off occurring earlier over time (Fig. 3), but this was not evident when we considered the years prior to and after our field work (§ 3.6.1). Late breeding in 1998 occurred because *El Nino* conditions resulted in substantially more snow that winter, which melted weeks later than we observed in other years (Fig. 3).

3.2.2. Depths of egg masses (Anaxyrus canorus and Pseudacris regilla)

A. canorus mostly deposited their long strings of zygotes in uneven individual clumps on the sediments at our study sites, or on decaying vegetation and detritus lying atop the sediments, in small pockets of shallow water (Fig. 4). Though lying on or very near the bottom of the wetland, the tops of these masses almost always were near the surface of the water (Fig. 4). In contrast, *P. regilla* mostly deposited their considerably smaller masses in deeper water (Fig. 4b and c) by attaching them (often in uneven elongated cylindrical shapes) to parts of emergent vegetation still standing in the water column from the previous season. This preference for deeper water resulted in *P. regilla* masses usually being farther away from the bottom of the wetland and from the water's surface than we observed for *A. canorus* (Fig. 4). This preference also resulted in us not observing *A. canorus* and *P. regilla* breeding in many of the same wetlands, except where deeper pooled water occurred adjacent to the shallower waters where the toads bred. Most *P. regilla* breeding happened soon after peak *A. canorus* breeding had occurred.

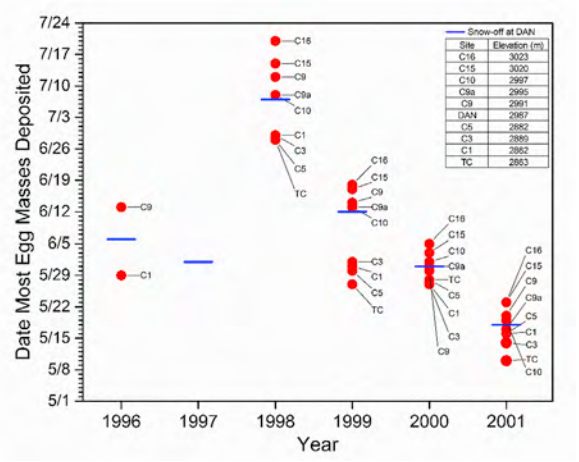

Fig. 3. Dates of peak egg-mass deposition and the relative breeding phenology for *Anaxyrus canorus* across our intensive study sites in Yosemite National Park from 1996 to 2001. DAN was an automated weather station located in Dana Meadows (Western Regional Climate Center, 2018), nearest to the sites in the middle of the elevation range. Note that we did not assess deposition dates for all sites during all years of this study. A strong *El Nino* event during the winter months of 1997/1998 caused an unusually large quantity of snow and late snowmelt during the 1998 season.

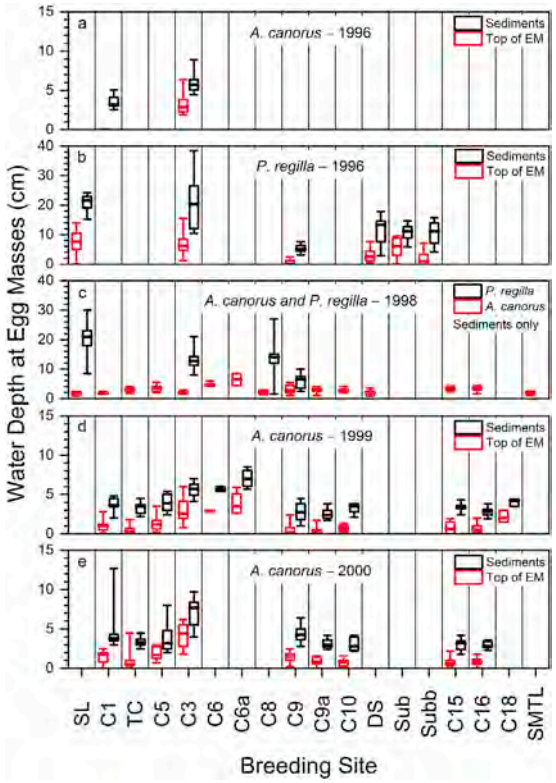

Fig. 4. Summaries of depths from the water's surface to the sediments and to the top of egg masses at the locations where individual egg masses were laid in various study sites in Yosemite National Park and the Inyo National Forest across years. *A.* = *Anaxyrus*, *P.* = *Pseudacris*, and EM = egg mass. The individual boxes contain the middle 50% of the data. Horizontal lines within boxes indicate the median. Whiskers extend to the maximum and minimum values for egg masses at each site. Note the different scales for y-axes among graphs.

3.2.3. Hatching success

We measured hatching success in variable numbers of egg masses of *A. canorus* and *P. regilla* across years (Table S2). Embryo mortality was common for *A. canorus* and often substantial in some egg masses, especially at our lower-elevation study sites (TC, C1, C3, and C5; Fig. 5). Hatching success at these lower sites was significantly different (Mann-Whitney test results: $U = 21618$; $Z = 11$; p-value $= < 1^{-14}$) from success at our mid- and higher-elevation study sites (C9, C9a, C10, C15, and C16) across years (with data from the outlier year of 1998 excluded). Note that such mortality was comparatively lower across all sites during the *El Nino* year of 1998 (Fig. 6), when breeding occurred considerably later than in the other years (Fig. 3), and across mid- and higher-elevation sites especially in 2001 (Fig. 6).

In general, we regularly observed lower mortality among *P. regilla* embryos relative to *A. canorus* embryos at breeding sites across our study area. We observed such relations at the study sites we describe here except at C3 in 1996 and Sub in 1997 (Fig. 6). Approximate 95% confidence intervals for median hatching success for both species at C3, C9, and DS in 1996 and SL, C3, and C9 in 1998, indicated that hatching success for *A. canorus* was lower except at C3 in both years (Fig. S1). The confidence intervals overlapped at C3 for each year, but especially 1996. Most, if not all, of this mortality appeared to be due to substantial numbers of predatory flatworms feeding on the embryos unusually early in development. The basin of C3 contained a section of deeper water that was unlike most other breeding sites for *A. canorus* in our study area. *P. regilla* deposited their egg masses in portions of this deeper water (Fig. 4). We hypothesized that this deeper portion of C3 could have retained water throughout the fall and winter. If that occurred, the flatworms might not have had to overwinter as eggs, allowing them to access and eat *P. regilla* embryos earlier in the spring than at other sites with discontinuous hydroperiods.

While assessing embryo mortality in individual *A. canorus* egg masses, we typically described whether embryos died during the early, middle, or late stages of embryo development (more or less prior to stage 13, from stages 13–16, or from stage 17 on, respectively, according to Gosner [1960]) based upon visual approximations with the naked eye. For example, results from 1999 to 2001 show that egg masses that contained dead embryos practically always contained embryos that had died early in development, regardless of whether other embryos in that mass died later in development, and that the numbers of egg masses with mortality at each stage varied by site and year (Fig. 7). Embryos that died during the middle or late stages of development were less common during 1999 compared with 2000 and 2001 (Fig. 7).

3.2.4. Presence and relative abundance of Saprolegnia diclina and predatory flatworms on Anaxyrus canorus egg masses

We visually and qualitatively assessed the relative quantities of *S. diclina* and flatworms on embryos and egg masses of *A. canorus* at breeding sites TC, C1, C3, C5, C9, C9a, C10, C15, and C16 in 2001 and tested for associations between them and embryo mortality, site elevation, and the median daily minimum air temperatures during embryo development (§ 2.2.5 and 2.6.5). Across all nine sites, we observed *S. diclina* on all egg masses we examined except one (Fig. 8a). *S. diclina* was present in low to moderate quantities on most egg masses and embryo mortality varied from low to high across those masses (Fig. 8a). We observed high quantities of *S. diclina* on some egg masses at C1 and TC (Fig. 8a), sites lower in elevation with relatively lower daily minimum air temperatures and higher embryo mortality (Fig. 9a–c).

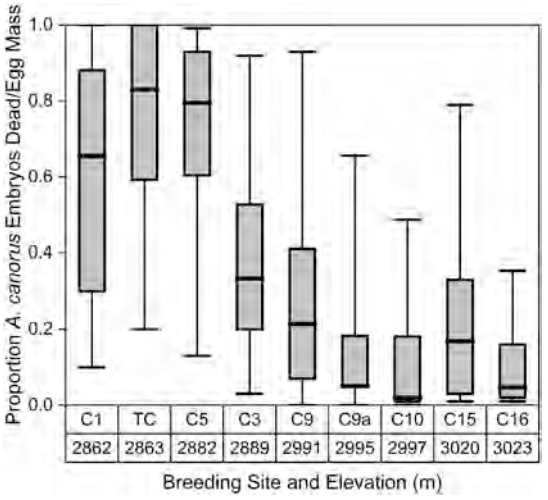

Fig. 5. Boxplots of the proportion of embryos of *Anaxyrus* (*A.*) *canorus* per egg mass that were dead by study site (Yosemite National Park) for 1996, 1997, 1999, 2000, and 2001 and the elevation (World Geodetic System of 1984) of the site. We only included sites where we assessed mortality during more than one year. We also did not include any data from 1998 because it was an *El Nino* year and an outlier in terms of when breeding occurred (Fig. 3) and warmer daily minimum temperatures during embryo development. The proportions of embryos that were dead per egg mass across the lower-elevation sites (<2900 m) were significantly different than proportions for the higher-elevation sites (>2900 m) across all years (via a Mann-Whitney test at $\alpha = 0.05$). Boxes include the middle 50% of the data. Thick lines within the boxes indicate the median value and whiskers extend to the maximum and minimum values.

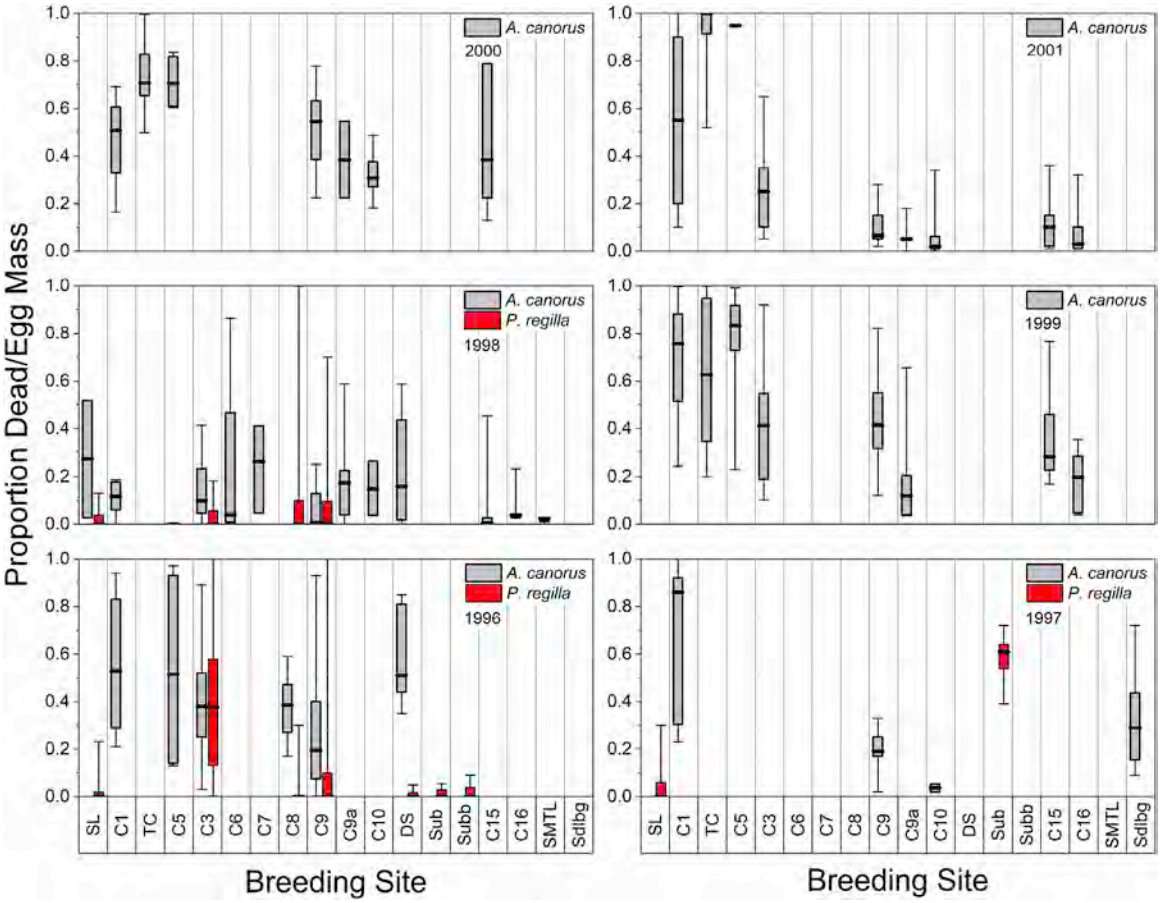

Fig. 6. Boxplots of embryo mortality among egg masses of *Anaxyrus* (*A.*) *canorus* and *Pseudacris* (*P.*) *regilla* measured *in situ* at various breeding sites in Yosemite National Park and the Inyo National Forest by year. Boxes include the middle 50% of the data. Thick lines within the boxes indicate the median value and whiskers extend to the maximum and minimum values.

We observed flatworms on fewer egg masses than *S. diclina*, especially at the sites higher in elevation, sites that also tended to have relatively higher daily minimum air temperatures during embryogenesis and lower embryo mortality in 2001 (Figs. 8b and 9). When present, flatworms occurred in low to moderate numbers on most egg masses and embryo mortality varied from low to high across those masses. Relative flatworm abundance was highest on a subset of the egg masses at sites C1, TC, and C5, as was embryo mortality (Fig. 8b). *S. diclina* was present in relatively high quantities on several of those same egg masses (Fig. 8a).

Embryo mortality across all nine sites was moderately associated with the relative abundance of *S. diclina* and of flatworms (Table 1). Embryo mortality similarly was associated with site elevation and median daily minimum air temperatures (during embryogenesis) (Table 1). Such air temperatures increased with elevation (Fig. 9b), whereas embryo mortality decreased with elevation (Fig. 9c) and warmer median minimum air temperatures (Fig. 9a). Overall, site elevation was strongly associated with median minimum air temperatures, moderately associated with embryo mortality, and less strongly associated with the relative abundance of *S. diclina* or of flatworms on egg masses (Table 1).

3.3. Field test of effects of enclosing embryos on hatching success – 1999

At $\alpha = 0.05$, significantly fewer embryos died across sites among those we enclosed and moved to slightly deeper water compared with those we left unenclosed in their original position (Mann-Whitney test – $U = 225.5$, $Z = 3.7$, p-value $= 2.5^{-4}$; Fig. 10).

3.4. Egg-mass translocation experiment – 2000

Significantly more embryos hatched among the portions of egg masses we translocated to moderately deeper water than those we left in their original position, except at C9 (Mann-Whitney test – $U = 592.0$, $Z = 3.3$, p-value $= 1.1^{-3}$) (Fig. 11). The

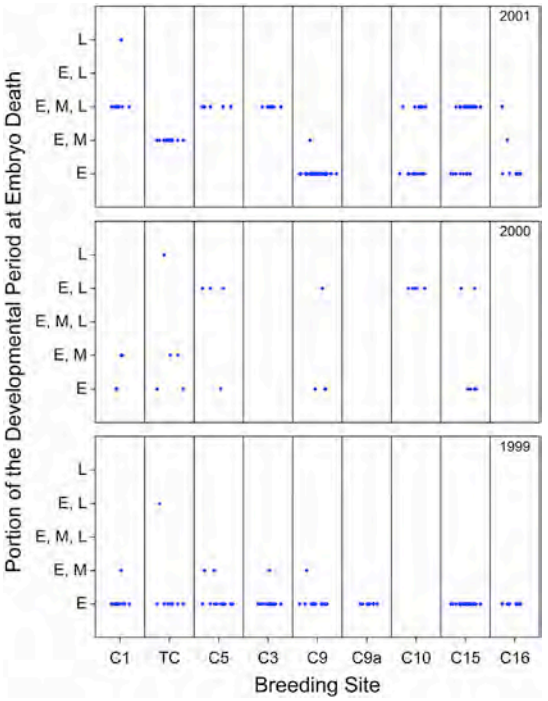

Fig. 7. The portion of the developmental period when embryos of *Anaxyrus canorus* died within individual egg masses across study sites in Yosemite National Park from 1999 to 2001. Each symbol represents one egg mass. Note that overlap exists among symbols that obscures some symbols for some sites and years. E, M, and L = early, middle, and late stages of development, respectively, based upon Gosner (1960). Each egg mass could contain embryos that had died during any or all portions of the development period. Early embryo mortality was associated with exposure to freezing. Medium and late mortality typically were induced by *Saprolegnia diclina* and/or predatory flatworms. Embryo mortality within a single egg mass could be due to any of these factors. Note that these data provide no information regarding the proportion of dead embryos within each egg mass.

embryos in the translocated portions were farther away from the water's surface (Table S1) and potential ice formation. These results were similar to more embryos hatching when we enclosed them and moved them to slightly deeper water compared with those left in their original position (§ 3.3) and further suggest that reducing freezing potential increased hatching success.

Freezing appeared to have killed some of the more exposed embryos early in development. We also observed *S. diclina* and flatworms killing more developed embryos in various parts of egg masses. Together, *S. diclina* and the flatworms (mostly at lower elevation sites) killed substantial numbers of older embryos in some egg masses, often the same ones. Our observations during this experiment, in the light of all our results to that point in time, provided us important insights into how freezing, *S. diclina*, and flatworms interacted variously to kill *A. canorus* embryos at our study sites.

The high mortality for the translocated embryos at C9 appeared to be related directly to temperature. We used the temperature loggers described previously to measure water temperatures alongside the egg-mass portions we left in their original positions and alongside those we translocated. The median maximum daily water temperature among the translocated portions in C9 during the experiment was 14.9 °C colder than the median maximum daily water temperature among the portions in their original locations within C9 (16.9 and 31.8 °C, respectively), a difference that was substantially greater than such differences at other sites. For example, such temperatures only differed by 1.3 °C (28.7 and 30.0 °C, respectively) at C1. Median water depths for the translocated egg-mass portions in C9 were only slightly deeper than such depths for translocated portions at the other sites (Table S1), but C9 had substantially deeper waters near the relatively shallow waters to which we had moved the translocated portions. Presumably those deeper waters kept the adjacent shallower waters colder than we expected. Those cold temperatures appeared to inhibit embryo development rates, as embryos among translocated portions of some egg masses at C9 died early in development, whereas others developed to mid- to later stages but were not able to hatch before *S. diclina* infected and killed them.

3.5. Laboratory test of effects of exposure to ice on hatching success

Mortality among *A. canorus* embryos was approximately proportional to the level of exposure to ice in this experiment (Fig. 12). Although exposure even to slush increased mortality, some embryos survived being encased in ice for 30 and 60 min. These results suggested that exposure to varying ice conditions in the field could induce different levels of embryo mortality within and among egg masses and that freezing severity and duration of exposure could be important determinants of such mortality within and across breeding sites.

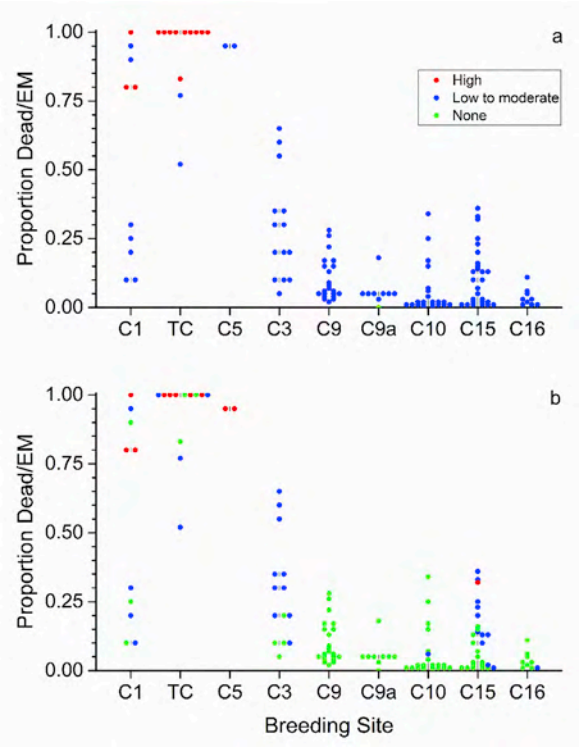

Fig. 8. Estimated proportions of dead embryos of *Anaxyrus canorus* per egg mass (EM) compared with the relative estimated abundance (high, low to moderate, and none, as defined in § 2.2.5) of (a) *Saprolegnia diclina* and (b) predatory flatworms for individual egg masses we sampled at breeding sites in Yosemite National Park in 2001. Each symbol represents one egg mass. The symbols in graphs a and b represent the same individual egg masses (and the same egg masses depicted in Fig. 9a).

3.6. Measurements of climate variables during Anaxyrus canorus breeding and embryogenesis

3.6.1. Measurements of snow-off 1981 to 2018

From 1981 to 2018, annual snow-off dates at DAN varied from early May to mid-July. June 1 was the median snow-off date (95% confidence interval = May 19 to June 6) and no consistent long-term patterns were apparent across all years (Fig. 13). Strong *El Ninos* drove substantial precipitation into the Sierra Nevada during the winter months of 1982/1983 and 1997/1998, which caused the latest recorded snow-off date to occur during 1983 and the second latest during our 1998 field season (Fig. 13).

3.6.2. Relation of the timing of snow-off to the timing of peak egg-mass deposition

We assessed median peak egg-mass deposition dates across years of our field study for *A. canorus* breeding sites that we assigned to either lower-, mid-, or higher-elevation categories. Based upon comparisons of these deposition dates with snow-off dates recorded at DAN, annual peak egg-mass depositions at our lower-elevation study sites (TC, C1, C3, and C5) typically occurred eight days earlier than the snow-off date at DAN. Peak depositions at the mid-elevation sites (C9, C9a, and C10), which were nearest to DAN, typically occurred one day after snow-off at DAN, whereas annual peak depositions at the higher-elevation sites (C15 and C16) typically occurred five days after snow-off was recorded at DAN.

3.6.3. Measurements of temperatures at individual study sites

At the sub-alpine elevations of our study sites, air temperatures during *A. canorus* breeding and embryogenesis typically swung between relatively disparate cold minimums and warm maximums over the course of 24 h (e.g., Fig. 14). Water-temperature dynamics tracked those of air temperatures closely (Fig. 14) in the shallow waters where the toads deposited their egg masses (Fig. 4). In the water column alongside *A. canorus* egg masses, minimum and maximum daily temperatures near the surface (alongside embryos in the top layer of those egg masses) often were colder and warmer, respectively, than temperatures near embryos in the bottom layers of the same egg masses (Fig. 14), which were lying on the sediments or on top of decaying vegetation just above the sediments.

Our measurements *in situ* from 1999 to 2001 showed that overnight air temperatures often fell below 0 °C during breeding and embryo development, more so at our lower- and mid-elevation study sites during 1999 and 2001 than at our higher-elevation sites (Fig. 15). During infrequent overnight visits we made to some of our more accessible lower-elevation

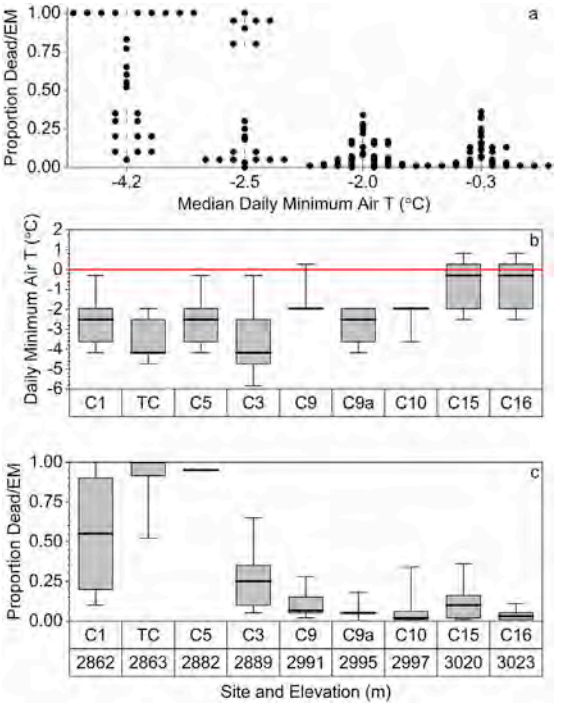

Fig. 9. (a) Estimated proportions of dead embryos of *Anaxyrus canorus* per egg mass (EM) sampled relative to the median daily minimum air temperatures (T) during a standardized five-day embryo-development period for nine breeding sites in Yosemite National Park in 2001. (b) Daily minimum air temperatures during the same five-day period. (c) Proportion of dead embryos per site relative to the elevation (World Geodetic System of 1984) of each site. These are the daily minimum temperatures recorded at the Dana Meadows (DAN) weather station near these sites that we adjusted to reflect the differences between DAN temperatures and temperatures we sampled *in situ* at breeding sites (see § 2.6.4 and 3.6.4). Each symbol in figure a represents a single egg mass and these masses are the same as those in Fig. 8. Boxes in figures b and c include the middle 50% of the data. Thick lines within the boxes indicate the median value and whiskers extend to the maximum and minimum values.

Table 1
The results of Spearman rank tests for associations between embryo mortality in *Anaxyrus canorus* and environmental factors potentially related to such mortality across nine study sites in Yosemite National Park in 2001. Numbers in parentheses are *p*-values (whereby $1.74^{-14} \equiv 1.74 \times 10^{-14}$, e.g.).

	Proportion of dead embryos	Site elevation	Adjusted median minimum temperature	Relative abundance of *Saprolegnia diclina*	Relative abundance of flatworms
Proportion of dead embryos	1	−0.614 (1.74^{-14})	−0.525 (2.43^{-10})	0.535 (8.96^{-11})	0.608 (3.45^{-14})
Site elevation	−0.614 (1.74^{-14})	1	0.890 (1.47^{-44})	−0.448 (1.26^{-7})	−0.349 (5.86^{-5})
Adjusted median minimum temperature	−0.525 (2.43^{-10})	0.890 (1.47^{-44})	1	−0.398 (3.68^{-6})	−0.312 (3.60^{-4})
Relative abundance of *Saprolegnia diclina*	0.535 (8.96^{-11})	−0.448 (1.26^{-7})	−0.398 (3.68^{-6})	1	0.406 (2.19^{-6})
Relative abundance of flatworms	0.608 (3.45^{-14})	−0.349 (5.86^{-5})	−0.312 (3.60^{-4})	0.406 (2.19^{-6})	1

breeding sites during embryogenesis, we observed surface ice covering all or portions of the wetlands in association with freezing air temperatures. The duration, extent, and thickness of overnight ice appeared to vary with the magnitude and duration of freezing temperatures (WS pers. obs.). We observed ice persisting until the rising sun warmed temperatures.

We also observed surface ice in contact with the top layers of *A. canorus* egg masses as well as ice encasing parts or all of egg masses when the ice was thick enough. These observations aligned well with the embryo mortality we often saw that occurred early in development and typically near or at the top of egg masses and that varied in extent within and among egg masses. In 2000, when overnight temperatures were relatively cold during embryo development across sites regardless of elevation category (Fig. 15), we observed thick ice at site TC (lower elevation) that froze some egg masses extensively such that those masses and dead embryos floated to the surface when the wetland thawed after sunrise. In contrast, we observed that freezing air temperatures froze embryos directly at some other lower-elevation sites when overnight freezing caused water levels to drop temporarily, most obviously by halting the influx of snowmelt that sustained those water levels (e.g., wet meadows on a slight slope) directly via runoff, thereby exposing embryos to freezing air temperatures.

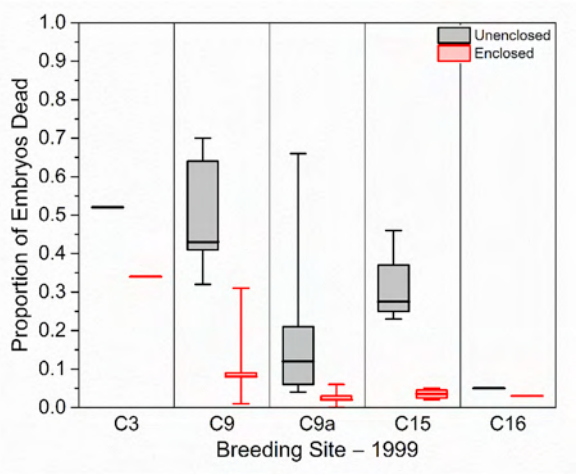

Fig. 10. Mortality among *Anaxyrus canorus* embryos that we either left unenclosed in their original location or placed in enclosures near the original position at five study sites in Yosemite National Park. Boxes include the middle 50% of the data. Thick lines within boxes indicate the median value. Whiskers extend to the maximum and minimum values.

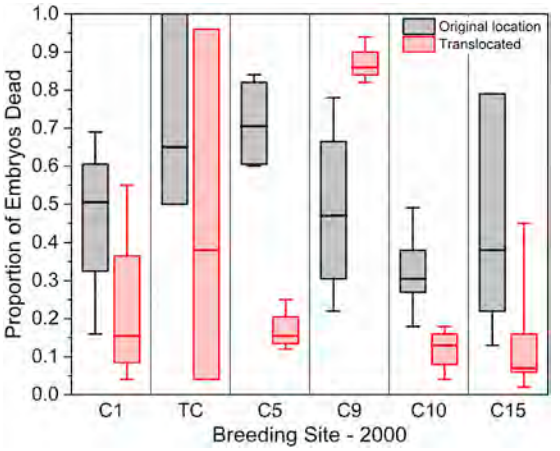

Fig. 11. Mortality among *Anaxyrus canorus* embryos that we either left in their original location or translocated to deeper water across five study sites in Yosemite National Park in 2000. Boxes include the middle 50% of the data. Thick lines within boxes indicate the median value. Whiskers extend to the maximum and minimum values.

3.6.4. Calibrations of DAN temperature data using in-situ measurements of air temperature

Daily minimum air temperatures recorded at the DAN weather station typically were warmer than those we measured at our study sites (Figs. 16–18). This might have been due to DAN's location within an area of trees with potentially less convective cooling overnight than occurred in the more open meadows that surrounded several of our study sites. Regardless, these differences required that we adjust DAN temperature data prior to using them to assess daily minimum temperatures at our study sites within and across breeding seasons.

We calculated a constant of −3.07 °C (±0.31 °C for a 95% confidence limit) for adjusting DAN minimum temperatures. This adjustment represented the median difference between the daily minimum temperatures recorded at DAN and those we measured coincidentally across our intensive study sites from 1999 to 2001 when the latter measurements were above the minimum detection limits of the temperature loggers.

3.6.5. Relations of observed Anaxyrus canorus embryo mortality to daily minimum air temperatures from 1998 through 2001

Results from a Spearman rank test showed that the median *A. canorus* embryo mortality across sites from 1998 through 2001 was relatively strongly associated with the median of the daily minimum air temperatures during the embryo-development period across sites ($n = 11$, correlation coefficient $= -0.770$, p-value $= 5.6^{-3}$).

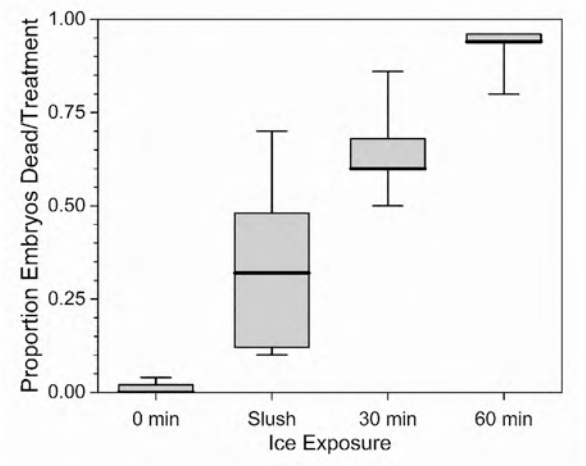

Fig. 12. Mortality among *Anaxyrus canorus* embryos that we exposed to ice during a laboratory experiment we conducted at the Sierra Nevada Aquatic Research Laboratory in 2000. Slush equaled 15 min of exposure to ice as particles in a slush solution that did not freeze completely, whereas embryos were exposed to water that was not frozen at all (0 min) or was completely frozen, to the naked eye, for 30 or 60 min in the other treatments. Boxes include the middle 50% of the data. Thick lines within boxes indicate the median value. Whiskers extend to the maximum and minimum values.

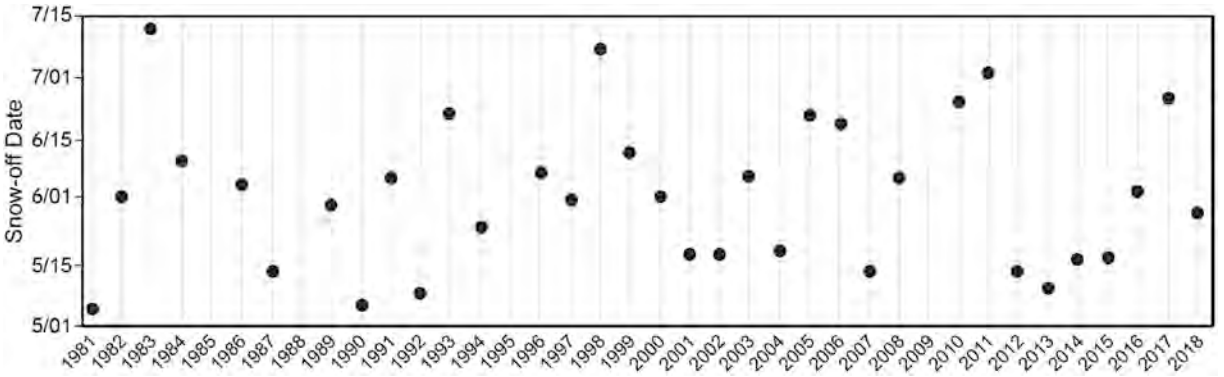

Fig. 13. Snow-off dates based upon data from the snow-pillow site at the weather station in Dana Meadows (DAN) in Yosemite National Park (Lundquist et al., [2016b]; California Department of Water Resources, [2018]), augmented with snow-presence data generated by satellite sensors when snow-pillow data were compromised from 2007 to 2009 (product MOD10A1.005, see Riggs et al., [2006]), or unavailable in 2018 (product MOD10A1.006, see Riggs et al., [2016]).

3.6.6. Estimated freezing potential for Anaxyrus canorus embryos (1986–2015)

A. canorus is well-known to breed immediately after snowmelt (FWS, 2014). If the timing we observed during our field study was similar to what occurred during non-study years from 1986 to 2015, results from our assessment indicate the potential could have been high for embryos to be exposed to substantial freezing during most of those years, but especially beginning in 1997 (Fig. 19). These results further indicate freezing potential might have increased during most of the years after our field study ended in 2001 (Fig. 19). Our field and laboratory work indicated that the extent and duration of freezing was important to embryo survival (e.g., § 3.2.3, 3.2.4, 3.5, and 3.63), especially early in embryogenesis. Thus, the daily minimum temperatures we estimated for our field sites during non-study years suggest that freezing potential could have been lower at the higher-elevation sites across most years and it appears those sites might have been the only sites to avoid freezing air temperatures in any year beyond 1998 (Fig. 19). In addition, it appears higher- and mid-elevation sites tended to have minimum air temperatures closer to zero than did lower-elevation sites in years when all sites had sub-zero temperatures (Fig. 19), which indicates the potential for more extensive freezing at the lower-elevation sites.

4. Discussion

4.1. Distribution and relative abundance of Anaxyrus canorus within our study area

We observed small numbers of adult *A. canorus* breeding at our study sites. Despite previous reports of greater abundance in the general area in the past (FWS, 2014), the numbers we observed, and subsequent reports of low abundance among other

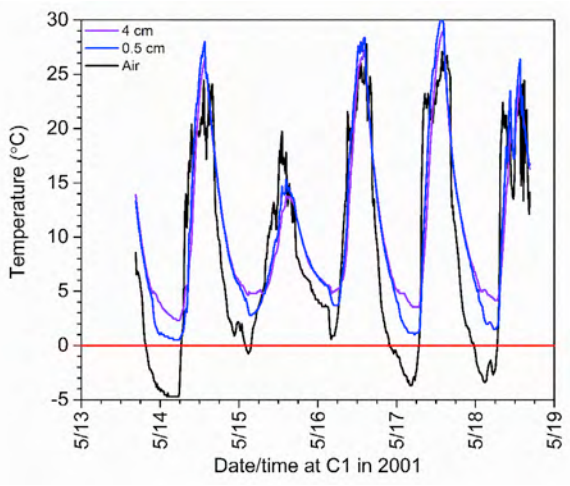

Fig. 14. Temperatures measured in air and in the water column during embryogenesis at breeding site C1 in Yosemite National Park in 2001. We measured the water temperatures at 0.5 cm and 4 cm below the water's surface alongside an egg mass of *Anaxyrus canorus*. Major ticks on the x-axis are at midnight and minor ticks occur in 6-h increments.

populations and years (FWS, 2014), illustrated the vulnerability of *A. canorus* to becoming endangered and underpin why the U.S. Fish and Wildlife Service listed the species as threatened throughout its range in 2014 under the U.S. Endangered Species Act (FWS, 2014).

We did not commonly observe dead adult or other post-metamorphic age classes of *A. canorus* throughout this study and such numbers were small and inconsistent across breeding sites when we did. However, we commonly observed widespread embryo mortality across sites, which could have contributed to limited abundance by reducing potential recruitment. In contrast, we observed high hatching success (e.g., Fig. 6) and impressive abundance for *P. regilla* adults at breeding sites in our study area. *P. regilla* occurred throughout this area, but females typically deposited their egg masses in deeper waters than did *A. canorus* (Fig. 4). Our measurements of pH and conductivity (data not shown) indicated that basic water chemistry did not differ among study sites in any meaningful way, suggesting to us early on that overnight freezing and/or UV-B radiation could have been responsible for the mortality we observed among *A. canorus* embryos, especially given the shallow waters in which females deposited their egg masses (Fig. 4). Furthermore, the potential severity of effects from freezing or UV-B could have been exacerbated at such high elevations. However, our tests for effects of UV-B on hatching success were negative (Appendix A).

4.2. Effects of freezing, Saprolegnia diclina, and a predatory species of Turbellaria

In contrast, our field and laboratory results demonstrated that annual weather conditions, interacting with a water mold (*S. diclina*) and a predatory species of flatworm (*Turbellaria* spp.), were responsible for most of the embryo mortality we observed among egg masses of *A. canorus*. We also observed mortality due to damage from competing males attacking breeding pairs in amplexus while egg-mass deposition was occurring, from embryos being buried deep in the middle of egg masses and sometimes covered with sediments, and from damage due to hailstorms, but these events occurred far less frequently. Thus, we believe our data provide important insights into how climate, interacting with disease and predation, can and has affected fitness, reproduction success, and the abundance of *A. canorus* over time and likely will in the future. These data illustrate mechanisms whereby changes in climate could affect similar dynamics and ultimately population persistence for other amphibian species as well and suggest the widespread potential for additive effects from multiple environmental factors on amphibian populations (Hof et al., 2011).

4.2.1. Freezing

For amphibian species that breed early after snowmelt, embryos can be vulnerable to exposure to cold temperatures and ice (Bragg, 1940; Schechtman and Olson, 1941; Douglas, 1948; Karlstrom, 1962; Herreid II and Kinney, 1967; Berven, 1982; Frisbie et al., 2000). Such embryos are known to vary in tolerance to cold and freezing (Moore, 1939; Schechtman and Olson, 1941; Douglas, 1948; Frisbie et al., 2000), but they typically cannot survive freezing temperatures or ice exposure for long (Moore, 1939; Douglas, 1948, but see Frisbie et al., 2000). In our study area, *A. canorus* bred at high-elevation sites very early after snowmelt (Fig. 3) and, importantly, in remarkably shallow water (Fig. 4), a relatively unique combination **(**Karlstrom, 1962; Dodd, 2013**)** that intrinsically posed potential temperature and freezing challenges for embryos.

As described in § 3.6.3, overnight temperatures (e.g., Figs. 15–19) were sufficiently cold throughout our study years and beyond for ice to form on *A. canorus* breeding sites during embryogenesis, similar to what Karlstrom (1962) observed during breeding at an *A. canorus* site (approximately 2743 m) on May 27, 1954, and what Frisbie et al. (2000) described at an early

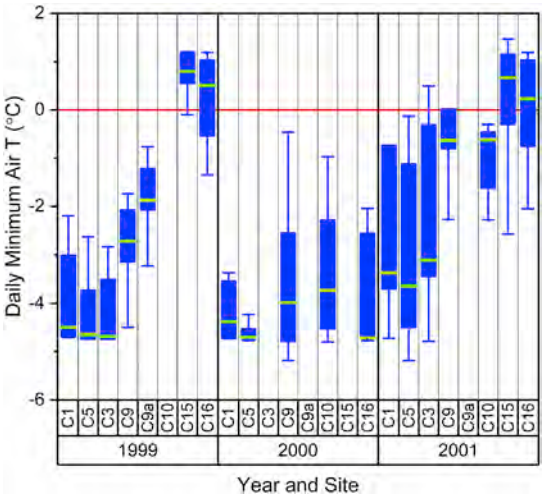

Fig. 15. Boxplots of daily minimum air temperatures we measured *in situ* over five-night intervals during embryogenesis for *Anaxyrus canorus* at eight breeding sites in Yosemite National Park from 1999 to 2001. The boxes include the middle 50% of the data, with the whiskers extending to the maximum and minimum data values. Green lines indicate median values. Data are missing for some sites and years because we did not measure air temperature with loggers at all sites in all years. Elevations of these sites increase from left to right on the x-axis (see Fig. 5). C1, C3, and C5 were lower-elevation sites. C9, C9a, and c10 were mid-elevation, and C15 and C16 were higher in elevation. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

breeding site for *Lithobates sylvaticus* (wood frog) in Kentucky. However, although ice formation likely is a common phenomenon in many areas with cold winters and early spring breeders, potential exposure of amphibian embryos to freezing appears to be underreported in the literature.

The frequency and magnitude of overnight freezing temperatures during embryogenesis varied by site and year (Figs. 15–19). Such variation naturally would have directly influenced the extent and duration of any overnight ice formation and, in turn, any freezing damage incurred by exposed embryos. However, we concluded that the location, timing, and extent of ice formation on breeding sites were not easy to predict, even within a site. At the least, the magnitudes of high and low daily air temperatures, a wetland's daily water volumes, the depths where individual egg masses were deposited, the physical structure and orientation of the site and associated solar warming and convective cooling, the heat capacity of sediments and vegetation in shallow areas, and patterns of snowmelt and water flow all appeared to have the potential to affect these dynamics.

Freezing potential was particularly high for *A. canorus* embryos that were positioned near the tops of the typically clumped embryos of individual egg masses, which usually were deposited separately from other masses on the substrate in shallow water (Fig. 4). Such deposition sites put the uppermost embryos especially close to the water's surface (Fig. 4), where they were exposed to overnight surface-ice formation, or freezing air temperatures when water levels receded as inflows from melting snow to wetlands froze (§ 3.6.3). Our laboratory results showed that young *A. canorus* embryos died in proportion to the extent and duration of exposure to ice, including slush for 15 min (Fig. 12), not unlike *L. sylvaticus* embryos that Frisbie et al. (2000) tested for tolerance to cold temperatures and ice exposure. Our laboratory results also showed that cold water temperatures (2 °C) did not affect hatching success, in contrast to effects others have reported after exposing amphibian embryos to cold temperatures (e.g., Moore, 1939). In support of our laboratory results, data from the field enclosure experiment in 1999 and from the translocation experiment in 2000 showed we reduced mortality *in situ* when embryos were less likely to be in contact with surface ice (Figs. 10 and 11). We also observed reduced mortality after we enclosed embryos during our UV-B field experiments in 1996 [C3 and C9] and 1998 [C3] (Appendix A), during which we also had reduced potential exposure to ice. In contrast, we observed substantial mortality among some portions of unenclosed egg masses we had moved to deeper water, and thereby reduced the potential for freezing, at TC and C1 during our field translocation experiment in 2000 (Fig. 11). Most of that mortality at TC was early in development and due to apparent freezing in association with cold overnight temperatures. However, the mortality at C9 occurred later in development and was due to *S. diclina*, suggesting that the colder, but not freezing, water might have retarded embryo development sufficiently to provide *S. diclina* time to spread through the egg mass before embryos could hatch.

The dynamic relations among freezing air temperatures, ice formation, and potential for freezing damage to *A. canorus* embryos aligned well with the mortality we routinely observed among *A. canorus* embryos that were located near the tops of egg masses and while they were early in embryogenesis (Fig. 7). Presumably this was due to freezing-induced physical disruption of protective egg jellies and membranes and freezing of embryo tissues and fluids themselves, particularly when in contact with ice (Frisbie et al., 2000). For comparison, Beattie et al. (1991) hypothesized that their field observations of mortality early in the development of *R. temporaria* (European frog) embryos might have been due to exposure to cold temperatures and/or to toxic metal ions but could not differentiate between the two.

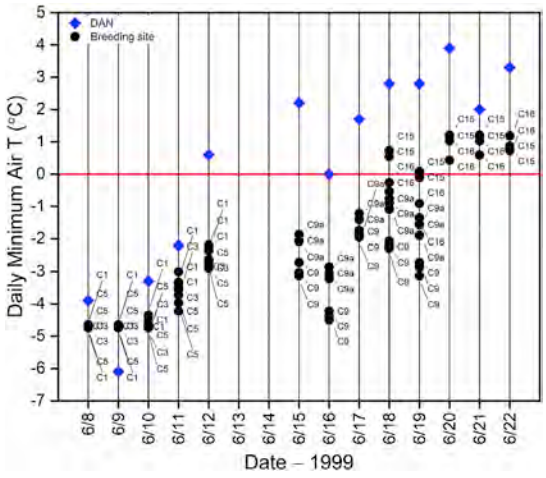

Fig. 16. Daily minimum air-temperatures we measured with temperature loggers at individual breeding sites in Yosemite National Park during embryogenesis for *Anaxyrus canorus* in 1999 compared with coincidental daily minimum air-temperature measurements recorded at the weather station in Dana Meadows (DAN) (Western Regional Climate Center, 2018) in Yosemite National Park. Note that the temperature loggers were limited to measuring temperatures > approximately −4.6 °C (varied with the logger). Thus, minimum air temperatures occasionally were colder than what the loggers could measure accurately (e.g., 6/8 through 6/10).

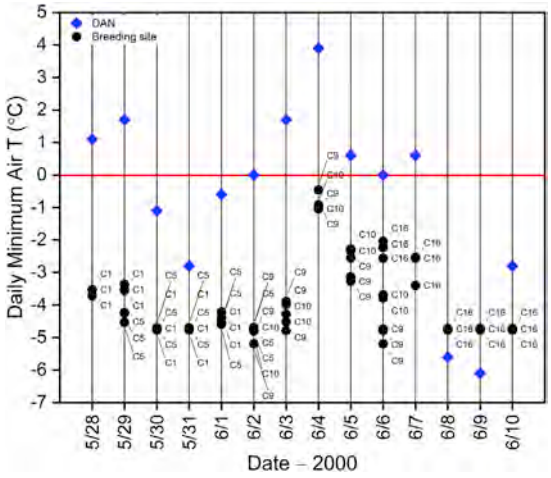

Fig. 17. Daily minimum air-temperatures we measured with temperature loggers at individual breeding sites in Yosemite National Park during embryogenesis for *Anaxyrus canorus* in 2000 compared with coincidental daily minimum air-temperature measurements recorded at the weather station in Dana Meadows (DAN) (Western Regional Climate Center, 2018) in Yosemite National Park. Note that the temperature loggers were limited to measuring temperatures > approximately −4.6 °C (varied with the logger). Thus, minimum air temperatures occasionally were colder than what the loggers could measure accurately (e.g., 5/30, 5/31, 6/2, 6/6, and 6/8 through 6/10).

Our observations that substantial mortality often occurred early in embryogenesis were telling. Freezing temperatures sufficient to induce ice formation were not necessarily limited to the first night of *A. canorus* embryo development (e.g., Figs. 16–18) and potentially could have induced freezing damage to embryos in later stages during our field study or, hypothetically, during the years before and after our study as well (Fig. 19a). However, embryos in the earliest stages of development appeared to be most vulnerable based upon their physical structure. Also, tolerance to freezing has been shown to increase with development in other species, such as *L. sylvaticus*, with embryos in the earliest stages of cleavage being most susceptible (Herreid II and Kinney, 1967). Increasing tolerance could be due to the expanding volume of the egg capsules and jelly over time (Bragg, 1940) and the increasing cellular and structural complexity of the developing embryo (Gosner, 1960). Regardless of any such mechanisms, given we did not observe *S. diclina* and predatory flatworms killing embryos in such early developmental stages and that the mortality we observed later in development typically was associated with *S. diclina* and the flatworms (following sections), exposure to freezing during the first night or two of embryogenesis appeared to have induced widespread (Fig. 7) and substantial embryo mortality among many *A. canorus* egg masses across sites and years (Fig. 6).

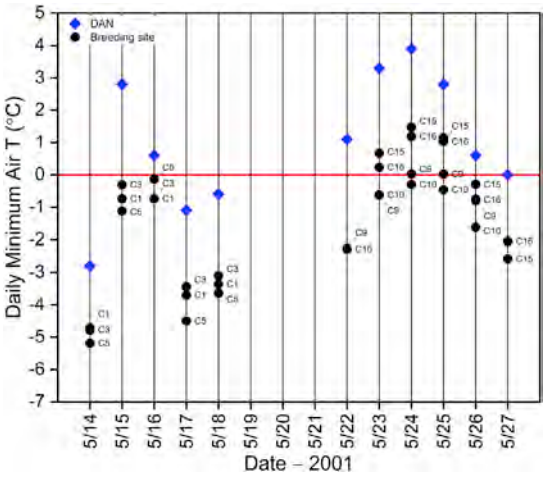

Fig. 18. Daily minimum air-temperatures we measured with temperature loggers at individual breeding sites in Yosemite National Park during embryogenesis for *Anaxyrus canorus* in 2001 compared with coincidental daily minimum air-temperature measurements recorded at the weather station in Dana Meadows (DAN) (Western Regional Climate Center, 2018) in Yosemite National Park. Note that the temperature loggers were limited to measuring temperatures > approximately −4.6 °C (varied with the logger). Thus, minimum air temperatures occasionally were colder than what the loggers could measure accurately (e.g., 5/14).

Our lowest and highest study sites differed in elevation by approximately 161 m. Although modest amid the mountainous terrain of our study area, this elevation difference proved important in terms of how it affected weather conditions during *A. canorus* breeding at sites along this gradient. As daily spring temperatures increased throughout the area, snowmelt and subsequent *A. canorus* breeding occurred first at the lower sites and last at the higher sites, a timeline that typically lasted several days (Fig. 3; § 3.6.2). Thus, by the time embryogenesis occurred at the higher sites, overnight temperatures tended to be somewhat warmer than temperatures were at the lower sites when embryogenesis had occurred earlier (Figs. 9b, 15 and 19, S2-S5; Table 1). These elevation/temperature differences meant any overnight ice formation during embryogenesis potentially was less extensive and shorter in duration at higher sites than at lower sites across years, as indicated by the negative association we found between temperature/elevation and embryo mortality (Figs. 5, 6 and 9c; Table 1). In support of such linked phenomena, breeding occurred unusually late across sites during the *El Nino* year of 1998 (Fig. 3), which resulted in relatively warmer overnight temperatures during embryogenesis across all sites and less potential for ice formation than in other years of our field study (Fig. 19 and compare Fig. S2 with Figs. S3-S5). Notably, embryo mortality also was lower across sites in 1998 than in other years, especially at the lower elevation sites C1, C3, and C5 (Fig. 6). Thus, our field data, coupled with our laboratory results, support the hypothesis that freezing overnight temperatures and ice formation directly caused embryo mortality that reduced reproduction success for *A. canorus* variously, but substantially in some egg masses, across our study sites. Importantly, such initial mortality also provided fertile substrates for infection by *S. diclina*, which, in turn, ultimately resulted in this pathogen killing many more embryos at some sites in some years.

4.2.2. Saprolegnia diclina

Oomycete pathogens (water molds) reduce fitness in a wide range of wild and cultivated organisms worldwide, sometimes devastatingly so for wild populations and agricultural production (e.g., Fernandez-Beneitez et al., 2008; Van den Berg et al., 2013). Among oomycetes known to inhabit freshwater habitats, species of the genus *Saprolegnia* have been associated with widespread mortality in crustacean, fish, and amphibian populations globally (Banks and Beebee, 1988; Beattie et al., 1991; Blaustein et al., 1994; Beebee, 1996; Green, 1999; Robinson et al., 2003; Van den Berg et al., 2013; Gleason et al., 2014; Ghirardi et al., 2018). In the United States, water molds have long been known to occur on dead amphibian embryos (e.g., Bragg, 1958, 1962), but reported results from studies of effects have been limited. *Saprolegnia ferax* is perhaps the best-known species that has been identified and shown to infect and kill U.S. amphibians, given it caused high mortality among embryos of *A. boreas* (western toad) and *R. cascadae* (Cascades frog) in Oregon (e.g., Blaustein et al., 1994; Kiesecker and Blaustein, 1997; Romansic et al., 2009). Reports of effects of *S. diclina* on amphibian populations have come mostly from Spain, Scotland, and Argentina (Fernandez-Beneitez et al., 2008, 2011; Perotti et al., 2013; Muir et al., 2015). However, Urban et al. (2015) detected *S. diclina* in wetlands in Connecticut, where it infected embryos of *Ambystoma maculatum* (spotted salamander) at high rates at some sites in some years, and Petrisko et al. (2008) detected it in wetland samples from Idaho and Montana.

Reports from surveys and classifications of oomycetes at U.S. amphibian breeding sites are limited, but we know more than one species of *Saprolegnia* and other oomycetes can be present in individual wetlands and potentially infect amphibians (Petrisko et al., 2008; Ruthig and Provost-Javier, 2012; Muir et al., 2015; Urban et al., 2015). We did not collect samples of *Saprolegnia*-infected egg masses across multiple sites and years to help determine if additional species were present. Also, recently improved molecular methods for classifying oomycetes taxonomically (e.g., Fernandez-Beneitez et al., 2008; Petrisko

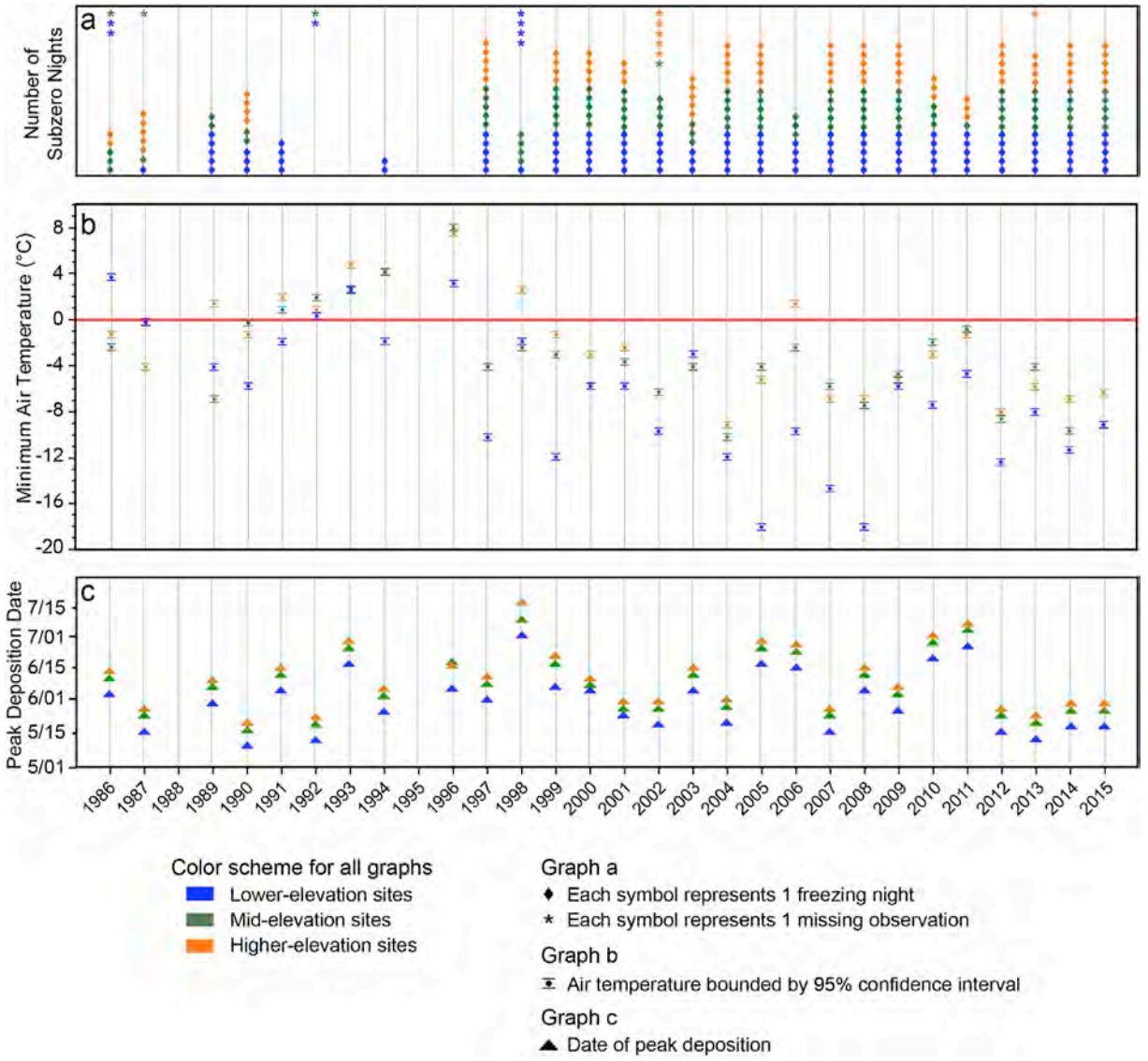

Fig. 19. Estimated peak-deposition dates for egg masses of *Anaxyrus canorus* relative to daily minimum air temperatures and the potential for exposure to freezing during embryogenesis at our lower-, mid-, and higher-elevation study sites in Yosemite National Park. Nineteen eighty-six to 2015 was the period of record available for air-temperature data measured at the Dana Meadows weather station (no data were available for 1988 and 1995) (DAN) (Western Regional Climate Center, 2018). (a) Number of nights with daily minimum air temperatures below 0 °C. (b) Lowest of the daily minimum air temperatures during embryogenesis (adjusted for site elevations [§ 2.6.4 and 3.6.4]) with 95% confidence limits. (c) Dates of estimated peak deposition. Note that identical values in b resulted in overlapping of symbols such that minimum air temperatures for mid-elevation sites are obscured by those for lower-elevation sites in 1987, 1993, 2000, and 2015. Similarly, such temperatures for higher-elevation sites are obscured by those for mid-elevation temperature sites in 1994 and 1997. No weather-station data were available for the estimated dates for embryogenesis at higher-elevation sites in 2002.

et al., 2008; Ault et al., 2012; Muir et al., 2015) were not available to us when we had field samples analyzed and could result in renaming old or identifying new species (Robinson et al., 2003; Ault et al., 2012; Van den Berg et al., 2013). Thus, we recognize further studies are necessary to document *Saprolegnia* and oomycete diversity in our study area and to better understand if any effects due to other species are comingled with those we observed and attribute here to *S. diclina*. To our knowledge, surveys or species identifications for oomycetes at amphibian breeding sites have not been reported previously for Yosemite National Park or nearby areas.

Within a breeding site and season, we usually first observed *S. diclina* as white growths on *A. canorus* embryos that had died in the upper layers of egg masses from apparent freezing damage. Our observations were consistent with reports that *Saprolegnia* colonized dead amphibian embryos more readily than live ones (zoospores have been shown to move chemotactically toward nutrients escaping from dead embryos [Robinson et al., 2003; Van den Berg et al., 2013]). Dead embryos presumably provided *S. diclina* zoospores (Fernandez-Beneitez et al., 2008, 2011) with fertile substrates for infection and

growth (Kiesecker and Blaustein, 1997; Robinson et al., 2003; Van den Berg et al., 2013; Muir et al., 2015, but see Songe et al., 2016). Eventually, *S. diclina* was visible on practically all dead embryos at our study sites, regardless of the development stage when they died, except occasionally for those buried in sediments or compacted at the center of large individual egg masses consisting mostly of otherwise healthy embryos.

Throughout the typical six days and five nights or so of embryogenesis, the density and extent of *S. diclina* visible on individual *A. canorus* egg masses varied spatially and temporally within and among egg masses, sites, and years (e.g., Fig. 8a). We observed egg masses with healthy embryos, no visible *S. diclina*, and high hatching success, even when other egg masses with dead and infected embryos were nearby but not in direct physical contact. This was similar to what Kiesecker and Blaustein (1997) reported regarding egg masses that were laid communally or not. We also observed *S. diclina* limited mostly to the embryos within an egg mass that had died very early in development. Often, however, *S. diclina* spread outwardly from such dead embryos, infecting live embryos and engulfing varying proportions of egg masses along the way (Kiesecker and Blaustein, 1997; Green, 1999; Robinson et al., 2003), which resulted in trapping and killing of embryos in various stages of development, including those near or at hatching. Thus, *S. diclina* appeared to be a facultative pathogen at our study sites, acting as a saprobe initially when dead embryos were present in an egg mass due to freezing, but subsequently functioning as an opportunistic pathogen to kill live embryos, as Ruthig and Provost-Javier (2012) demonstrated for *Saprolegnia* and other oomycetes with *L. catesbeianus* (American bullfrog).

Our observations of the general stages at which embryos died among egg masses, sites, and years (e.g., Fig. 7) reflected the variable extents to which *S. diclina* had spread across individual egg masses and killed embryos at the time. When *S. diclina* spread throughout an egg mass, it was visible as white clumps, grayish or greenish (due to associated algal growth) cloudiness, or as light-colored hyphae in and on the egg jellies, membranes, and embryos themselves (Fig. S6). When *S. diclina* proliferated in this way, such as in 2001 at the lower-elevation sites especially, the pathogen (singly or in concert with predatory flatworms) killed many live embryos across multiple egg masses before they could hatch (as reflected in Fig. 8a and b). The ultimate extent of such spreading and killing of live embryos appeared related to the number of embryos dead initially from apparent freezing. Thus, we observed apparent freezing-facilitated infection of *A. canorus* embryos by *S. diclina*, followed by a temperature-driven race between uninfected, healthy embryos developing towards hatching and *S. diclina* spreading throughout an egg mass and killing such embryos before they could hatch. This race often played a substantial role in how many embryos hatched at a given study site.

The key role that embryo exposure to ice and/or freezing air temperatures appeared to play in determining the extent of *S. diclina*-induced mortality among *A. canorus* embryos was reflected in the fact that we observed fewer dead embryos, and less *S. diclina*, when we experimentally reduced the likelihood of exposure to freezing (Figs. 10 and 11; § 2.3 and 2.4). We do not know of any reports of similar relations between freezing temperatures and oomycete pathogenicity for amphibians, although Kiesecker et al. (2001) reported that precipitation-related variable water levels affected relations between UV-B, *S. ferax*, and embryo mortality in Oregon. Overall, the direct and indirect effects of temperature that we observed annually on *S. diclina* pathogenicity were variable, complex, and nuanced (and include additional considerations we discuss in Appendix B). Predatory flatworms killing *A. canorus* embryos later in embryogenesis, often in concert with *S. diclina*, added to this complexity.

4.2.3. Predatory flatworms

We observed one predator species feeding most prominently on *A. canorus* embryos during this study. A species of free-living flatworm (Turbellaria – Pennak, 1978; Thorp and Covich, 2001; Figs. S7 and S8), which we were not able to identify ourselves or via outside experts, ate variable numbers of *A. canorus* embryos across several breeding sites (e.g., Fig. 8b for 2001). These flatworms were able to swim and move across surfaces to invade egg masses, penetrate egg jellies and membranes, and feed directly on embryos that typically were in later developmental stages. Their effects on embryo mortality were clearly visible while they were feeding, but embryo and capsule remnants afterward typically were distinctive and a telltale sign of recent flatworm predation even when the worms were no longer present. They also preyed upon newly hatched, relatively immobile larvae that lay alongside an egg mass after hatching and prior to dispersing, often in large numbers for lengthy periods of time.

Due to their tiny size initially when they first were visible on egg masses, and their presence coincidentally with *S. diclina* on some egg masses (Figs. 8 and S8), we did not fully appreciate the extent to which these flatworms killed embryos in some cases until later in this study. They ranged from very abundant on egg masses to low in abundance or not present on others, even within the same breeding site. Also, the relative abundance of flatworms on egg masses and their effects on embryo mortality in general were not consistent across sites (Fig. 8b) and years. This was reflected to some unknown extent in our assessments of the developmental stages when embryos died from 1999 to 2001, given mortality in later stages almost certainly was due to flatworms and/or *S. diclina* (Fig. 7). Not only was the number of flatworms present on an egg mass important in terms of mortality among *A. canorus* embryos, but the size of the worms and the timing of their arrival also appeared to be key in terms of how many embryos could hatch before worms ate them. In 2001, which was the only year we attempted to categorize their relative abundance among egg masses and breeding sites, we observed the flatworms more often and in greater abundance at lower-elevation sites (Fig. 8b).

To our knowledge, Segev et al. (2015) reported the only other data that describe flatworm (*Schmidtea nova*) predation on anuran embryos (while noting that reporting of results of flatworm predation on urodeles also had been very limited). During their study of 20 *R. temporaria* egg masses in one pond in Germany, *S. nova* was present on 62% of the egg masses, with an

average of 3.94 ± 0.79 and a maximum of 13 worms per egg mass. Sixty-two percent is not substantially different from the proportions we observed at some breeding sites (Fig. 8b). However, a maximum of 13 is considerably lower than the dozens of flatworms we observed on some individual *A. canorus* egg masses at our study sites (WS pers. obs.).

As with *S. diclina*, we suspect the flatworms typically overwintered as resistant eggs at most of our shallow study wetlands due to these sites often drying during the summer and/or freezing during winter (Thorp and Rogers, 2011). Such eggs had to have hatched relatively soon after snow and ice melted the following spring to allow the worms to feed on *A. canorus* embryos. Though we cannot be certain given we did not identify these worms to species, chances are that the newly hatched flatworms were miniature adults that did not have a larval stage (Thorp and Rogers, 2011). Often relatively tiny when we first noticed them on egg masses, they eventually grew to approximately 5 mm in length at the largest size we observed.

When we surveyed our study sites in 2001, we detected flatworms present on a substantial number of *A. canorus* egg masses, albeit on fewer masses and at fewer sites than where we observed the presence of *S. diclina* (Fig. 8). Interestingly, we observed flatworms at the highest relative abundance on many of the same egg masses (at lower-elevation sites C1, TC, and C5) on which we also observed the highest densities of *S. diclina* (Fig. 8). Clearly, flatworms were competing with *S. diclina* for embryos at these and other sites (Fig. S8). Daily minimum air temperatures at the lower-elevation sites during embryogenesis (Fig. 9b) surely led to ice formation and to a relatively high freezing potential for *A. canorus* embryos in some egg masses. As described earlier, our general observations indicated that freezing damage and dead embryos facilitated *S. diclina* infection of individual egg masses initially and ultimately accelerated its growth across a mass, seemingly in relation to the original number of dead embryos. Such dynamics appeared to be occurring to the greatest extent at sites C1, TC, and C5 during 2001. However, how such freezing and *S. diclina* dynamics might or might not have affected, including facilitating somehow, flatworm presence and abundance on egg masses is not clear. This is true especially given that the flatworms, by disrupting egg jellies and membranes and killing embryos, also appeared to facilitate *S. diclina* infections of egg masses and to cause the release of nutrients that helped fuel *S. diclina's* growth across the mass that resulted in killing live embryos following initial infection. Such facilitation by flatworms happened later in embryogenesis, whereas facilitation associated with freezing typically was initiated when embryos died during the first night or two after fertilization/deposition. Thus, flatworms appeared to be the primary or sole facilitators of *S. diclina* infection and growth on some egg masses when freezing effects were minimal or did not occur.

More detailed field measurements coupled with complementary laboratory and field experiments are necessary to improve our understanding of how temperature, freezing, *S. diclina*, and flatworms affect hatching success for *A. canorus* differentially under variable temperature conditions, differences such as we observed across years of this study. Nonetheless, this example of inter-kingdom competition (e.g., Rohlfs, 2005; Davenport and Riley, 2017, among many others) between a pathogen and a predator for embryos of *A. canorus* is one where temperature played a critical role in the annual outcomes. Temperature was critical from the earliest stages of embryogenesis, when embryos were most susceptible to freezing (to the potential benefit of *S. diclina* and at the flatworm's expense when *S. diclina* received a boost in infection and growth rates), through to hatching as live embryos were in a race to develop sufficiently and hatch before being killed by *S. diclina* and/or flatworms when these organisms were present on, or could invade, an egg mass.

4.2.4. Estimated freezing potential for Anaxyrus canorus embryos (1986–2015)

The archived DAN temperature data indicate that sub-zero overnight temperatures might have been common across years from 1986 to 2015 during the annual time periods when *A. canorus* likely bred, especially after 1997. Such temperatures would have made for high annual potential for freezing and subsequent cascading effects of *S. diclina* for *A. canorus* embryos, similar to or greater than we observed during this field study. We determined that the timing of snow-off was not meaningfully associated with daily minimum air temperatures across sites and years (Spearman correlation coefficient = 0.255, *p*-value = 2.0^{-2}). This is apparent in there being no noticeable shift in snow-off dates after 1997 (Fig. 13) in relation to the consistently colder minimum air temperatures that occurred after 1997 (Fig. 19b). For example, snow-off dates in 1990 and 1992 were comparable with those from 2012 to 2015, but the former years had warmer air temperatures during projected periods of embryogenesis for *A. canorus*.

California's climate has been warming since at least 1895 (e.g., Kadir et al., 2013). Importantly though, data from the DAN station reveal that average annual temperatures used to determine the warming trend are not informative about seasonal conditions during *A. canorus* embryogenesis, especially because snow-off plays such a critical role in determining breeding and is a function of winter precipitation as well as temperatures. Thus, we cannot assume that continued increases in annual air temperatures in the Sierra Nevada, as predicted by climate models (PRBO Conservation Science, 2011), will result in warmer conditions during *A. canorus* embryogenesis in our study area.

Outcomes from climate models indicate that annual snowpacks could decrease over the coming decades (e.g., PRBO Conservation Science, 2011). However, climate projections vary regarding future quantities of annual and seasonal precipitation in the Sierra Nevada, with some models predicting increases and others predicting decreases or non-stationary vacillations between droughts and extreme precipitation events (PRBO Conservation Science, 2011; Gershunov et al., 2017, 2019; Polade et al., 2017). Therefore, any projections regarding how future weather/climate conditions might affect the timing of *A. canorus* breeding and the freezing potential for embryos are highly uncertain. Earlier snow-off might increase the risk that *A. canorus* embryos will be exposed to freezing temperatures, although the DAN data indicate that is not always the case (Figs. 13 and 19). In turn, anticipating the extent of freezing-associated effects from *S. diclina* in conjunction with effects from flatworm predation on embryo mortality, recruitment, and population persistence for *A. canorus* also is highly uncertain. Determining

actual ecological outcomes in the face of such uncertainties will require detailed research *in situ* (Sadinski et al., 2018). Fortunately, options exist to straightforwardly conduct such research while also effectively reducing embryo mortality at breeding sites (as we discuss in Appendix C). It appears that using integrated technologies to monitor the statuses of breeding subpopulations, concurrent with conducting an active management program to increase hatching success *in situ*, could be effective components of efforts to recover *A. canorus* populations.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary information

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ADVANTAGES OF LONG-TERM, MULTI-SCALE MONITORING: ASSESSING THE CURRENT STATUS OF THE YOSEMITE TOAD (*ANAXYRUS* [*BUFO*] *CANORUS*) IN THE SIERRA NEVADA, CALIFORNIA, USA

CATHY BROWN[1], *KATIE KIEHL, AND LUCAS WILKINSON*

USDA Forest Service, Stanislaus National Forest, 19777 Greenley Road, Sonora, California 95370, USA
[1]*Corresponding author, email: cathybrown@fs.fed.us*

***Abstract.*—A comprehensive bioregional evaluation of the current status of at-risk species is critical for effective management and conservation. As part of a long-term, multi-scale amphibian monitoring program, we evaluated the current status of the Yosemite Toad (*Anaxyrus* [*Bufo*] *canorus*) on national forest lands across the species' range in the Sierra Nevada, California, USA. We conducted monitoring at extensive (rangewide) and intensive (individual population) scales with small watersheds (2–4 km^2), individual meadows, and breeding areas within meadows as sample units. Yosemite Toad breeding was found in an estimated proportion of 0.84 ± 0.03 (SE) of recently occupied watersheds (locality data from 1990–2001), and 0.13 ± 0.04 of historically occupied watersheds (locality data prior to 1990). Rangewide, breeding was found in an estimated proportion of 0.22 ± 0.01 of watersheds. We quantified demographic parameters (abundance and survival of breeding males, abundance of egg masses, successful metamorphosis) in six meadows in two watersheds. Abundances were small, with the largest populations having only 16–21 and 18–19 breeding males each year. Annual survival rates of males by meadow ranged from 0.49–0.72. Numbers of egg masses per year were low, and the proportion of breeding areas with successful metamorphosis ranged from 0.14–0.73. Using the multi-scale data, we examined Yosemite Toad spatial and temporal occupancy patterns. Yosemite Toads tended to breed in one or two sites (lakes, meadows, stream reaches) per watershed every year, and occasionally in other sites. This assessment of the status of the Yosemite Toad will inform management decisions at both bioregional and population scales and the development of conservation priorities.**

Key Words.—amphibian demography; *Anaxyrus canorus;* bioregional monitoring; multi-scale monitoring; Sierra Nevada; Yosemite Toad

INTRODUCTION

Amphibians are imperiled worldwide (Beebee and Griffiths 2005; Wake and Vredenburg 2008) and over 40% of all amphibian species have decreasing population sizes (Stuart et al. 2004). As efforts to identify and monitor at-risk populations have increased, the role of spatial and temporal scale in providing robust assessments of status and understanding the population dynamics of amphibians has come to the forefront (Hecnar and M'Closkey 1997; Meyer et al. 1998; Skelly et al. 2003). Many population studies have been conducted at local scales such as individual lakes or ponds and often over short time periods (Briggs and Storm 1970; Pechmann et al. 1991; Richter and Siegel 2002). However, bioregional assessments, generally conducted over large areas often defined by ecological characteristics, are needed to fully evaluate a species status (Stuart et al. 2004; Gompper and Hackett 2005; Bonardi et al. 2011; Cameron et al. 2011; Gould et al. 2012), and monitoring over broader spatial and temporal scales may be more effective at separating general population trends from local fluctuations (Pechmann et al. 1991; Hecnar and M'Closkey 1997; Meyer et al. 1998; Skelly et al. 2003; Trenham et al. 2003). Logistically, the types of data that are feasible to collect at bioregional and local scales differ (see Beebee and Griffiths 2005). Detailed abundance and demographic data provide the most insight into population dynamics, but are usually too expensive and logistically impractical to collect long-term and over large geographic areas. As a result, researchers increasingly use occupancy data as a more cost-effective alternative (Trenham et al. 2003; Bailey et al. 2004; Corn et al. 2005; Gould et al. 2012). However, occupancy data alone provide no information on changes in abundance, which may be a first sign of impending distributional declines (Muths et al. 2003; Weir et al. 2009; Collen et al. 2011), or key vital rates and life-stage specific population dynamics (Berven 1990; Semlitsch et al. 1996; Biek et al. 2002; Scherer et al. 2005). One solution is to collect occurrence data across bioregional scales to evaluate rangewide persistence and more detailed demographic data at a smaller subset of locations to provide insights on local population dynamics such as abundance, survival, and recruitment (e.g., Corn et al. 1997).

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The Yosemite Toad (*Anaxyrus* [*Bufo*] *canorus*) is a species well suited for a multi-scaled monitoring approach. The Yosemite Toad is endemic to the Sierra Nevada, California, where it occurs predominantly on public lands (almost 99% of its range), much of which is in wilderness areas. Declines in the Yosemite Toad have been documented (Kagarise Sherman and Morton 1993; Jennings and Hayes 1994; Drost and Fellers 1996), and the U.S. Fish and Wildlife Service has determined that listing the species as endangered under the Endangered Species Act is warranted but precluded by higher priority actions (U.S. Fish and Wildlife Service 2002). However, a comprehensive assessment of status across the species' range has not previously occurred and potential causes of decline are not well understood.

There are multiple challenges to monitoring the Yosemite Toad. If surveys are timed correctly, all life stages are relatively easy to detect; however, the suitable survey periods for each life stage are relatively short and are not concurrent. Breeding commonly occurs in shallow, warm water areas that typically dry over the summer and include wet meadows, shallow ponds, shallow flooded, grassy areas adjacent to lakes, and slow flowing streams (Karlstrom 1962). Yosemite Toads are explosive breeders where adults arrive at snowmelt, lay eggs over a short period of time, and then leave the breeding areas (Kagarise Sherman 1980). Because they are not commonly found after breeding, surveys for adults must occur at snowmelt over a 1–2 week period, when most locations are difficult to access. Eggs hatch into larvae in about 4–15 days (Karlstrom 1962; Kagarise Sherman 1980), tadpoles often metamorphose by early to mid August (Karlstrom 1962; pers. obs.), and metamorphs disperse from immediate breeding areas (pers. obs.). The rapid development, desiccation of ephemeral breeding areas, and dispersal behavior result in a short survey window for each of these stages, which, combined with the remote locations of much of the species' range, makes it logistically difficult to collect demographic information on all life stages over bioregional scales.

To provide a comprehensive bioregional assessment of the status of the Yosemite Toad that addressed these monitoring challenges, the USDA Forest Service implemented a long-term multi-scale monitoring program on national forest lands in the Sierra Nevada. In an extensive component, we estimated the proportion of occupied watersheds at the scale of the range of the Yosemite Toad on national forest lands using a spatially balanced, unequal probability survey design. In an intensive component, we estimated abundance and survival of adult breeding males, number of egg masses, and successful metamorphosis in six meadows in two watersheds. Between the two components, we conducted surveys at three scales, watershed, site (lake, meadow, stream reach), and breeding area (contiguous lentic water) within sites. In this paper, we present a baseline assessment of bioregional population status for the Yosemite Toad. We also show how data collected for status and trend can be used to address other questions useful for management by presenting insights on Yosemite Toad spatial and temporal occupancy patterns.

MATERIALS AND METHODS

Study region.—The study region for the extensive component is the portion of the historical range of the Yosemite Toad that occurs on national forest lands within the Sierra Nevada, California, USA (Fig. 1). This area comprises about 10,500 km^2 extending from Alpine County south to Fresno County and contains survey watersheds at elevations from 1,859 to 3,703 m. Aquatic habitats within the study region are chiefly fed by snowmelt, and include lakes, ponds, wet meadows, and streams, which vary greatly in size, vegetation, hydrology, and topography. A variety of management activities occur within the study region although much is in designated wilderness where management activities are more limited and access is only by foot or pack animal. Livestock grazing occurs in many Sierran meadows and legacy effects exist even in those areas where grazing no longer occurs (Menke et al. 1996). Fish stocking has occurred since the late 1800's and is still widespread (Bahls 1992; Knapp 1996), and recreational activities are increasing in high elevation wilderness areas (USDA Forest Service 2001). Other activities such as vegetation, fire and fuels, and road management also may affect the species at lower elevations.

The two intensive watersheds included Bull Creek (4.86 km^2), located in Fresno County in the southern Sierra Nevada, and Highland Lakes (2.9 km^2), located in Alpine County in the central Sierra Nevada (Fig. 1). Elevations in Bull Creek range from 2,134 m to 2,489 m and vegetation is predominantly forested with small meadow and riparian openings (0.33 ha to 5.1 ha). Management activities occurring in the watershed include livestock grazing, recreation, timber harvest, and ongoing ecological research. Highland Lakes, situated in a saddle surrounded by high peaks, is chiefly open with large areas of alpine meadow containing numerous small pools and areas of flooded vegetation. Elevations of suitable Yosemite Toad habitat range between 2,536 m and 2,621 m. This watershed contains a popular campground and draws large numbers of visitors for both summer and winter recreational activities. Livestock grazing also occurs in the watershed.

Design and field methods extensive component.— Probability-based survey designs such as the one used in this program require a precisely defined target

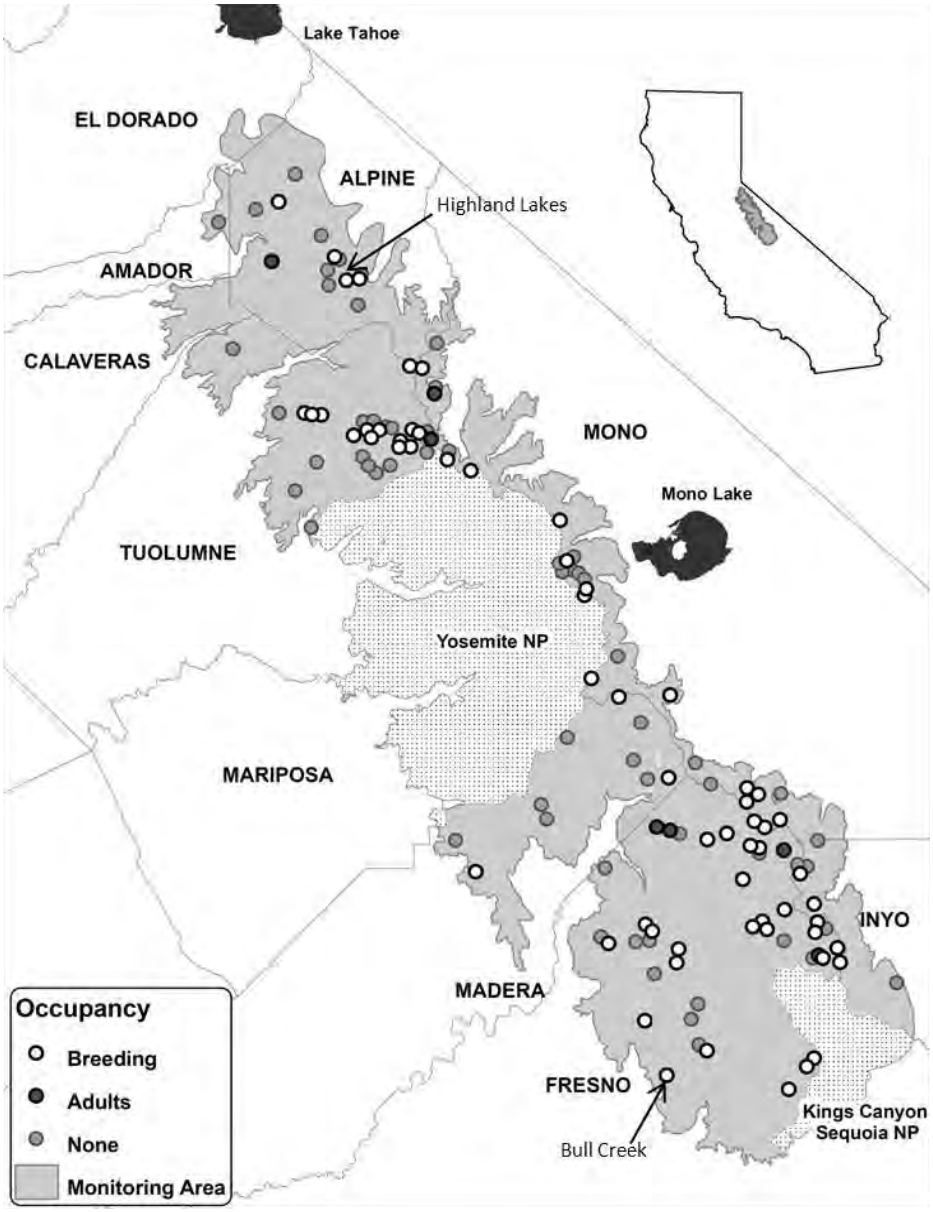

FIGURE 1. Study region and distribution of known occupied watersheds for the Yosemite Toad (*Anaryxus canorus*) in the Sierra Nevada, California, USA. The monitoring area is national forest lands within the range of the Yosemite Toad. Bull Creek and Highland Lakes are the two Yosemite Toad intensive watersheds

population (i.e., the set of units defining the geographic scope of inference) and a sample frame (commonly a geographic information system [GIS] representation of the target population) from which the sample is selected (Olsen et al. 1999). We defined our target population as all watersheds, delineated to 2–4 km^2 in size, with available aquatic habitat on national forest lands within the range of the Yosemite Toad. Because there was no existing sample frame (e.g., GIS coverage) and it was not feasible to create one (i.e., delineate all 2–4 km^2 watersheds within the monitoring area), we used the Forest Inventory and Assessment (FIA) systematic random hexagonal grid (Brand et al. 2000) densified to hexagons of 2.6 km^2.

We compiled all available Yosemite Toad locality data from state and federal agency records, academic researchers, and from literature and museum sources. We assigned each of the 10,077 hexagons (and

corresponding grid point centers) in the sample frame to one of three mutually exclusive temporal categories based on the compiled locality data: (1) *Recent*, toads documented within 10 years prior to the start of the sampling (defined to be after 1990); (2) *Historical*, toads documented only prior to 1990; and (3) *Unknown*, no locality data. A spatially distributed random sample was selected from the sample frame using a generalized random tessellation stratified survey design (GRTS) for a finite resource with unequal probability of selection based on the three temporal categories (Stevens and Olsen 1999; Stevens and Olsen 2004). We selected a larger proportion of the sampled hexagons from areas most likely to have Yosemite Toads (*Recent*). We delineated watersheds, 2–4 km^2, around the selected grid point centers using the Hydrologic Unit Code rule set (U.S. Department of Agriculture 1997).

Temporally, the study design uses an augmented serially alternating panel design (Urquhart et al. 1998; Urquhart and Kincaid 1999). The initial design specified that 20% of the *Recent* watersheds (n = 16) were to be visited every year (referred to as the annual watersheds), and the remaining watersheds once every five years on a rotating schedule. Due to funding limitations, the full sample of watersheds took eight years to complete (2002–2009). Based on preliminary analyses of the first five years of data, we determined that completing the full sample, thereby increasing the precision of the estimates, was more important than beginning the second cycle.

We determined watershed occupancy by surveys of all lentic (lakes, wet meadows) and a sample of lotic habitat (perennial and ephemeral streams) within each watershed. We identified lakes and meadows using aerial photographs that we verified in the field. We randomly selected three 300-m perennial stream reaches per watershed, one from each of three gradient classes (low < 2%, medium 2–8%, and high > 8%), and two 100-m ephemeral stream reaches located in meadows from a USDA Forest Service Sierra-wide GIS coverage (Region 5 Remote Sensing Lab in 2001, available from Cathy Brown). We refer to the individual lakes, meadows, and selected stream reaches in each extensive watershed as sites.

From June-September 2002–2009, we used Visual Encounter Surveys (VES) to determine Yosemite Toad occupancy in each extensive watershed (Crump and Scott 1994; Olson et al. 1997). We surveyed all wadeable water at each site (lake, meadow, and selected stream reach) and we made an effort to survey watersheds early in the season before sites dried up to maximize detection of the tadpole stage. Although our primary goal was to detect tadpoles, we recorded data on all life stages observed.

Design and field methods intensive component.—We subjectively selected two intensive watersheds using the following criteria: (1) contained a variety of aquatic habitat types; (2) contained at least three breeding lakes, meadows, or stream reaches separated by more than 200 m; (3) supported a relatively large number of adult toads; and (4) had easy access at snowmelt and during the summer. From 2006–2009, we visited three meadows in each watershed at snowmelt to conduct adult capture-mark-recapture (CMR) and egg mass surveys (Bull Creek meadows: 520M15, 520M16, 520M20; Highland Lakes meadows: 37188, 37213, 37165). The ecology of the Yosemite Toad is ideal for using Pollock's robust design (Pollock 1982; Kendall et al. 1997) to estimate abundances of breeding males during their spring chorus. The robust design is two-tiered with primary sampling periods that occur over longer intervals that allow population gains (recruitment/immigration) and losses (mortality/emigration), and secondary sampling occasions within each primary period where the population is assumed to be closed. We treated each annual breeding period as a primary sampling period. Because males congregate in breeding choruses for the short duration of the breeding period, we treated multiple samples over consecutive days during each primary period as secondary occasions from a population that is relatively closed. The robust design is not as suitable for estimating female abundances. Female toads remain in breeding areas for only a few days leaving shortly after amplexus, thus violating the assumption of population closure among the secondary occasions. Still, we marked females when possible.

We conducted CMR surveys as soon as breeding choruses formed at snowmelt and surveys continued for at least five consecutive days each year. The timing of snowmelt and the subsequent breeding varied among years ranging from late April to mid May in Bull Creek and from late May to late June at Highland Lakes. We surveyed each intensive meadow for at least six hours each day. At each meadow, crews rotated among the breeding choruses, visually scanning the breeding areas, actively searching in burrows and under ground cover, and using cues from calling males to locate toads. All unmarked toads > 40 mm snout-urostyle length (SUL) were PIT-tagged (passive integrated transponder; Martin 2008) using AVID MUSICC Microchips™ (Avid Identification Systems, Inc., Norco, California, USA) and released. Upon initial capture each year, we recorded the snout-urostyle length, weight, and sex of each toad. We identified marked animals by their unique tag numbers at each subsequent recapture, and we used these data to create capture histories.

We conducted egg mass counts at the end of the five day adult CMR period. Conducting counts of Yosemite Toad egg masses can be challenging because females lay eggs in long strings and sometimes split masses over two

or more locations or lay them communally. Also, eggs may hatch prior to the completion of the five day period or be deposited after counts are conducted. To address these challenges, we used several methods to determine the most efficient approach. We used the more intensive dependent double-observer method (Grant et al. 2005) in 2006 and independent double-observer method (Nichols et al. 2000) in 2007 and 2008. After employing and testing these multiple observer methods, individual egg mass detection probabilities were very high (> 0.96) and consistent among observers. Accordingly, in 2009 we simply used a tally of unique eggs masses (i.e., conditional probability of detection = 1) from a single observer. This was simpler and more efficient, and in our judgment, an accurate estimate of the number of Yosemite Toad masses laid each year. Although the methods differed among years, the estimates of egg mass numbers were similar and reasonable given the numbers of adults we observed. Thus, in our judgment, the three methods were comparable. In addition, based on our observations during the five day period and our subsequent surveys of these meadows for the extensive component, it is unlikely that we missed large numbers of egg masses.

In 2006, we visited each intensive meadow every two weeks (Bull Creek 29 June - 25 August; Highland Lakes 12 July - 7 September) for a total of six visits. At each breeding area in each intensive meadow, two observers independently counted tadpoles and metamorphs. Additional surveys were conducted by one observer at Bull Creek once per week (10 visits, 17 June - 19 August) in 2009 and at Highland Lakes once every two weeks (five visits, 15 June - 27 August) in 2007 and twice (14 July, 29 July) in 2008. These data were used to document successful metamorphosis for each breeding area.

Analysis extensive component.—We based the analyses of occurrence data on an unequal probability survey design where the weight for each watershed evaluated is the inverse of the probability of selection for that watershed (Diaz-Ramos et al. 1996). The contribution of each sample watershed to the final estimate is proportional to the watershed weight. For example, sample watersheds with higher probability of selection (e.g., *Recent* watersheds) have lower weights and thus contribute less to the final estimate. We conducted analyses using the R software (R Development Core Team, Vienna, Austria), an R contributed library (spsurvey: Spatial Survey Design and Analysis, Kincaid and Olsen 2009) developed for the statistical analysis of probability survey data, and SAS® software (SAS Institute Inc., Cary, North Carolina, USA).

The presence of tadpoles indicates the existence of a reproducing population rather than, for example, an adult moving through an area. Therefore, our primary goal was to estimate the proportion of watersheds occupied (ψ) by breeding (eggs, tadpoles, or metamorphs). Too few adults were found to model them separately, so to account for all areas occupied by the species, we also estimated the proportion of watersheds occupied by any life stage. For both occupancy states (breeding, any life stage), we estimated the proportion of occupied watersheds for the entire range of the species (rangewide, $\psi(.)$) and relative to the temporal period when toads were last observed (*Recent*, *Historical, Unknown,* ψ(temporal category)). We used a maximum likelihood approach that incorporates the probability of detecting the species (p) and the watershed weights (described below; also MacKenzie et al. 2006). Methods that do not account for p typically result in an underestimate of occupancy unless the probability of detection is near one (MacKenzie et al. 2006). We assumed that the occurrence of toads was closed during the eight-year monitoring period (i.e., occupancy state in each watershed did not change) and used the annual watershed data to estimate the probability of detection. This approach differs from most studies where visits occur over shorter time periods, typically within a season. If the population closure assumption is violated, the probability of occupancy may be overestimated. We recognize that eight years may be a long time to assume that watershed occupancy is constant. Our approach may be reasonable given the likely slow and persistent effects resulting from many management activities, but be more questionable for threats such as an epidemic pathogen that causes widespread and rapid declines. We address this assumption and its implications in our discussion.

We modeled p as a function of two covariates, survey date (measured by the number of days from January 1) and snow pack of the preceding winter. Snowpack was quantified as the percentage of normal snowpack for the Sierra Nevada measured on 1 April each year (California Department of Water Resources, California Data Exchange Center. Available from http://cdec.water.ca.gov/ [Accessed 17 September 2009]). The Sierra Nevada receives most of its precipitation between December and April (Howat and Tulaczyk 2005). Date of survey and seasonal water are important factors for detecting many amphibian species (Schmidt 2005; Weir et al. 2005; Lacan et al. 2008). Yosemite Toads breed in ephemeral habitats and metamorphose within one summer. Thus, we predicted that p should be highest in early season surveys and in years with higher snow pack (i.e., more available water). Habitats dry up sooner in drought years, so we tested for a survey date and snow pack interaction. We developed ten a priori models where ψ = probability of occupancy and p = probability of detection (Table 1).

We used a generalized version of the maximum

TABLE 1. Model selection for occupancy estimates for the Yosemite Toad (*Anaryxus canorus*) for breeding and any stage, summarized rangewide and by temporal category. K is the number of parameters in the model. AIC_c is the Akaike Information Criterion adjusted for small sample sizes. w_i is the Akaike weight for comparing models. ψ is the probability of occupancy and p is the probability of detection. Models comprising ≥ 95% of the weight are in bold.

Breeding					Any Stage				
Model	K	AIC_c	ΔAIC_c	w_i	Model	K	AIC_c	ΔAIC_c	w_i
Rangewide, ψ (.)									
***p*(Survey Date * Snow Pack)**	5	1851.7	0.0	0.996	***p*(Survey Date * Snow Pack)**	5	2059.9	0.0	1.000
p(Snow Pack)	3	1862.8	11.1	0.004	*p*(Survey Date + Snow Pack)	4	2232.0	172.2	0.000
p(Survey Date + Snow Pack)	4	1885.2	33.5	0.000	*p*(Snow Pack)	3	2276.0	216.2	0.000
p(.)	2	2027.4	175.7	0.000	*p*(Survey Date)	3	2368.6	308.8	0.000
p(Survey Date)	3	2029.3	177.6	0.000	*p*(.)	2	2372.0	312.2	0.000
Temporal Category, ψ (Temporal Category)									
***p*(Survey Date * Snow Pack)**	7	1459.8	0.0	1.000	***p*(Survey Date + Snow Pack)**	6	1872.7	0.0	1.000
p(Snow Pack)	5	1487.8	28.0	0.000	*p*(Snow Pack)	5	1909.8	37.2	0.000
p(Survey Date + Snow Pack)	6	1523.4	63.6	0.000	*p*(Survey Date * Snow Pack)	7	1913.8	41.2	0.000
p(.)	4	1534.1	74.3	0.000	*p*(.)	4	1955.4	82.7	0.000
p(Survey Date)	5	1538.6	78.8	0.000	*p*(Survey Date)	5	1957.6	85.0	0.000

likelihood procedure developed by MacKenzie et al. (2002) appropriate for our more complex unequal probability survey design. The following notation is used: S, the number of space-time subunits in the study; n_s, the number of watersheds in the sample in subunit s; V, number of distinct seasonal sampling occasions; ψ_{si}, probability that a species is present in watershed i within subunit s; p_{siv}, probability of detecting a species in watershed i within subunit s on visit v, given the species is present. Then let $\mathbf{d}_{si} = (d_{si1}, d_{si2}, \ldots, d_{siV})$ where

$$d_{siv} = \begin{cases} 1 & \text{if species is detected in watershed i in subunit s on visit } v \\ 0 & \text{if species is not detected in watershed i in subunit s on visit } v \\ \text{NA} & \text{if no visit was made in watershed i in subunit s on visit } v \end{cases}$$

and s=1,…,S, i=1,…,n_s and v=1,…,V. Let $\mathbf{x}_{si} = (x_{si1}, x_{si2}, \ldots, x_{siK})$ be K watershed-specific covariates for watershed i within subunit s and

$$\mathbf{y_{si}} = \begin{bmatrix} y_{si11} & \cdots & y_{siV1} \\ \vdots & \ddots & \vdots \\ y_{si1M} & \cdots & y_{siVM} \end{bmatrix}$$

be M watershed-specific and visit-specific covariates for watershed i within subunit s. The likelihood equation for a stratified unequal probability survey design, such as the one used in this program, is

$$L(\boldsymbol{\psi}, \mathbf{p}|\mathbf{x}, \mathbf{y}, \mathbf{d}) = \prod_{s=1}^{S} \prod_{i=1}^{\text{ns}} f(\mathbf{d}_{si}|\mathbf{x}_{si}, \boldsymbol{y}_{si})^{w_{si}}$$

$$= \prod_{s=1}^{S} \prod_{i=1}^{ns} \left[\psi_{si} \prod_{v=1}^{V} (1 - p_{siv})^{(1-d_{siv})} {p_{siv}}^{d_{siv}} + D(\mathbf{d}_{si}) \right]^{w_{si}}$$

where S subunits are present and each watershed has a weight, $w_{si,}$ and

$$D(\mathbf{d}_{si}) = \begin{cases} 0 & \text{if } \mathbf{1}'\mathbf{d}_{si} > 0 \\ 1 - \psi_{si} & \text{if } \mathbf{1}'\mathbf{d}_{si} = 0 \end{cases}$$

and both ψ_{si} and p_{siv} may depend on the covariates. The term $D(\mathbf{d}_{si})$ distinguishes the watersheds where a species is detected on at least one visit and those sites where a species is not detected on any visits. This is the same likelihood equation as in MacKenzie et al. (2002) when all weights are equal, as is the case for a simple random sample. We maximize the log likelihood using the function "optim" in R (R Development Core Team, Vienna, Austria). Variance estimates for ψ and p are obtained from the Fisher information matrix derived from the Hessian matrix evaluated at the ψ and p estimates. Confidence intervals are constructed as the estimate ± the square root of these variance estimates multiplied by the $(1 - \alpha/2)$th percentile of the standard normal distribution. We evaluated the relative support for each model using Akaike Information Criterion for small sample sizes (AIC_c) and Akaike weights (w_i) (Burnham and Anderson 2002). We dropped models that could not be fit to the data from the model set and we used the remaining models to compute model-averaged estimates (Burnham and Anderson 2002; MacKenzie et al. 2006).

Analysis intensive component.—We analyzed capture history data for male Yosemite Toads to estimate abundances during spring breeding and apparent annual survival rates. We designated survival "apparent"

because we cannot distinguish between male Yosemite Toads that die from those that permanently emigrate (Williams et al. 2002). We ran analyses separately for each of the six intensive meadows (three in each watershed). Because the robust design assumes that populations are closed over secondary occasions (there is no immigration or emigration), we tested for demographic closure for each intensive meadow each year. Examination of the capture histories suggested that any violation of the closure assumption likely resulted from immigration into the meadows during the primary period (i.e., males were not all present at the start of the secondary occasions but once present they tended to remain). Because sample sizes were small, to obtain better fitting models, we chose to test for immigration, but not emigration. This was done by fitting a Pradel model (Pradel 1996) with no immigration (recruitment = 0, closed model) and a model allowing immigration (recruitment unconstrained, open model, Boulanger et al. 2002). We compared the closed and open models for each meadow and year using likelihood ratio tests. For meadows where the closure test suggested that populations were not closed, we pooled captures from all but the last visit within each primary period such that each primary period included two secondary occasions (Kendall 1999). For meadows where populations were closed, to reduce the number of models for comparison, we conducted exploratory analysis for each meadow each year by fitting the data to four Huggins closed population models where the probability of capture was held constant (M_o) or allowed to vary by behavior (M_b), time (M_t), or both (M_{tb}) (White et al. 1982). For each meadow, we chose the closed population model that had the most support, based on Akaike weights (w_i) using $QAIC_c$ values, for inclusion in the robust design analysis.

We fit the resulting data to four Pollock's robust design models where apparent survival (Φ) was held constant or allowed to vary among years, and the probability of capture (p) and recapture (c) were modeled with the best supported closed population model, and held constant ($p(.)$), or allowed to vary among years, ($p(t)$) (Table 2). We did not include temporary emigration because in our preliminary analysis, most models could not be fit to the data or had little support, likely due to small sample sizes and the short study duration (four years). Instead, we compiled the breeding schedules of adult males from the CMR data. We used the program RDSurviv (Kendall and Hines 1999) to test the goodness of fit for the most general model for each meadow and calculate the variance inflation factor, $\hat{c}$, based on the Pearson's X^2 test ($\hat{c} = X^2/df$, Amstrup et al. 2005). We based model selection on Akaike weights (w_i) calculated from $QAIC_c$ values (Burnham and Anderson 2002). We calculated abundance and apparent survival estimates by model averaging of the final model set (Burnham and Anderson 2002). We used the R (R Development Core Team, Vienna, Austria) package, RMARK (Laake, J., Version 1.9.6) for model fitting and averaging.

TABLE 2. Final models and Akaike weights used to estimate numbers of Yosemite Toad (*Anaryxus canorus*) adult males using the robust design from 2006–2009 in six meadows in two watersheds in the Sierra Nevada, California. Models that could not be fit to the data are not included. $QAIC_c$ is the Akaike Information Criterion adjusted for small sample sizes and overdispersion. w_i is the Akaike weight for comparing models. φ is annual survival rate, p is probability of capture, and c is probability of recapture.

Model	# Param.	$QAIC_c$	w_i
Bull Creek Watershed			
520M16			
$\varphi(.)p(.)c(.)$	3	269.0	0.538
$\varphi(.)p(\text{year})c(\text{year})$	9	269.9	0.343
$\varphi(\text{year})p(.)c(.)$	5	273.2	0.066
$\varphi(\text{year})p(\text{year})c(\text{year})$	11	273.7	0.053
520M15			
$\varphi(.)p(\text{year})$	5	178.0	0.486
$\varphi(.)p(.)$	2	179.0	0.286
$\varphi(\text{year})p(\text{year})$	7	180.1	0.164
$\varphi(\text{year})p(.)$	4	182.0	0.064
520M20			
$\varphi(\text{year})p(.)$	3	67.9	0.873
$\varphi(.)p(\text{year})$	4	73.0	0.068
$\varphi(\text{year})p(\text{year})$	5	73.3	0.059
Highland Lakes Watershed			
37188			
$\varphi(.)p(.)$	2	125.5	0.516
$\varphi(.)p(\text{year})$	5	126.2	0.377
$\varphi(\text{year})p(.)$	4	129.7	0.065
$\varphi(\text{year})p(\text{year})$	7	130.5	0.043
37213			
$\varphi(.)p(.)$	2	65.0	0.670
$\varphi(\text{year})p(.)$	3	67.2	0.220
$\varphi(.)p(\text{year})$	4	69.1	0.085
$\varphi(\text{year})p(\text{year})$	5	71.5	0.025
37165			
$\varphi(.)p(.)c(.)$	3	116.5	0.668
$\varphi(\text{year})p(.)c(.)$	4	118.1	0.305
$\varphi(.)p(\text{year})c(\text{year})$	7	123.5	0.020
$\varphi(\text{year})p(\text{year})c(\text{year})$	8	125.7	0.007

For years where we estimated egg mass abundances, via either the double observer or independent double observer methods, we analyzed the data using the program DOBSERV (Hines, J.E., U.S. Geological Survey, Laurel, Maryland, USA). Two models were fit to the data, $p(.)$ and $p(\text{observer})$, where the probability of detection was held constant and allowed to vary among

observers, respectively. Finally, for each year and watershed, we calculated the proportion of breeding areas where metamorphs were detected.

Analysis of spatial and temporal occupancy patterns.—We examined temporal and spatial breeding occupancy patterns at three scales: watershed (extensive component), site (individual lake, meadow, or stream reach in the extensive watersheds), and breeding area (contiguous areas of standing water) in the intensive meadows. In this analysis, we included only the annual watersheds where breeding occupancy was detected in at least one survey (n = 14 watersheds) and the intensive meadows. Because of the small sample size, our objective of examining temporal and spatial patterns together, and the fact that we did not have multiple surveys within a year to estimate probability of detection, we chose a descriptive approach rather than more complex dynamic occupancy modeling (e.g., MacKenzie et al. 2003). This descriptive approach does not incorporate probability of detection. To examine temporal variability, we assigned watersheds, sites, and breeding areas to one of three categories: (1) occupied every year surveyed; (2) unoccupied only one year; and (3) unoccupied 2+ years. We also examined both temporal and spatial occupancy in combination by looking at the number of sites per extensive watershed and breeding areas per intensive meadow that were consistently occupied by breeding. We defined consistently occupied to be occupied every year or unoccupied only one year. We assigned watersheds and intensive meadows to three categories: (1) three or more sites/breeding areas consistently occupied every year; (2) only one or two sites/breeding areas consistently occupied every year; and (3) no sites/breeding areas consistently occupied every year.

RESULTS

Extensive component.—Within the range of the Yosemite Toad, we surveyed 134 watersheds between 2002 and 2009, including 18 that were surveyed annually (Table 3). The interaction model, p(survey date * snow pack), had the most weight for both breeding and any stage occupancy rangewide and for breeding occupancy by temporal category (Table 1). The best model for any stage by temporal category was *p*(survey date + snow pack). In general, these models indicated a high probability of detection (≥ 0.8) if surveys are conducted early enough in the season (e.g., prior to mid August) in all but the lowest snow pack years such as occurred in 2007 (snowpack was 45% of average on April 1).

The rangewide occupancy estimate ($\hat{\psi}$) for the Yosemite Toad was 0.22 ± 0.012 (SE) for breeding and 0.29 ± 0.013 for any stage (Table 3, Fig. 1). Breeding was found in a relatively large proportion of the *Recent* watersheds ($\hat{\psi}$= 0.84 ± 0.032) compared to only 0.13 ± 0.038 of *Historical* watersheds (those occupied prior to 1990). Finally, breeding was observed in an estimated 0.05 ± 0.004 of *Unknown* watersheds. Occupancy estimates for any stage were similar to those for breeding; adults were found in few additional watersheds that did not have breeding.

TABLE 3. Sample sizes for monitoring surveys and the estimated proportion of occupied watersheds ($\hat{\psi}$) for the Yosemite Toad (*Anaryxus canorus*) from 2002–2009. $\hat{\psi}$ and the standard error (SE) are shown for breeding and any stage rangewide and by temporal category. The estimated # of watersheds is the estimated number of watersheds of the target size (2–4 km^2) within the range of the species.

		Range	Recent	Historical	Unknown
# Watersheds Surveyed		134	69	20	45
# Annual Survey Watersheds		18	12	0	6
# Sites Surveyed		2213	1243	273	697
Estimated # Watersheds		3069	213	103	2753
Estimated # Watersheds SE		1415	38	64	1415
#	Breeding	65	45	9	11
ψ	Breeding	0.22	0.84	0.13	0.05
SE	Breeding	0.012	0.032	0.038	0.004
#	Any Stage	72	48	10	14
ψ	Any Stage	0.29	0.85	0.15	0.08
SE	Any Stage	0.013	0.031	0.042	0.005

Intensive component.—The Pradel models could not be fit to the mark-recapture data for four meadow-year combinations, probably due to low sample sizes. Based on the likelihood ratio test, populations were closed in two intensive meadows and open in three intensive meadows most years surveyed; the sixth meadow could not be modeled. For the meadow-years with open populations, the parameter estimates for immigration rates were low (range = 0.06–0.26) suggesting that violation of the closure assumption was not severe. The behavior model, M_b (the probability of capture, *p*, differs from the probability of recapture, *c*), had the most support in the two intensive meadows where populations were closed (Table 2). Overall, the goodness-of-fit analysis suggested that the most general model adequately fit the data with ĉ values ranging from 1.0–1.8. Because there was some overdispersion, we used $QAIC_c$ for our model selection criteria and adjusted the standard errors by ĉ for each meadow.

The total number of unique individuals captured per intensive meadow during the four-year monitoring period ranged from 4–37 for males and 5–38 for females. Accordingly, annual population estimates were also small (Table 4). The largest populations in each watershed had estimates of only 16 (meadow 520M15 in

TABLE 4. Estimates of numbers of Yosemite Toad (*Anaryxus canorus*) breeding adult males (M), egg masses, male survival (φ), and counts of females (F) encountered from 2006–2009 in six meadows in two watersheds of the Sierra Nevada, California, USA. Number of individuals (# Indiv) is the number of unique male and female toads found during the four year period. Confidence intervals (CI) are 95%.

		520M15			520M16			520M20			37188			37213			37165		
		Value	SE	CI	Value	SE	CI	Value	SE	CI	Value	SE	CI	Value	SE	CI	Value	SE	CI
M	# Indiv	37			19			4			34			27			9		
	2006	20.6	1.9	19–29	13.6	4.2	11–32				19.2	1.6	18–27						
	2007	18.7	4.8	14–37	10.1	2.2	8–20	3.0	0.1	3–4	19.4	0.7	19–23	14.3	1.4	13–20	6.2	0.5	6–9
	2008	20.1	2.5	17–29	12.0	1.4	11–18	4.0	0.2	4–5	18.2	1.0	18–21	14.2	1.3	13–20	7.2	0.6	7–11
	2009	15.9	1.9	14–24	9.1	1.6	8–17	2.0	0.1	2–3	18.3	0.6	18–20	12.0	1.2	11–17	3.1	0.4	3–6
φ	06–07	0.64	0.12	0.39–0.83	0.69	0.12	0.44–0.87				0.71	0.08	0.53–0.85						
	07–08	0.62	0.11	0.40–0.80	0.68	0.11	0.44–0.86	0.98	0.08	0.01–0.99	0.71	0.08	0.53–0.84	0.49	0.16	0.22–0.76	0.59	0.17	0.27–0.85
	08–09	0.57	0.13	0.32–0.79	0.67	0.12	0.41–0.86	0.52	0.26	0.12–0.89	0.72	0.08	0.53–0.85	0.49	0.16	0.22–0.77	0.52	0.17	0.22–0.80
F	# Indiv.	18			15			8			38			19			5		
	2006	11			13						9			2					
	2007	4			1			6			23			11			3		
	2008	14			11			2			24			11			5		
	2009	3			6			2			26			11			0		
Eggs	2006[1]	18	0.3	18–20	27	0.5	27–30				17	0.3	15–18	10	0.0	10–10			
	2007[2]	7	0.2	7–9	19	0.4	19–22	7	0.2	7–9	12	1.0	11–17	7	0.0	7–7	5	0.0	5–5
	2008[2]	48	7.6	40–73	28	3.1	25–39	13	0.0	13–13	20	1.3	19–26	16	0.7	16–20	5	0.0	5–5
	2009[3]	3			3			1			30			13			4		

[1]Dependent Double Observer Method, [2]Independent Double Observer Method, [3]Number of egg masses found during surveys. Counts from this method were less influenced by difficulties distinguishing individual masses from communal masses or broken fragments.

2009) to 21 (meadow 520M15 in 2006) and 18 (meadow 37188 in 2008) to 19 (meadow 37188 in 2007) males each year. One meadow in each watershed had very small numbers (2–4 and 3–7 males, respectively) each year. The numbers of males per year was fairly consistent among years, though confidence intervals varied. Annual survival estimates for breeding males were fairly similar among meadows and among years, ranging from a low of 0.49 in meadow 37213 to a high of 0.71–0.72 in meadow 37188. Only a few toads were found in meadow 520M20 where survival was 0.98 from 2007–2008. Precision for the survival estimates was low, likely due to the small sample sizes. Of 130 unique males captured in the two watersheds, 65 (50.0%) were captured in only one year, 34 (26.2%) were captured in two years, 18 (13.8%) were captured in three years, and 13 (10%) were captured in all four years. Only six males (4.6%) were captured in nonconsecutive years.

For both the dependent and independent double observer approaches used to survey for egg masses, the constant model, $p(.)$, was the best model for each intensive meadow each year and the detection probabilities were high (usually > 0.96). In general, the numbers of egg masses were low, and within the range of the numbers of toads estimated by CMR (Table 4). In a few meadow-years, estimates were greater and had wide confidence intervals. These were in meadows and years where distinguishing individual masses from communal masses or broken fragments was particularly difficult. In general, the proportion of breeding areas with successful metamorphosis was fairly low ranging from 0.14 at Bull Creek in 2009 to 0.73 at Highland Lakes in a wet year (2006, Table 5). Although direct comparisons are possible for only one year, Highland Lakes generally had more breeding areas with successful metamorphosis than Bull Creek based both on occupancy and our general observations of numbers of metamorphs.

Spatial and temporal occupancy patterns.—At the extensive scale, 93% of the 14 watersheds surveyed annually where breeding was documented were occupied most years (Fig. 2). A single dry year, 2007, accounted for most of the documented missed breeding (four of six watersheds). The one watershed missing two years was unoccupied in 2007 and 2008. In contrast, evidence of reproduction was found most years in only 30% of

TABLE 5. Proportion of breeding areas with eggs or tadpoles that had metamorphs for the Yosemite Toad (*Anaryxus canorus*) from 2006–2009 in two watersheds in the Sierra Nevada, California.

	# Breeding Areas With Eggs or Tadpoles				# Breeding Areas With Metamorphs				Proportion of Breeding Areas with Metamorphs			
Watershed	2006	2007	2008	2009	2006	2007	2008	2009	2006	2007	2008	2009
Highland Lakes	11	7	11	9	8	3	7	*	0.73	0.43	0.64[1]	*
Bull Creek	13	9	12	7	6	*	*	1	0.46	*	*	0.14

* No surveys were conducted to look for metamorphs.
[1]Only 2 visits were made at Highland Lakes during 2008, so proportions may have been higher.

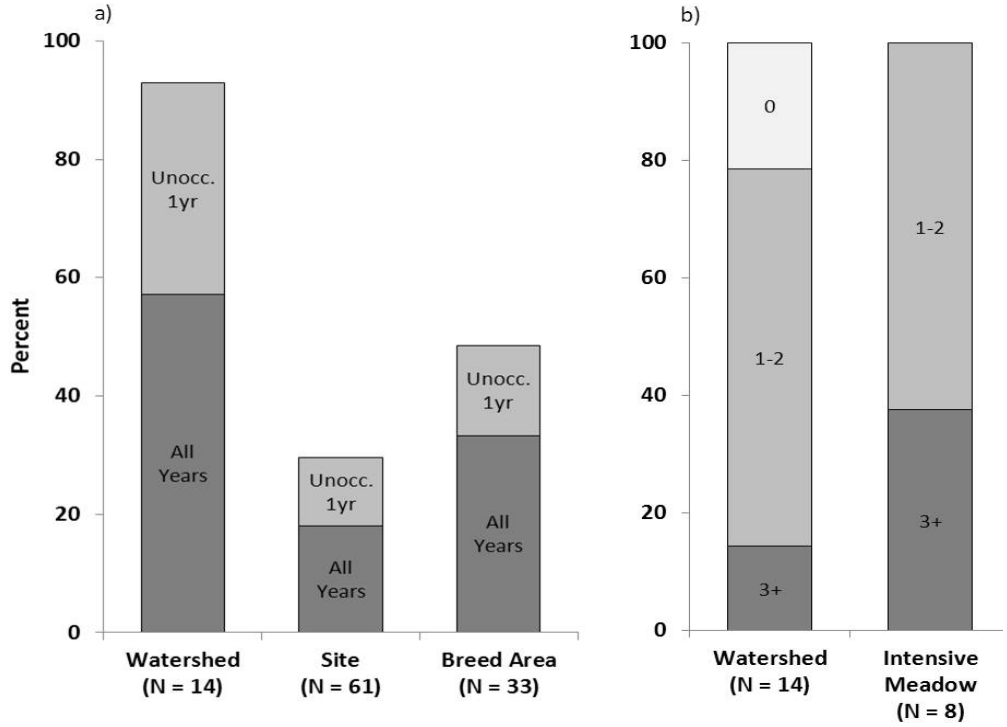

FIGURE 2. Spatial and temporal breeding occupancy patterns for the Yosemite Toad (*Anaryxus canorus*) in the annual watersheds and intensive meadows including (a) percentage of watersheds, percentage of lakes, meadows, and stream reaches (sites), and percentage of intensive meadow breeding areas that were consistently occupied (occupied all years, unoccupied 1 year) and (b) percentage of annual survey watersheds that had 0, 1–2, or 3+ sites consistently occupied and the percentage of intensive meadows that had 0, 1–2, or 3+ breeding areas consistently occupied.

occupied sites and 49% of breeding areas (intensive meadows). The consistency in occupancy at the watershed scale supports our assumption of population closure for the occupancy estimates. Spatially, more than half of the watersheds (64%) had only one or two sites that were consistently occupied with other sites occupied only in some years (Fig. 2). Fourteen percent of the watersheds had three or more sites that were consistently occupied. Of the intensive meadows, 63% had only one or two breeding areas consistently occupied and 38% had three or more breeding areas consistently occupied. In the intensive watersheds, only three males moved among meadows during the breeding period though they did move among breeding areas within the meadows.

DISCUSSION

Based on results from this multi-scale monitoring program, we conclude that the Yosemite Toad is still fairly well-distributed but that abundances are low. Yosemite Toad occupancy has declined from levels observed historically, but toads are still fairly widespread relative to post-1990 records. Only a few assessments of Yosemite Toad occupancy have been conducted for comparison with these monitoring results. During a 1992 resurvey of sites surveyed by Grinnell and Storer (1924), Drost and Fellers (1996) found the Yosemite Toad had disappeared or declined from 69% of the sites (n = 13) and that toad abundances were generally low. Jennings and Hayes (1994) found the species absent in approximately 50% (n = 29) of 55 historically occupied localities. No data external to the monitoring program exists to evaluate our population closure assumption for the Yosemite Toad. However, examination of occupancy in the annual watersheds indicates there has been no obvious violation within this first monitoring cycle. No trend was apparent and the pattern of detection at the watershed scale appeared to be most related to the influences of available water and survey date (Table 1, also see spatial and temporal occupancy results). Nonetheless, it is possible that our occupancy estimates are high.

Yosemite Toad abundance estimates in the two intensive watersheds were much smaller than reported historical abundances at other locations. During a long-term study at Tioga Pass Meadow, California (1971–1982), approximately 2,270 Yosemite Toads were marked with annual counts ranging from 162 to 342 males (1974–1979). In six other locations near Tioga

Pass, three Yosemite Toad populations were substantially larger and three had numbers similar to those found in our intensive meadows (Kagarise Sherman and Morton 1993). Abundances in our intensive meadows may have been substantially greater in the past. According to Martin (2008), Highland Lakes supported one of the largest breeding populations in the northern Sierra Nevada. Historical population sizes are unknown, but by the early 1980's, populations had declined to approximately 50–100 toads in one meadow in the watershed (Martin 2008). This is similar to our estimate of abundance in the entire watershed (three meadows) in a given year, suggesting that abundance has declined further since that time. The only other information on historical abundances is qualitative; historical accounts used terms such as "many males present", "common" (Grinnell and Storer 1924), and "numerous" (Mullally 1953).

If the abundances found in our intensive watersheds are reflective of a broader pattern, it may be that populations are small rangewide, even though Yosemite Toads were found to still occur in many of the *Recent* watersheds. Only 18 ± 6.1% of the occupied watersheds we surveyed rangewide had > 1,000 tadpoles or > 100 metamorphs, subadults, or adults detected at the time of survey (Cathy Brown, unpubl. data). Although not all surveys were conducted at the peak of tadpole presence and adults are not commonly detected outside the breeding period, these data in combination with documented local population declines (e.g., Kagarise Sherman and Morton 1993; Drost and Fellers 1996) lend support to the hypothesis that reduced abundances may be widespread in Yosemite Toad populations. Abundances of the closely related *Anaxyrus boreas* in northeastern Oregon and the Rocky Mountains of Colorado were comparable to the Yosemite Toad historical abundances from the Tioga Pass Meadow population (Muths et al. 2003; Bull and Carey 2008; Scherer et al. 2008). However, as a result of infection by the amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*), some populations in Colorado have declined to very small numbers (Muths et al. 2003; Muths et al. 2008). Whether *Bd* is a factor in Yosemite Toad declines is currently under study (Celeste Dodge, pers. comm.). *Bd* has been found in Yosemite Toads (Green and Kagarise Sherman 2001; Fellers et al. 2011) and the prevalence varies among populations and both prevalence and infection intensity is higher on juveniles than on adults (Celeste Dodge, Vance Vredenburg, Cathy Brown, and Amy Lind, unpubl. data).

No prior estimates of survival and successful metamorphosis exist for the Yosemite Toad. The apparent survival of reproductive males in our intensive meadows was similar or slightly lower than the ranges of those reported for stable populations of adult male *A. boreas* in Colorado. For example, Muths et al. (2003) reported survival rates for *A. boreas* of 78% prior to a large *Bd* related population decline (also see Scherer et al. 2005) and Scherer et al. (2008) reported survival rates ranging from 46% to 86% in uninfected ponds. Successful metamorphosis of Yosemite Toads in our intensive meadows was generally low, particularly given that it was measured by presence rather than number of metamorphs. Reasons for the low success and apparent differences between the Bull Creek and Highland Lakes watersheds are unknown. We are in the preliminary stages of investigating these results, and at Bull Creek, our observations suggest that much of the mortality is at the egg and early tadpole development stages. This analysis would be strengthened by estimating abundances of metamorphs rather than just presence, though this is very difficult to do.

Variable and episodic reproductive success is common in aquatic amphibians suggesting that low recruitment in a given year may not necessarily reflect population declines, particularly for long-lived species like the Yosemite Toad (Berven 1990; Semlitsch et al. 1996; Taylor et al. 2006). Yosemite Toad eggs and tadpoles are susceptible to a variety of natural stochastic environmental events such as freezing and desiccation resulting in naturally high mortality and low to no recruitment in some years (Kagarise Sherman 1980; Kagarise Sherman and Morton 1993; pers. obs.). The persistence of the species over the long-term may depend on both high survival rates for the long-lived adults (15 or more years, Kagarise Sherman and Morton 1984) and periodic high recruitment (e.g., Alford and Richards 1999). This dynamic was explored by Biek et al. (2002) who found that losses of post-metamorphic life stages were more likely to lead to population declines than losses in the egg or tadpole stages. The importance of both recruitment and adult survival is demonstrated by results from long-term monitoring of an *A. boreas* population in Colorado with abundances similar to our larger Yosemite Toad populations. Persistence of the population was sustained by high rates of survival (92% for males) of long-lived adults, but recruitment was very low (2–5%), and the resulting population growth rates showed the population to be in a slow decline (Muths and Scherer 2011).

Temporal and spatial occupancy.—In the majority of our annual occupied 2–4 km^2 watersheds, the Yosemite Toad consistently bred in one or two lakes, meadows, or stream reaches, and then only occasionally in other sites. Similarly, in 63% of the intensive meadows, Yosemite Toads consistently bred in one or two of the breeding areas, but only occasionally in other locations (Fig. 2b). Possible explanations include (1) population sizes are too low for toads to breed every year or to saturate the available habitat; (2) toads consistently breed in the best habitat, but occasionally breed in less optimal habitat; or

(3) some sites have suitable habitat only under certain environmental conditions. For example, a site may have optimal habitat during high snowpack years but may desiccate prior to metamorphosis during low snowpack years.

Data from the intensive watersheds provided further insights on how the species uses available habitat spatially and temporally. Only a few animals moved among meadows for breeding, suggesting that Yosemite Toads have high site fidelity at the scale of individual meadows. High site fidelity is common to many toad species (Breden 1987; Sinsch 1992; Muths et al. 2006). Males did, however, move among breeding areas within the meadows. Overall, Yosemite Toads in our study appear to be selecting particular breeding areas, even though some areas were not used every year. Given the fast development of toad eggs and tadpoles, it is likely that the breeding areas are chosen based on water retention and thermal regime. The pattern of snowmelt also may play a role; areas that melt early may be chosen more often for breeding (Olson 1992; pers. obs.). Further investigation is needed to better understand these occupancy patterns including whether the sites and breeding areas that are occasionally occupied are a result of generally small population sizes or reflect habitat differences and their importance for long-term persistence.

In our intensive meadows, the proportion of toads found one, two, three, or all four years were similar to those reported by Kagarise Sherman (1980) in Tioga Pass Meadow during a 4-year period (1976–1979). Based on capture histories, only 5% of males (n = 6) in our intensive meadows skipped one or more years. Similarly, Kagarise Sherman (1980) found that only 7% of 522 males captured over multiple years were thought to have skipped one or more years. Other studies of the closely related *A. boreas* reported that < 25% (Olson 1992) and 31% (Bull and Carey 2008) of males skipped one or more years of breeding. Muths et al. (2006, 2010) found some evidence for temporary emigration in both male and female *A. boreas*.

Multi-scale and long term monitoring.—When designing a monitoring program, the information objectives and scale are interrelated. There has been a recent emphasis on monitoring occupancy because it is more feasible for bioregional scale, long-term programs and it is robust to population fluctuations that have been documented in many amphibians at local scales (Corn et al. 2005; MacKenzie et al. 2006; Gould et al. 2012). Yet occupancy is a relatively coarse measure of population dynamics; declines in abundance may precede the distributional changes measured by occupancy (Beiswenger 1986; Collen et al. 2011). Results from this monitoring demonstrate the value of occupancy, abundance, and demography data. The bioregional occupancy data provide affordable robust broad-scale information and suggest that the Yosemite Toad is still widespread relative to 1990 distributions, the abundance data collected in the intensive meadows suggest that populations may be small, and the demography data provides insights on vital rates. For some species, such as the highly aquatic mountain yellow-legged frogs (*Rana muscosa* and *R. sierrae*), it may be possible to collect both occupancy and relative abundance data bioregionally (Cathy Brown et al., unpubl. data; also Hecnar and M'Closkey 1997; Bonardi et al. 2011). This is not feasible given the Yosemite Toad's ecology, and even for the mountain yellow-legged frogs, obtaining other demographic information (e.g., survival) is not pragmatic rangewide.

Our monitoring results agree with other studies that have found that survey results vary depending on scale. Spatially, Hecnar and M'Closkey (1997) concluded that determination of the status of the Green Frog, *Lithobates (Rana) clamitans*, was dependent on spatial scale and that assessments conducted at smaller scales can lead to incorrect inferences. We also found that occupancy variability depended on scale. Annual variability in occupancy at the site scale of individual lakes, meadows, and stream reaches was higher than at the watershed scale. Given our rotating panel design, single visits at the site scale once every five years may under represent occupancy; however, occupancy was fairly consistent from year to year at the watershed scale. Temporally, longer time series have been shown to be critical for separating short-term fluctuations from longer term trends. Studies have documented large fluctuations in population abundances (Pechmann et al. 1991; Semlitsch et al. 1996; Gibbs et al. 1998; Meyer et al. 1998; Raithel et al. 2011) and site occupancy (Skelly et al. 2003; Trenham et al. 2003) that occur naturally, but do not necessarily reflect declines (see Alford and Richards 1999). We have completed only one monitoring cycle in the extensive component and the time series for our abundance estimates in the intensive meadows is relatively short (four years). Completion of additional monitoring cycles will determine if our initial spatial and temporal occupancy and abundance patterns are consistent over the long term.

Conservation and management.—Management strategies may differ if animals remain in the same sites every year, if different sites are occupied different years (e.g., metapopulation, Levins 1970), or if there is a site that provides most of the recruitment for a cluster of sites (mainland, MacArthur and Wilson 1967; source population, Pulliam 1988). For example, if certain sites are always used for breeding then protection could focus on these. Alternatively, if a variety of sites are used from year to year and by different life stages then a wider protective zone including connectivity among both

consistently occupied and occasionally occupied sites may be more appropriate. Preliminary interpretation of our monitoring results in combination with the knowledge that adults use additional habitats (Karlstrom 1962; Kagarise Sherman 1980; Martin 2008; Liang 2010) suggests that a combination of these approaches is warranted. Identification and additional protection for "mainland" breeding sites is clearly important, but our results suggest that management also consider incorporating broader protection zones that include adult habitats and "island" sites. Further, understanding the annual variation of occupancy can inform decisions on monitoring design. For example, if a species is found in the same places every year, it may be possible to gain efficiencies by making less frequent visits to the same locations. Conversely, if they do not occupy a location every year, it may be necessary to survey more often to have confidence in trend estimates. Our data suggest that at the watershed scale, occupancy is fairly consistent from year to year and is strongly related to snowpack. However, at the site scale, less frequent visits may miss occupancy in some sites.

The Yosemite Toad appears to have declined over a longer time span, yet still persists in the majority of watersheds occupied since 1990. The declines in occupancy from historical locations and the apparent small population sizes in at least two locations merit the development of proactive conservation actions. Research on potential causes and possible mitigation measures is needed. This baseline assessment of status provides data to inform management decisions for the Yosemite Toad and is the foundation for subsequent trend evaluation. By continuing to track trends over time, we will be able to evaluate management success and will provide an early warning system to facilitate proactive conservation planning. Data collected through the program has given us both quantitative and qualitative insights on the status and ecology of this sensitive species which benefit its conservation.

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CATHY BROWN, a Wildlife Biologist on the Stanislaus National Forest, Sonora, California, is the team leader of the USDA Forest Service Sierra Nevada Amphibian Monitoring Program. Cathy received her B.S. in Conservation and Resource Studies from the University of California, Berkeley and her M.S. in Forest Science from Oregon State University, Corvallis, where she studied large scale population dynamics in pond-breeding amphibians. She currently works on multi-scale monitoring and conservation of amphibians in the Sierra Nevada, California. (Photographed by Katie Kiehl)

KATIE KIEHL is an Ecologist with the USDA Forest Service on the Stanislaus National Forest in Sonora, California. After receiving a B.S. in environmental biology/zoology from Michigan State University, Katie earned an M.S. in biology from the University of Illinois. She currently works on the monitoring and conservation of amphibians in the Sierra Nevada, California. (Photographed by Celeste Dodge)

LUCAS WILKINSON is an Ecologist with the USDA Forest Service on the Stanislaus National Forest in Sonora, California. Lucas received a B.A. in Environmental Sciences from Northwestern University and an M.S. in ecology from the University of Georgia. His current work focuses on amphibian conservation and population ecology in the Sierra Nevada, California. (Photographed by Katie Kiehl)

B-43_Photos of toadlets at Saddlebag Lake

From:	Steve Norton
To:	Matthew Woodhall; Shannon Luoma
Cc:	Carissa Shoemaker; Lauren Rosenkranz; Brad Blood
Subject:	FW: Toadlets at Saddlebag
Date:	Monday, August 29, 2022 10:34:17 AM
Attachments:	image003.png image001.png image002.png image004.png 17271_SoInletBucaSite1_08262022.jpg 17271_Herp3SoInletBucaSite_08262022.JPG 17271_Herp7SoInletBucaSite_08262022.JPG

For our records, CDFW just sent me the email below with attached photos. No new information included, but good photos.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Monday, August 29, 2022 10:06 AM
To: Steve Norton <steve.norton@psomas.com>
Cc: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: Toadlets at Saddlebag

Hi Steve,
I was at Maul and Green Treble Lakes in the Harvey Monroe Hall RNA near Saddlebag Lake on Friday.
I stopped in at the Saddlebag south inlet Buca site to have a quick look.
Main site/pond was dry although a little moist and muddy, probably from rain. Photo attached.
There were lots of sub adult Treefrogs and quite a few toadlets hopping around. Photo attached.
The lowest of the small ponds at the site still had water and there were still Pssi (Hyre) larvae present.
Thought you might be interested to see a toadlet photo.
Sierrally

B-43_Photos of toadlets at Saddlebag Lake

B-43_Photos of toadlets at Saddlebag Lake

B-43 Photos of toadlets at Saddleback Lake

08/26/2022 15:25

From:	Steve Norton
To:	Matthew Woodhall; Shannon Luoma
Cc:	Carissa Shoemaker; Lauren Rosenkranz; Brad Blood
Subject:	Lee Vining Relicensing CDFW Communications - FW: Toadlets at Saddlebag
Date:	Tuesday, August 30, 2022 12:18:10 PM
Attachments:	image001.png image002.png image003.png image004.png

Hi Shannon,
Below is an email exchange I've been having with Jim Erdman (CDFW). There is no new information in these exchanges, but still important for our administrative record. I am about to send a follow up email but will copy all on that exchange.
-Steve

Steve Norton
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Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
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From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Monday, August 29, 2022 12:57 PM
To: Steve Norton <steve.norton@psomas.com>
Cc: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: RE: Toadlets at Saddlebag

Cool. Great stuff.
I too have been "site refining" the area to provide better more detailed site information for the Buca Pops. in general.
Great motivation and opportunity to compile Buca data and update GIS to reflect actual on ground site extent, etc.
I look forward to comparing info.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Monday, August 29, 2022 12:45 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>

Subject: RE: Toadlets at Saddlebag

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Those are great photos!
We were out early last week collecting the wildlife cameras and did a little exploring for other potential breeding habitat in the greater vicinity (well beyond the project boundary). I'd like to pick your brain and see if you (or anyone else) has looked at these spots before. I'll send you an email with some specifics later this week but one of these sites looked really good.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Monday, August 29, 2022 10:06 AM
To: Steve Norton <steve.norton@psomas.com>
Cc: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: Toadlets at Saddlebag

Hi Steve,
I was at Maul and Green Treble Lakes in the Harvey Monroe Hall RNA near Saddlebag Lake on Friday.
I stopped in at the Saddlebag south inlet Buca site to have a quick look.
Main site/pond was dry although a little moist and muddy, probably from rain. Photo attached.
There were lots of sub adult Treefrogs and quite a few toadlets hopping around. Photo attached.
The lowest of the small ponds at the site still had water and there were still Pssi (Hyre) larvae present.
Thought you might be interested to see a toadlet photo.
Sierrally

B-44_Discussion re populations at Buca site

From:	Steve Norton
To:	James.Erdman@wildlife.ca.gov
Cc:	Carissa Shoemaker; Lauren Rosenkranz
Subject:	Lee Vining Hydroelectric Relicensing Discussion Summary
Date:	Friday, November 11, 2022 4:38:27 PM
Attachments:	image001.png image002.png image003.png Phone Summary Memo-111122.docx Phone Summary Memo_YOTO-111122.docx

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Hi Jim,

The attached two documents are brief bullet point summaries of our phone conversations this past field season. I wrote these a few months back, but they needed some additional approvals before sending out. If you have any edits or comments, just let me know.

Thanks and hope you're enjoying a long weekend!

-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
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MEMORANDUM

November 11, 2022

To:
Jim Erdman
California Department of Fish and Wildlife (CDFW)

Matt Woodhall
Southern California Edison (SCE)

Shannon Luoma
Kleinschmidt

From:
Steve Norton
Psomas

Subject: **Yosemite Toad Survey Findings Discussions, Lee Vining Hydroelectric Relicensing Project**

This memorandum transmits to the California Department of Fish and Wildlife (CDFW), a brief summary of telephone conversations held on June 29 and July 25, 2022, between CDFW (Jim Erdman) and Psomas (Steve Norton). The conversations were concerning recent Yosemite toad (*Anaxyrus canorus*) survey findings at and in the vicinity of the Lee Vining Hydroelectric Relicensing Project, located east of Yosemite National Park, California. Below are highlights from those conversations.

- Portions of the Psomas and CDFW field surveys in June 2022 for Yosemite toad occurred in overlapping areas. Specific locations include the margins and inlets at the southern end of Tioga Lake and the meadow above the southern shore of Saddlebag Lake. Shared observations are mostly consistent except:
    - Psomas observed additional adult toads in the meadow at the southern end of Saddlebag Lake;
    - Psomas observed additional adult toad carcasses in the meadow at the southern end of Saddlebag Lake;
    - CDFW observed Yosemite toad tadpoles in small pools above the southeastern margin of Tioga Lake and in a large meadow south of Tioga Lake.
- CDFW noted that, in practice, western toads are not considered to occur above 8,000 feet in elevation; however, CDFW acknowledged that they were not aware of any publications or other published data explicitly documenting this.
- The yellow-legged frog reintroductions planned for the region (as shared by CDFW during the Project TWG meetings) have not yet begun. The reintroductions cannot occur until all fish are removed from the identified lakes, which has been delayed for logistical reasons.

Thank you again for speaking with me and please let me know if you have any additions or edits.

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MEMORANDUM

November 11, 2022

To:
Jim Erdman
California Department of Fish and Wildlife (CDFW)

Matt Woodhall
Southern California Edison (SCE)

Shannon Luoma
Kleinschmidt

From:
Steve Norton and Brad Blood
Psomas

Subject: Yosemite Toad Discussions, Lee Vining Hydroelectric Relicensing Project

---

This memorandum transmits to the California Department of Fish and Wildlife (CDFW), a brief summary of a telephone discussion held on August 9, 2022, between CDFW (Jim Erdman), Southern California Edison (SCE; Matt Woodhall), Psomas (Steve Norton and Brad Blood), and Kleinschmidt (Shannon Luoma). The conversation was regarding Yosemite toad (YOTO, *Anaxyrus canorus*) at and in the vicinity of the Lee Vining Hydroelectric Relicensing Project (project), located east of Yosemite National Park, California. Below are highlights from the conversation.

- Psomas relayed the findings from the most recent YOTO survey on July 26, 2022. Specifically:
    - Both of the pools where toad tadpoles were likely observed on date along Lee Vining Creek (downstream of Saddlebag Lake) were dry and the tadpoles within were assumed to have not survived.
    - The pools along the margin of Tioga Lake were also dry.
    - Other pools in the flood plain immediately adjacent to these pools still had water and were supporting both newly hatched tadpoles and Sierra treefrog metamorphs.
    - Toadlets and other subadult toads were observed in the meadow south of Saddlebag Lake. No adult carcasses were observed.
- Psomas had a biologist conducting a survey for amphibians at the project site during the week of August 8 to 12, 2022. SCE is planning on conducting additional YOTO surveys on site the week of August 22 to collect additional data during and after the substantial rainfall currently occurring at high elevations. CDFW confirmed that only a few more weeks are left in the survey season for YOTO.
- SCE discussed the general need for additional data to verify the identity of toad species (*Anaxyrus* spp.) on and in the vicinity of the project. The general consensus is that toad species located above 8,000 feet in elevation are YOTO, but there are records of western toad (*Anaxyrus boreas*) occurring above 8,000 feet including a museum record of western toad from the eastern entrance of Yosemite National Park, adjacent to the project. A possibility remains that some of the toad species observed at the project, could be western toad or a hybrid of western toad and YOTO. SCE and Psomas are in the process of expanding their literature review and anticipates expanding survey efforts in 2023 to help resolve this question.

- CDFW discussed how phenotypic traits in both YOTO and western toad are typically diagnostic of species and field observations by CDFW over many field seasons have reinforced the consensus of western toad or their hybrids not occurring above 8,000 feet in elevation. Regardless, CDFW appreciates the collection of additional data that may benefit California wildlife. CDFW referenced several researchers and scientific authors that would be good to contact or have their literature reviewed.
- All parties on the call were appreciative of the data sharing and discussions that took place. SCE and CDFW agreed to continue these conversations to maintain transparency, relay findings, and continue partnership.

Thank you again for the discussions and please let me know if you have any additions or edits.

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Lauren Rosenkranz

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, November 16, 2022 12:22 PM
To: Steve Norton
Cc: Carissa Shoemaker; Lauren Rosenkranz; Black, Russell@Wildlife
Subject: RE: Lee Vining Hydroelectric Relicensing Discussion Summary

Great, thanks!

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, November 16, 2022 12:06 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>
Subject: RE: Lee Vining Hydroelectric Relicensing Discussion Summary

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Perfect: the descriptions of habitat as you described are accurate.

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, November 16, 2022 12:02 PM
To: Steve Norton <steve.norton@psomas.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>
Subject: RE: Lee Vining Hydroelectric Relicensing Discussion Summary

Steve,
Thanks for clarifying.
I read it as: Fringing habitat on SE side of Tioga Lake where larvae were seen in June (CDFW) was dry.
Area where Buca larvae were detected by PSOMAS along Lee Vining/Saddlebag Creek (downstream of Lake & Sawmill CG) was dry but there were other side pooled habitat areas that contained freshly hatched Pssi larvae and metamorphs.
Does that sound right? Just adding some notes to my datasheets to capture the data.

Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, November 16, 2022 10:23 AM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>
Subject: RE: Lee Vining Hydroelectric Relicensing Discussion Summary

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Hi Jim,
That's good insight on the possible duration of the breeding activities at Saddlebag.

Regarding your questions, the "other pools in the flood plain" were actually referring to Lee Vining Creek downstream of Saddlebag. Also, yes: the newly-hatched tadpoles were *Pseudacris sierrae*.
I will clarify both of those statements in the memo and redistribute.

Thanks for getting back to me and see you in the Spring!
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Wednesday, November 16, 2022 10:02 AM
To: Steve Norton <steve.norton@psomas.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>
Subject: RE: Lee Vining Hydroelectric Relicensing Discussion Summary

Hi Steve,
Thank you for providing the memo summary of our conversations on June 29 and July 25, 2022. "Phone Summary Memo_YOTO-111122".
Thank you for providing the memo summary of our conversation on August 9, 2022. "Phone Summary Memo-111122".

I have reviewed each document and have a quick question regarding the "Phone Summary Memo-111122".

In the line “Other pools in the flood plain immediately adjacent to these pools still had water and were supporting both newly hatched tadpoles and Sierra treefrog metamorphs”. This in in regards to the Tioga Lake fringing habitat pools and floodplain.
Were the “newly hatched tadpoles” also Sierra Treefrogs (*Pseudacris sierrae*)? The line reads a bit unclear and may be mistaken for Buca larvae.
Otherwise I have no other questions. Thank again for putting those together.

I find it pretty amazing that you saw toadlets on July 26 and Saddlebag South Inlet and I saw toadlets in the same location on August 26. A whole month later. I would have thought they would all morph at a similar time and disperse. A month seems pretty long. Perhaps there was a much longer egg mass deposition period than I expected and therefore time lag between metamorphosis. Makes me think a good number dispersed between our visits and that productivity is higher than I suspected. Just some thoughts.
Have a great winter. Hope to see you in early spring at Saddlebag Lake.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Friday, November 11, 2022 3:38 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com
Subject: Lee Vining Hydroelectric Relicensing Discussion Summary

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Hi Jim,
The attached two documents are brief bullet point summaries of our phone conversations this past field season. I wrote these a few months back, but they needed some additional approvals before sending out. If you have any edits or comments, just let me know.
Thanks and hope you’re enjoying a long weekend!
-Steve

Steve Norton
PSOMAS | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

MEMORANDUM

November 16, 2022

To:
Jim Erdman
California Department of Fish and Wildlife (CDFW)

Matt Woodhall
Southern California Edison (SCE)

Shannon Luoma
Kleinschmidt

From:
Steve Norton and Brad Blood
Psomas

Subject: Yosemite Toad Discussions, Lee Vining Hydroelectric Relicensing Project

---

This memorandum transmits to the California Department of Fish and Wildlife (CDFW), a brief summary of a telephone discussion held on August 9, 2022, between CDFW (Jim Erdman), Southern California Edison (SCE; Matt Woodhall), Psomas (Steve Norton and Brad Blood), and Kleinschmidt (Shannon Luoma). The conversation was regarding Yosemite toad (YOTO, *Anaxyrus canorus*) at and in the vicinity of the Lee Vining Hydroelectric Relicensing Project (project), located east of Yosemite National Park, California. Below are highlights from the conversation.

- Psomas relayed the findings from the most recent YOTO survey on July 26, 2022. Specifically:
    - Both of the pools where toad tadpoles were likely observed previously along Lee Vining Creek (downstream of Saddlebag Lake) were now dry and the tadpoles within were assumed to have not survived.
    - Other pools in the Lee Vining flood plain immediately adjacent to these pools still had water and were supporting Sierra treefrog (both newly hatched tadpoles and metamorphs).
    - The pools along the margin of Tioga Lake were also dry.
    - Toadlets and other subadult toads were observed in the meadow south of Saddlebag Lake. No adult carcasses were observed.
- Psomas had a biologist conducting a survey for amphibians at the project site during the week of August 8 to 12, 2022. SCE is planning on conducting additional YOTO surveys on site the week of August 22 to collect additional data during and after the substantial rainfall currently occurring at high elevations. CDFW confirmed that only a few more weeks are left in the survey season for YOTO.
- SCE discussed the general need for additional data to verify the identity of toad species (*Anaxyrus* spp.) on and in the vicinity of the project. The general consensus is that toad species located above 8,000 feet in elevation are YOTO, but there are records of western toad (*Anaxyrus boreas*) occurring above 8,000 feet including a museum record of western toad from the eastern entrance of Yosemite National Park, adjacent to the project. A possibility remains that some of the toad species observed at the project, could be western toad or a hybrid of western toad and

YOTO. SCE and Psomas are in the process of expanding their literature review and anticipates expanding survey efforts in 2023 to help resolve this question.

- CDFW discussed how phenotypic traits in both YOTO and western toad are typically diagnostic of species and field observations by CDFW over many field seasons have reinforced the consensus of western toad or their hybrids not occurring above 8,000 feet in elevation. Regardless, CDFW appreciates the collection of additional data that may benefit California wildlife. CDFW referenced several researchers and scientific authors that would be good to contact or have their literature reviewed.
- All parties on the call were appreciative of the data sharing and discussions that took place. SCE and CDFW agreed to continue these conversations to maintain transparency, relay findings, and continue partnership.

Thank you again for the discussions and please let me know if you have any additions or edits.

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Lauren Rosenkranz

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Monday, December 12, 2022 2:02 PM
To: Steve Norton; Matthew Woodhall
Cc: Shannon Luoma; Finlay Anderson; Brad Blood; Carissa Shoemaker; Sarah Berryman; Lauren Rosenkranz
Subject: RE: Agenda for 2:30 call regarding 2023 Proposed Yosemite Toad Field Survey and Research Efforts
Attachments: Maier2022_BucaGenomics_ClimateAdapt.pdf

Steve and all,
I recently received some new literature on Buca.
Please find attached the latest paper by Paul Maier (Buca guru) concerning genomics and climate change.
FYI only, in case you have not seen it.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Monday, December 12, 2022 12:09 PM
To: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Matthew Woodhall <Matthew.Woodhall@sce.com>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Sarah Berryman <sarah.berryman@psomas.com>; lauren.rosenkranz@kleinschmidtgroup.com
Subject: Agenda for 2:30 call regarding 2023 Proposed Yosemite Toad Field Survey and Research Efforts

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Below is the agenda for our meeting at 2:30.
See you all then!
-Steve

MEETING AGENDA
December 12, 2022
Conference call between SCE, Kleinschmidt, Psomas, and CDFW
SUBJECT:
2023 Proposed Yosemite Toad Field Survey and Research Efforts for the Lee Vining Hydroelectric Relicensing Project

1) Discuss Revised Survey Locations for 2023.
2) Discuss available options for authorizing DNA collection.
3) Discuss proposed methods for DNA collection.
    a. eDNA vs tail clips vs swabs

   b. What labs are available/does CDFW recommend to do analysis
4) Request additional Yosemite toad locations not available in CNDDB.
5) Next steps
   a. Update Chad with USFWS on our proposed 2023 survey strategy

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Check for updates

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DOI: 10.1111/eva.13511

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ORIGINAL ARTICLE

Using landscape genomics to delineate future adaptive potential for climate change in the Yosemite toad (*Anaxyrus canorus*)

Paul A. Maier[1,2] | Amy G. Vandergast[3] | Andrew J. Bohonak[1]

[1]Department of Biology, San Diego State University, San Diego, California, USA

[2]FamilyTreeDNA, Gene by Gene, Houston, Texas, USA

[3]Western Ecological Research Center, U.S. Geological Survey, San Diego, California, USA

Correspondence
Paul A. Maier, Department of Biology, San Diego State University, MC 4614, 5500 Campanile Drive, San Diego, CA 92182-4614, USA.
Email: paulm@genebygene.com

Funding information
Achievement Rewards for College Scientists Foundation; Harold & June Memorial Scholarship; Jordan D. Covin Scholarship

Abstract

An essential goal in conservation biology is delineating population units that maximize the probability of species persisting into the future and adapting to future environmental change. However, future-facing conservation concerns are often addressed using retrospective patterns that could be irrelevant. We recommend a novel landscape genomics framework for delineating future "Geminate Evolutionary Units" (GEUs) in a focal species: (1) identify loci under environmental selection, (2) model and map adaptive conservation units that may spawn future lineages, (3) forecast relative selection pressures on each future lineage, and (4) estimate their fitness and likelihood of persistence using geo-genomic simulations. Using this process, we delineated conservation units for the Yosemite toad (*Anaxyrus canorus*), a U.S. federally threatened species that is highly vulnerable to climate change. We used a genome-wide dataset, redundancy analysis, and Bayesian association methods to identify 24 candidate loci responding to climatic selection (R^2 ranging from 0.09 to 0.52), after controlling for demographic structure. Candidate loci included genes such as MAP3K5, involved in cellular response to environmental change. We then forecasted future genomic response to climate change using the multivariate machine learning algorithm Gradient Forests. Based on all available evidence, we found three GEUs in Yosemite National Park, reflecting contrasting adaptive optima: YF-North (high winter snowpack with moderate summer rainfall), YF-East (low to moderate snowpack with high summer rainfall), and YF-Low-Elevation (low snowpack and rainfall). Simulations under the RCP 8.5 climate change scenario suggest that the species will decline by 29% over 90 years, but the highly diverse YF-East lineage will be least impacted for two reasons: (1) geographically it will be sheltered from the largest climatic selection pressures, and (2) its standing genetic diversity will promote a faster adaptive response. Our approach provides a comprehensive strategy for protecting imperiled non-model species with genomic data alone and has wide applicability to other declining species.

KEYWORDS
adaptive potential, admixture, conservation unit, ESU, landscape genomics, natural selection

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1 | INTRODUCTION

Conservation biologists agree upon the goal of preserving evolutionary processes to help species persist across a diversity of habitats (Allendorf et al., 2013; Frankel & Soulé, 1981). However, an objective delineation of conservation units is often challenging due to disagreement regarding the appropriate processes to preserve, and ambiguity regarding which ecological and genetic patterns are the best surrogates for them (Table 1). The long-standing debate about how to operationally define Evolutionarily Significant Units (ESUs) exemplifies this: researchers disagree whether ESUs should delineate historically isolated lineages (Avise, 1994; Bowen, 1998; Moritz, 1994, 2002) or circumscribe populations that have historically adapted to similar phenotypes, without specific regard for their shared ancestry (Crandall et al., 2000; Ryder, 1986; Vogler & Desalle, 1994; Waples, 1991). Conceptually, both approaches are an attempt to preserve historical trajectories that may represent early stages toward the formation of new species (de Queiroz, 1998), and hence both should be maintained. Yet in practice, the relative order of events (e.g., lineage vicariance, adaptive evolution, reproductive isolation), and the type of dataset elucidating them (e.g., molecular, ecological, morphological) might suggest the primacy of one process over another. If evolutionary legacy were indeed the best process to conserve, then ESUs would ideally be delimited by giving proportional weight to both neutral and adaptive genetic divergence, based on all empirical evidence for each (Fraser & Bernatchez, 2001).

The ESU approach could be criticized as misguided because it implicitly assumes that ancient divergence and/or adaptation are good indicators of future persistence and/or adaptation. This assumption is ubiquitous in conservation genetic studies: "future" units of potential are informed by temporal periods ranging from the ancient past to the present (Allendorf et al., 2013; Casacci et al., 2014; Fraser & Bernatchez, 2001). Yet, adaptive genetic diversity preserved in ancient lineages is unlikely to be equally relevant to future selective environments (Crandall et al., 2000). ESUs defined by characters thought to be adaptive (such as distinct morphologies, behaviors, or a nuclear gene sequence) might present an incomplete picture of future fitness, or be incongruent with future selection, assuming the traits in question are even heritable (Fraser & Bernatchez, 2001; Moritz, 2002). Alternatively, some conservation genetic studies attempt to delineate Management Units (MUs), which are generally defined as demographically independent populations connected by dispersal rates below a threshold of 10% (Hastings, 1993), and diagnosed by significantly distinct allele frequencies (Dizon et al., 1992; Moritz, 1994; Palsbøll et al., 2007). MUs are meant to represent the scale of contemporary gene pools, although they are often delineated with similar operational criteria as ESUs (e.g., significant divergence of allele frequencies).

Future units of adaptive diversity are ultimately the target for preservation. Although both ancient lineage distinctiveness and current genetic diversity are important components of evolutionary potential, the persistence of a population into future environmental conditions is ultimately decided by its future adaptive optimum, and whether it can garner sufficient genetic novelty to adapt and grow (Frankham, 2005; Radwan et al., 2010; Vilas et al., 2006). In a changing environment, populations must track the optimum

TABLE 1 Conservation units reflecting evolutionary pattern and process

	Time frame			
	Ancient past	**More recent past**	**Present**	**Near future**
Process	I. Lineage Isolation II. Lineage Adaptation	Secondary contact with admixture, introgression	Demographically independent populations	Future adaptation, population persistence
Lineage formation				
Evo. Forces	I. Drift-mutation balance II. Divergent selection	Outbreeding, hybrid vigor, recombination	Drift-migration balance	Hard and soft selection
Pattern	I. Fixation of alleles, or reciprocal monophyly II. Non-exchangeability	High genome-wide π, and inter-population H_O, unique alleles	Distinct gene pools with dispersal rates <10%	Correlation of outlier alleles with future environmental gradients
Units	ESUs	GEUs (in contact zones)	MUs (potentially hierarchical)	GEUs
References	Ryder (1986), Waples (1991), Moritz (1994), Crandall et al. (2000)	Allendorf et al. (2001), Hedrick (2013), Klütsch et al. (2016), Quilodrán et al. (2020)	Dizon et al. (1992), Hastings (1993), Waples and Gaggiotti (2006), Palsbøll et al. (2007)	Bowen (1998, 1999), Fitzpatrick and Keller (2015)

Note: From the perspective of present day, population genetic processes from each time period uniquely shape evolutionary potential within a species. The formation of lineages that will persist and adapt through time depends on current adaptive or reproductive differences (ESUs), recent adaptive admixture (GEUs in contact zones), the current maintenance of genetic diversity (MUs), and sufficient population fitness to survive future environmental change (GEUs). Consequently, four classes of genetic patterns reflecting these four processes can and should be separately modeled to accurately delineate intraspecific conservation units.

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phenotype with an adequate supply of adaptive mutations, or else the demand of local selective pressures will render them extinct (Kopp & Hermisson, 2009; Matuszewski et al., 2014). In lieu of backward-looking ESUs or MUs, future-directed conservation units that track new local environments are better expressed as Geminate Evolutionary Units (GEUs), which refer to incipient lineages expected to diverge by future adaptation (Bowen, 1998, 1999; Jordan, 1908). The field of landscape genomics is well-equipped to identify genetic loci undergoing putative adaptive change using a biogeographic approach (Cushman & Huettmann, 2010; Li et al., 2017). Identifying patterns of adaptive potential can directly inform conservation decisions, such as the U.S. Fish & Wildlife Service's recovery plans, or the IUCN's species action plans. For example, such patterns may highlight regions vulnerable to loss of "representation," i.e., flexibility for future adaptation (Funk et al., 2019; Smith et al., 2018). Although other studies have prescribed the use of historically adaptive loci to define conservation unit boundaries (Bonin et al., 2007; Funk et al., 2012), or predicted future adaptation using experimental data (Hoffmann & Sgrò, 2011), ancient DNA (Fordham et al., 2014; Orsini et al., 2013), or outlier loci (Fitzpatrick & Keller, 2015), we propose using both neutral and putatively adaptive genomic variation to build explicitly predictive, future conservation units. We now adapt and codify this GEU concept into a landscape genomic context, by defining GEUs as populations expected to adapt similarly to models of future environmental change, and potentially form new lineages (Table 1).

We applied this GEU landscape genomics approach to the U.S. federally threatened Yosemite toad (*Anaxyrus canorus*), a sub-alpine species endemic to the central Sierra Nevada of California. Yosemite toads are an ideal species for this application because they are extremely vulnerable to ongoing climate change. Adults exclusively breed in the transient and exceptionally shallow ponds of mountain meadows (Grinnell & Storer, 1924; Karlstrom, 1962; Ratliff, 1985), making them highly dependent upon seasonal snowpack and associated groundwater and runoff levels. Tadpoles regularly face high desiccation mortality (Brown et al., 2015; Sherman, 1980; Sherman & Morton, 1993) exacerbated by opportunistic parasites and predators (Sadinski et al., 2020). Adults and subadults are sensitive to temperature-induced reduction in body fat levels that can influence their overwintering survival and fecundity (Morton, 1981). A recent study predicted that future climate perturbations to snowpack will shift the species range upward in elevation, via corridors of net migration (Maier et al., 2022b). Yosemite toads are also a burgeoning model for different temporal units of conservation (Table 1). Several temporal processes have already been studied: ancient lineage formation (Maier et al., 2019; Figure 1), lineage fusion and adaptive introgression via secondary contact (Maier, 2018; Maier et al., 2019), and gene migration (i.e., dispersal and subsequent interbreeding) between current gene pool boundaries (Maier et al., 2022a; Shaffer et al., 2000; Wang, 2012). For example, there is some evidence that lower-elevation lineages have repeatedly undergone adaptive

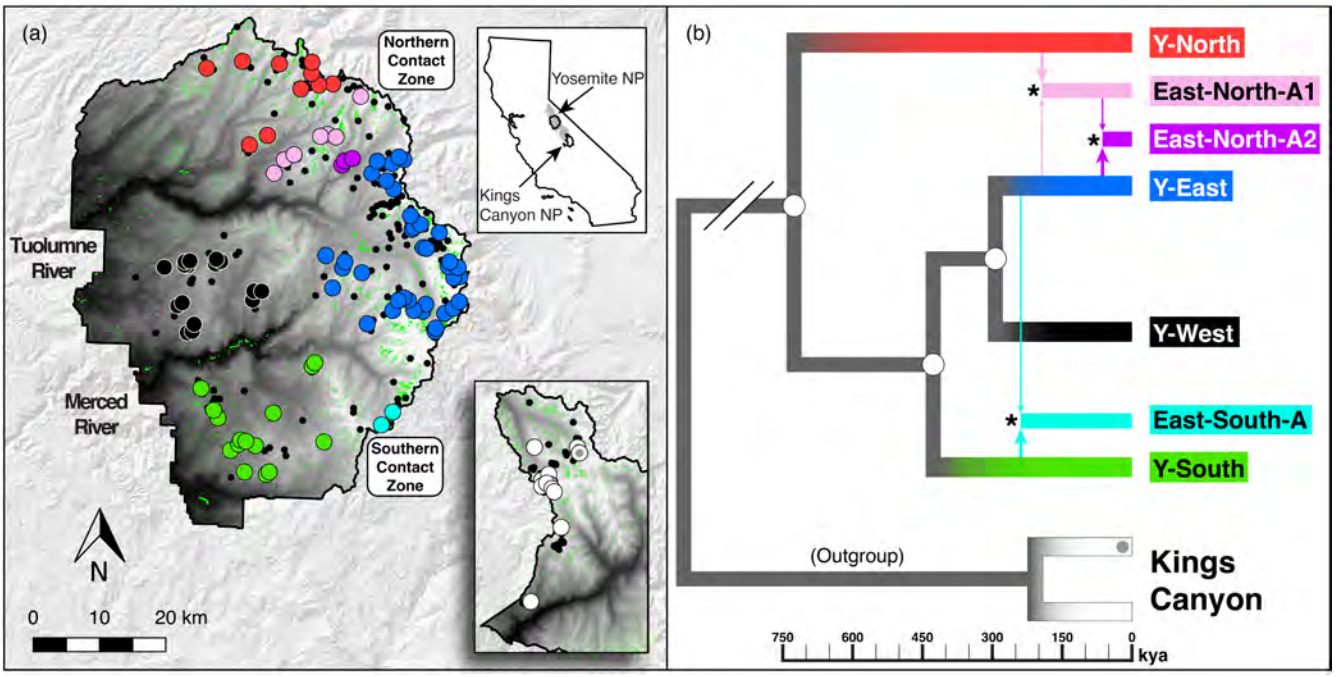

FIGURE 1 Study area and phylogeographic structure. (a) Primary study area in Yosemite National Park (YOSE), and outgroup locations in Kings Canyon National Park (KICA), CA include approximately 33% and 4% of sites known to be occupied by Yosemite toads, respectively. Top right inset shows the range of Yosemite toads in gray, and the boundaries of YOSE and KICA black. Green polygons are all meadows within the parks. Solid black circles indicate all known Yosemite toad meadows identified between 1915 and the present. Large circles indicate the meadows sampled and sequenced in the present study ($n = 90$; $n = 12$). Colors correspond to phylogenetic lineages shown in panel (b). Random jitter is added to protect the locations of this threatened species. (b) Previously identified ancestral lineages and their estimated divergence dates (Maier et al., 2019), including four "pure" lineages, and three "fused" or "admixed" lineages (asterisks), which comprise two contact zones: (East-North-A1/A2 in northern YOSE; East-South-A in southern YOSE).

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divergence from higher-elevation lineages, as they inhabited refugia in different climates (Maier et al., 2019). Together with forecasted patterns of climate adaptation, these patterns of past and current genetic structure may be useful for guiding GEU delimitation.

We leveraged a genome-wide dataset in this study, so that we could model the genetics of putative climate adaptation separately from full-genome processes. The use of outlier single nucleotide polymorphisms (SNPs) for conservation unit delineation is not new (Allendorf et al., 2010; Bonin et al., 2007; Funk et al., 2012); however, we applied a unique community ecology approach for modeling outlier SNP variation into future conditions using the non-linear regression tree approach, Gradient Forests (GF; Ellis et al., 2012; Fitzpatrick & Keller, 2015). We estimated selection pressure across the landscape as allelic change required to remain in the adaptive optimum. For all future genetic models, we assumed that climatic selection is directional, and hence will deplete climate-associated additive genetic variation (h^2) over time. Conceptually, the response (R) of a future GEU to climatic selection pressure (S) can be represented by the breeder's equation: $R = h^2S$ (Falconer, 1960; Lush, 1937); in a conservation genomic context h^2 and S can be thought of as genetic supply and demand for adaptation to a stressor. The potential for Yosemite toads to replenish h^2 fast enough to respond to additional climate change will likely depend upon exogenous genetic migrants (N_em) rather than new mutations ($N_e\mu$), given the rapid pace of climate change and small population sizes. Importantly, gene migration of recombinant diversity from contact zones between lineages could introduce novel alleles and expedite this process (Maier, 2018; Maier et al., 2019).

In this study, our goals were to (1) identify GEUs of Yosemite toads that are adapting to climate in similar ways in Yosemite National Park, (2) quantify the relative extent to which future climate change is anticipated to impact those populations, and (3) forecast where adaptive genetic variation (h^2 for loci under climatic selection) most needs to be replenished by gene flow. We used a highly robust spatial sampling scheme to reduce bias associated with unsampled locations, and a double-digest Restriction Site Associated DNA Sequencing (ddRADseq) dataset that was previously described (Maier et al., 2019). Our GEU approach to conservation genomics is a novel and informative way for anticipating future patterns of evolutionary potential as they relate to population persistence.

2 | MATERIALS AND METHODS

2.1 | Sample selection, molecular methods, ddRAD sequencing, and bioinformatics

We chose Yosemite National Park (YOSE) as our focal study area, but also took advantage of sampling and sequencing efforts in nearby Kings Canyon National Park (KICA). Including population outgroups can benefit landscape genomic studies by augmenting power to detect true genetic-environmental associations, while reducing the rate of false discoveries (Selmoni et al., 2020). Population boundaries are highly correlated with meadow boundaries (Maier et al., 2022a), and thus we sampled 535 individual tadpoles from 90 meadows in YOSE, and 109 samples from 12 meadows in KICA ($M = 6.2$, $SD = 2.8$ samples per meadow; Table S1) to maximize representation across all known breeding locations from a recent 6-year survey effort (Lee et al., 2022), and overlap with previous studies (Berlow et al., 2013; Maier, 2018; Maier et al., 2019, 2022a, 2022b; Shaffer et al., 2000; Wang, 2012; Figure 1). All animal handling was performed in accordance with San Diego State University animal care and use protocol #13-03-001B.

We used a previously generated ddRADseq SNP and haplotype dataset (Maier, 2018; Maier et al., 2019) for Yosemite toads in YOSE and KICA. The dataset contains a maximum of 3261 polymorphic loci with a mean of 2.29 SNPs/locus and 2.78 haplotypes/locus, prior to filtering. Details about the library preparation, sequencing, and bioinformatic parameters used to identify variable loci are described in the Supplementary Information. Briefly, libraries were prepared using a ddRADseq protocol (Peterson et al., 2012; Protocol S1), then sequenced using 2 × 100 bp sequencing on seven lanes of an Illumina HiSeq 2500. The dataset was compiled and analyzed with Stacks v1.19 (Catchen et al., 2011, 2013) and assembled de novo. We only used R1 of each paired-end sequence to reduce the redundancy of closely linked markers. Additionally, we applied the following quality filters: a minimum 10× depth of coverage per locus, a minor allele frequency (MAF) of 0.005, heterozygosity less than 0.5 (in each park and overall), and a missing data frequency of 0.25 (in each park and overall). One SNP per locus was randomly selected from the 2039 remaining RAD loci and used for all subsequent SNP-based analyses. Toad genome sizes are approximately five gigabases (Streicher, 2021); hence, we estimate our ddRADseq sampling to cover approximately (2039 × 96 bp)/5 Gb = 0.0039% of the genome. For N_e analysis (see below), haplotypes can be more informative than biallelic SNPs; hence, RAD haplotypes were also summarized as unique integers using custom R v4.1.2 scripts (R Core Team, 2022).

2.2 | Novel workflow for modeling adaptive optima under climate change

We modeled future selective pressure and lineage formation in four general steps: (1) identification of loci that presently show patterns of climatic selection, (2) statistically modeling the potentially non-linear relationships between climatic selection and allele frequencies to find adaptive clusters (potential future lineages), (3) forecasting those predicted lineages into a plausible scenario of future climate change to compare the selection pressures on each one, and (4) using geo-genomic simulations to model how climate change will affect relative fitness of future lineages, and diminish their likelihood of persisting. Environmental gradients can often be non-linear (García-Ramos & Huang, 2013), and similarly, allelic response curves of organisms undergoing adaptation can have non-linear threshold effects (Blows & Brooks, 2003; Curtsinger & Ming, 1997). Given

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the increasingly common observation that allelic optima are very sensitive to particular threshold values in climate (e.g., Fitzpatrick & Keller, 2015; Marrot et al., 2022; Shryock et al., 2015), we tried to capture this potential non-linearity. We chose to focus our predictions on YOSE, which is a representative sample of the species: it contains approximately 33% of all known Yosemite toad meadows across nearly its entire elevational distribution, a wide range of climatic conditions, and has seven different ancestral lineages (Figure 1). For the initial discovery of loci under selection, we included KICA samples to increase the confidence that outlier loci represent climatic and not population patterns.

2.3 | Environmental data collection

We extracted mean climatic data values using a 500 m radius buffer around the coordinates of our sample locations. This buffer distance was chosen to circumscribe the mean yearly dispersal distance of 275 m, which varies between sexes (males: 166 m; females: 420 m; Liang, 2010). A total of 30 variables were used (Table 2): these included 19 bioclimatic variables from WorldClim 1.4 at 1 km resolution (Hijmans et al., 2005), and 11 hydrologic variables from the 2014 California Basin Characterization Model v65 (BCM) at 270 m resolution (Flint et al., 2013). We chose these datasets because climate change and variability are thought to be potent stressors for Yosemite toads (Brown et al., 2015), and both WorldClim and BCM datasets have previously been shown to influence toad occupancy and genetic structure (Maier, 2018; Maier et al., 2019; Viers et al., 2013; Wang, 2012). Additionally, anticipated changes in snowpack (average and variability) and associated runoff from climate change are predicted to force an upward range shift in the species (Maier et al., 2022b). The WorldClim (http://www.worldclim.org/) and BCM (http://climate.calcommons.org/) variables were taken from 30-year averages available on their respective hosting websites: 1960–1990 (WorldClim), and 1981–2010 (BCM). To account for the differing spatial resolutions, we only averaged the portions of each pixel overlapping the 500 m buffer (i.e., a weighted mean). Future projections of these 30 variables were generated using the Community Climate System Model (CCSM v4), under representative concentration pathway (RCP) 8.5 (Riahi et al., 2011). The RCP 8.5 scenario models a "business-as-usual" future where emissions continue to rise throughout the 21st century, leading to increase in global mean surface temperature of 2.6–4.8°C throughout the century (IPCC, 2014). Future climatic variables were taken from the available 20-to-30-year averages: 2061–2080 (WorldClim), and 2070–2099 (BCM).

A principal component analysis (PCA) was used to reduce the climatic data into a set of orthogonal (uncorrelated) predictors, which were combined with elevation, latitude, and longitude. We also included Moran's Eigenvector Maps (MEMs), which describe spatial autocorrelation based on the arrangement of sample locations (Dray et al., 2006; Griffith, 1996). These are important to include in landscape genomic models because they can account for otherwise unmodeled genetic structure, particularly from either isolation by distance or phylogeographic signal in separate lineages. There is some chance these MEMs may represent unsampled environmental variation of interest. However, for the purpose of identifying loci that are putatively responding to climatic selection, MEMs are best treated as a nuisance variable to help remove ancestry-informative loci. Failure to properly disentangle demographic and climatic patterns can result in many false positive "outlier" loci that reflect non-adaptive processes. We used the adespatial v0.3.14 package (Dray et al., 2016) in R to build a spatial neighborhood with $k = 10$ neighbors, inversely weight by the distance between points, then test for significance of spatial autocorrelation in each MEM with 100 random permutations. We chose $k = 10$ neighbors because this value best corresponded to the 30 km spatial scale over which isolation-by-distance operates in the species (Maier et al., 2022a, 2022b), while giving each meadow a consistent number of neighbors. We used the first four of these MEMs because they aligned with phylogeographic breaks (Maier et al., 2019; Figure 1). All variables were centered and scaled by standard deviations.

2.4 | Identification of loci under putative climatic selection

Two primary methods for identifying regions of the genome responding to natural selection are the genome scan for unusual values of genetic differentiation and genetic-environment association (GEA) methods. We chose the GEA approach due to its ability to explicitly control for erroneous patterns caused by demographic structure, and to better identify the environmental correlates of selection. We identified loci putatively responding to divergent selection (either directly or by physical linkage) using two independent approaches: (1) constrained ordination with partial Redundancy Analysis (pRDA; hereafter "RDA"), and (2) the Bayesian covariance program bayenv. Combining methods is important to reduce error rates, particularly in a species with hierarchical genetic structure such as the Yosemite toad, because this can lower statistical power (De Villemereuil et al., 2014).

RDA has emerged as a powerful GEA method with a relatively low rate of false positive discovery (Capblancq & Forester, 2021; Contreras-Moreira et al., 2019; Forester et al., 2018). It consists of two steps, first performing a multivariate linear regression between population SNP frequencies and environment, then ordinating the fitted values with PCA, such that linear combinations of the environmental variables (X) maximize the variance explained in linear combinations of the genetic data (Y) (Legendre & Legendre, 1998). This can be extended further to partial out hierarchical genetic structure by adjusting the regression after removing this nuisance effect. We searched for candidate SNPs using the first five climatic PCs representing >95% of environmental variance, for all YOSE and KICA coordinates. We used the rda function in the vegan package (v2.5.7; Dixon, 2003) to perform

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TABLE 2 Climatic data definitions and sources

Variable	Definition
Source: WorldClim (Bioclim), current timespan 1960–1990, future timespan 2061–2080	
bio1	Annual Mean Temperature
bio2	Mean Diurnal Range (Mean of monthly (max temp − min temp))
bio3	Isothermality (bio2/bio7) (×100)
bio4	Temperature Seasonality (SD ×100)
bio5	Max Temperature of Warmest Month
bio6	Min Temperature of Coldest Month
bio7	Temperature Annual Range (bio5–bio6)
bio8	Mean Temperature of Wettest Quarter
bio9	Mean Temperature of Driest Quarter
bio10	Mean Temperature of Warmest Quarter
bio11	Mean Temperature of Coldest Quarter
bio12	Annual Precipitation
bio13	Precipitation of Wettest Month
bio14	Precipitation of Driest Month
bio15	Precipitation Seasonality (Coefficient of Variation)
bio16	Precipitation of Wettest Quarter
bio17	Precipitation of Driest Quarter
bio18	Precipitation of Warmest Quarter
bio19	Precipitation of Coldest Quarter
Source: California BCM 2014, current timespan 1981–2010, future timespan 2070–2099	
aprpck_ave	Mean April 1 snowpack snow water equivalent
aprpck_std	SD of April 1 snowpack snow water equivalent
cwd_ave	Annual mean climatic water deficit; potential minus actual evapotranspiration
cwd_std	Annual SD of climatic water deficit; potential minus actual evapotranspiration
cwd_sum_ave	Summer mean climatic water deficit; potential minus actual evapotranspiration
rch_ave	Annual mean recharge; amount of water that penetrates below the root zone
rch_std	Annual SD of recharge; amount of water that penetrates below the root zone
rch_sum_ave	Annual summer recharge; amount of water that penetrates below the root zone
run_ave	Annual mean runoff; amount of water that becomes stream flow
run_std	Annual SD of runoff; amount of water that becomes stream flow
run_sum_ave	Annual summer runoff; amount of water that becomes stream flow

Note: All precipitation variables are in units of mm, and all temperature variables are in units of °C. The timespans were matched as nearly as possible between datasets, based on the available summaries.

RDA using nine nuisance variables: the four MEMs representing phylogeographic structure, and the first five principal components of a PCA performed on the allele frequencies, representing any remaining population structure. Significant RDA axes were selected using 1000 permutations with the anova.cca function. Candidate outlier SNPs were identified as those with loadings outside the 95% quantiles for any significant RDA axis (following Forester et al., 2018).

Bayenv v2.0 (Coop et al., 2010; Günther & Coop, 2013; Hancock et al., 2008) is a Bayesian method that explicitly tests for correlations between the allele frequencies of SNPs and their environmental drivers, while accounting for overall genetic covariance by population structure. Unlike many other correlative methods, bayenv accounts for the effects of shared population history and uneven sampling noise, and then tests for linear environmental associations in a Bayesian framework. Since bayenv already considers

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population covariance, we did not include the five genetic PCs; however, we still included the four MEMs as phylogeographic nuisance variables. Ten replicate bayenv runs were performed to account for Markov chain Monte Carlo (MCMC) stochasticity using different starting seeds, for 100,000 steps each. The median Bayes factor and Spearman's correlation coefficient for each variable and SNP were then combined (Contreras-Moreira et al., 2019). We considered as outliers those loci having a significant association with at least one of the five principal components, determined by a Bayes factor outside the two-tailed 95% quantile interval, and absolute Spearman's correlation coefficient $|\rho|$ outside the one-tailed 95% quantile interval (given the possibility of both positive/negative associations). Additionally, we filtered any outliers that contained significant correlations with any of the MEMs, as a second pass for removing the effects of phylogeographic structure. Finally, we took the intersect of RDA and bayenv candidates as a conservative set of likely climate-related SNPs.

2.5 | Annotating the gene function of outlier loci

Outlier loci were compared to a previously described Yosemite toad transcriptome (Maier, 2018), assembled from three individuals spanning YOSE (data publicly deposited at https://www.ncbi.nlm.nih.gov/bioproject/PRJNA574353). A blastn search was performed between each outlier RAD sequence and RNA transcript, retaining the top hit with the -max_hsps option, contraining matches to be contiguous with the -ungapped option, and filtering out expectation (E) values greater than 1×10^{-6}. For each positive match, the annotations of the transcript were recorded if available, including top blastx protein match, and gene ontologies.

2.6 | Modeling future natural selection with GF

We used GF to model the potentially non-linear relationships between outlier loci and climate, and to forecast the shift in adaptive optimum by future climate change. GF is an extension of random forests (Breiman, 2001) developed for community ecology, which can model species abundances over non-linear environmental gradients, where cross-validated R^2 is aggregated across each species to give an estimated community "turnover" for each predictor (Ellis et al., 2012). This idea has recently been applied to predict adaptive genomic "turnover," which in essence is a summary form of adaptive genetic variation as a function of the landscape (Bay et al., 2018; Fitzpatrick & Keller, 2015). The GF model can then be used to forecast the amount of net allelic change required to match the future climate. We built GF models using the gradientForest v0.1.32 package (Ellis et al., 2012), predicting the previously identified outlier loci with the 30 climatic variables described above. We used the raw variables instead of principal components because GF (unlike the linear models of bayenv) deals with multicollinearity by randomly bootstrapping variables at each split of each decision tree in the forest. If any variable is sufficiently collinear, then its R^2 weighted importance is calculated by permuting that variable with other correlated variables (Strobl et al., 2008). Hyperparameters for GF were chosen by first performing 10-fold cross validation for the following combinations, and choosing the set with highest R^2: mtry (2, 4, 6, 8, 10), maxLevel (0, 2, 4, 6), and corr.threshold (0.5, 0.7, 0.9). In the final model, we generated 5000 bootstrapped trees for each forest, randomly sampling [mtry] variables at each split. Out-of-bag permuting was conditioned using variables within $2^{[\text{maxLevel}]}$ partitions of correlated variables, defined as having absolute correlation $|\rho|>$ [corr. threshold].

2.7 | GEU delimitation

GEU membership was assigned for each population in two steps: (1) detecting the optimal number of adaptive genomic clusters identified from the GF model, and (2) predicting membership using the k-means clustering method, which has previously been used in genomic population assignment (Dray et al., 2016). The GF predictions were first ordinated with a PCA to visualize the predicted adaptive genetic gradients as a map, with areas of similar adaptive genetic composition clustering together in multidimensional space. K-means clustering was performed iteratively with the kmeans function for values up to the total number of environmental variables, i.e., $K\in[1, 30]$, using 10 random sets and a maximum 1000 iterations. For comparison, hierarchical clustering was also performed for the same K values using the hclust function with Ward's minimum variance method, and absolute Manhattan distance. For each method, the within-cluster sum of squares (WSS) was summed and plotted against K. Both the "elbow" and "silhouette" methods were used to independently verify the optimal cluster number. The elbow method chooses the inflection point where adding an additional cluster has diminishing improvement on WSS, whereas the silhouette method measures how well each population fits in its cluster. Finally, GEU membership was assigned using the optimal K.

2.8 | Predictions of future selective pressure by climate change

We predicted both current and future allelic state for each pixel on the map. For this purpose, variables were rescaled to the lowest resolution of the data (1 km) using bilinear interpolation, to prevent statistical bias that can result from combining different resolutions. However, once multi-variable predictions were made for each pixel, the combined prediction map was again resampled to a finer resolution for display purposes. Since GF predicts allele frequency for each variable separately (weighted by cumulative variable importance), we calculated future selective pressure as the Euclidean distance between current and required future allele frequencies, using the philentropy v0.5.0 package (Drost, 2018).

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2.9 | Estimated levels of neutral and adaptive genetic diversity

Neutral genetic diversity tends to be correlated with heritable variation for traits under selection because both tend to increase with the effective population size (N_e). However, the correlation is not expected to be large, especially if strong selection has recently depleted adaptive genetic variation from a large population. Furthermore, inter-lineage contact zones may harbor high levels of recombinant diversity regardless of N_e, which could prove beneficial for future selection. Therefore, a comparison of all three types of diversity can provide meaningful insight about adaptive potential.

We used two measurements of overall neutral genetic diversity, estimated from the same populations reported in Maier et al. (2019, 2022a). First, we used explicit estimates of N_e for local neighborhoods of meadows, based on the single-sample linkage disequilibrium (LD) method in NeEstimator v2 (Do et al., 2014). We chose to generalize from this neighborhood scale because individual meadow sample sizes were often too small for meaningful confidence intervals. The LD method utilizes correlations between closely linked markers across samples; hence, we used the haplotype (rather than the biallelic SNP) version of the dataset. We also removed outlier loci prior to running the program because markers are assumed to be selectively neutral. Second, we used average gene diversity (π) across all loci, quantified using Stacks (Catchen et al., 2011, 2013). We then calculated π across the outlier loci identified above as an estimate of adaptive genetic variation. All patterns in relative park-wide diversity were visualized using inverse distance weighted interpolation, implemented in the gstat v2.0.8 package (Gräler et al., 2016; Pebesma, 2004).

2.10 | Geo-genomic simulations to model future lineage fitness and persistence

We used geographically explicit genomic simulations to corroborate patterns of climatic selection pressure across the landscape of future lineages, using the simulation package Geonomics v1.3.6 (Terasaki Hart et al., 2021). Although our GF model can predict the required allelic change to remain optimally adapted $\delta(f)$, and N_e/π estimates can suggest standing adaptive variation available to mount an adaptive response, by themselves these results cannot predict how effectively Yosemite toads will adapt, or how hard selection (excess deaths that depress population size) will influence persistence of each lineage, and the species. Following Terasaki Hart et al. (2021), we conceptualized Yosemite toad fitness ω for individual i under a steadily changing climate as:

$$\omega_i = 1 - \phi_{x,y}\left(\left|e_{x,y} - z_i\right|\right)^{\gamma}$$

where e is the optimal phenotypic value based on the environment at coordinate (x, y), z is the individual's actual phenotype, ϕ is the selection coefficient or probability of death when phenotypic mismatch is most extreme, and γ is a scaling coefficient assumed to be 1.0 for linearity. We assumed that the optimal polygenic allele frequencies $\delta(f)$ between time periods t_0 and t_1 represent a shift in adaptive optimum of "climate phenotype" $e_{t1} - e_{t0}$. In this case, e_{t0} represents a baseline phenotype of zero prior to climate change, and e_{t1} represents the optimal phenotype in each successive year. We used the year 2010 (the last year prior to sample collection) as t_0 to model climate change in all subsequent years until 2100.

We projected all 30 climatic variables to each year from 2010 to 2100, and then aggregated that time series to 5× lower resolution (1350 m) for computational feasibility. Natural selection rasters representing $e_{x,y}$ were produced by using the GF model to predict $\delta(f)$ or selective difference from the baseline at each successive year. We used the "spatially contingent" model of selection where ϕ is allowed to vary by pixel, in this case as a function of population density. Theory and simulations show that the efficacy of selection should depend upon both selection and drift (population size) coefficients (Gravel, 2016). Interpolated N_e was therefore used as the relative "carrying capacity layer," both for estimating ϕ and for demographic calculations. We estimated the starting number of individuals using a lognormal distribution of meadow census sizes with mean 100 and upper 95% CI of 504, given an average male count of 252 at hyperdiverse Tioga Pass Meadow (Sherman & Morton, 1993). Recent survey efforts suggest approximately 300 occupied meadows in YOSE (Lee et al., 2022), giving an estimated 30,000 toads in YOSE. We estimated per-pixel population density by dividing this value by the sum of pixel values in the carrying capacity layer. Census population size for the species is very difficult to estimate, so we focus on the relative sizes of lineages instead of absolute terms.

Additional natural history and genetic information was used to inform the remaining model parameters. We used the empirically derived Yosemite toad migration surface (Maier et al., 2022b) as the "conductance layer" for relative migration probability at each pixel. The lognormal parameters for dispersal distances were selected to match the mean and max (assumed: upper 95% CI) seasonal movement distances of 270 and 1260 m (Liang, 2010). Breeding age was taken as four for male, five for females, with a maximum lifespan of 15 (Sherman, 1980). We matched the genomic architecture to the observed dataset: 2039 loci, with the identified number of outlier loci underlying climatic adaptation. We performed the simulation 10× with a minimum burn-in of 100 years, followed by 200 years of non-adaptive evolution to reach stationarity, and finally 90 years of climate change.

3 | RESULTS

3.1 | Quality control of the genotype data

We examined spatial patterns of locus depth and missing data to ensure that our ascertainment of genotype data was not leading to biased outlier detection. Spatially aggregated loss of alleles (by low depth) or genotypes (by high missingness) could potentially drive erroneous correlations between SNPs and environment. The mean

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depth of coverage in the final dataset was 81.8 (per-individual 95% CI: 33.31–144.56; per-locus CI: 22.6–167.0; Figure S1). Mean per-individual depth summarized across meadows showed no spatial pattern, and importantly, no meadows had less than 30× which according to Illumina corresponds to a 0.995 probability of a correct genotype call (Figure S2). Mean missingness in the final dataset was 7.1% (per-individual 95% CI: 1.5%–24.6%; per-locus CI: 0.3%–19.6%; Figure S3). Similarly, mean per-individual missingness summarized across meadows showed no strong spatial pattern, and 100/102 meadows (98%) had less than 15% loci missing (Figure S4). We investigated this further by performing a PCA, with 1/0 values representing presence/absence of a genotype. Mean meadow scores of the first four components showed no clear pattern (Figure S5). Hence, we had confidence that our environmental association results were not biased by the data.

3.2 | Ordinated environmental data

The first five components of the PCA on climatic variables cumulatively contained 96.6% of the variance. PC1 (64.7%) had highest loadings for temperature-related WorldClim variables, whereas PC2 (15.7%) and PC3 (6.4%) had highest loadings for differing aspects of runoff, recharge, and snowpack variables of the BCM dataset (Table S2; Figure S6). Specifically, PC2 was most associated with runoff variability, and to a lesser degree snowpack and summer groundwater recharge. In contrast, PC3 was most associated with groundwater recharge. The last two components corresponded most with temperature variability (PC4; 5.7%) and climatic water deficit variability caused by patterns of annual precipitation (PC5; 4.1%). Out of 16 MEMs found to have significantly positive spatial autocorrelation based on 100 random permutations, the first four matched known patterns of phylogeographic structure (Figures 1 and S7): MEM1 distinguished the two parks (YOSE and KICA), MEM2 distinguished the most distant lineage in YOSE (Y-North), MEM3 separated Y-East from the remainder of the park, and MEM4 distinguished the two lower-elevation lineages (Y-South and Y-West). Hence, these variables were included in the RDA and bayenv analyses to flag and remove possible instances where environmental correlations were false positives due to phylogeographic structure.

3.3 | Identification of loci under putative climatic selection

The environmental variables in our RDA model explained 16.7% of the 102 SNP frequencies, with an adjusted R^2 (after correcting for bias from number of predictors) of $R^2_{adj} = 0.12$. Population and phylogeographic structure comprised 24.9% of the "conditional" variance in the model, and the remaining principal components comprised 58.5% of "unconstrained" variance, similar to model error in linear regression. Given that most SNPs are expected to be neutral, this low model explanatory power is expected. The ANOVA-like permutation test for association between each RDA canonical axis and SNPs showed that RDA axes 1–4 are significant predictors (Table S3), and altogether explained 83.9% of the constrained variance. Biplots of climatic loadings suggest some general patterns to the four RDA axes (Figure S8). RDA1 explains by far the largest amount (50.1%) of constrained variance, and runoff variability (PC2) and temperature variability (PC4) as well as latitude have the highest loadings. RDA2 is mostly driven by temperature (PC1) and elevation, RDA3 is driven by a complex pattern of temperature (PC1) and precipitation patterns (PC5), and RDA4 is driven by groundwater recharge (PC3). We found 394 RDA candidate SNPs outside the 95% quantiles for loadings.

Bayenv results from 10 replicate runs had relatively high consistency for Bayes factors (ρ: 0.79–0.98; Figure S9), and more so for Spearman's correlation coefficients (ρ: 0.98–0.98; Figure S10). We found an initial list of 273 bayenv candidate SNPs after applying an outlier filter of 95% quantile interval for Bayes factor and correlation coefficient. A further 203 candidates with potentially spurious environmental associations (to MEMs) were then removed, resulting in 70 bayenv candidate SNPs. A final list of 24 RDA/bayenv outliers were identified out of 2039 SNPs examined, after taking the intersect of 394 RDA candidates and 70 bayenv candidates (Table S4; Figures S11 and S12). The most common bayenv predictors were PC2 (nine SNPs), elevation (eight SNPs), and PC1 (seven SNPs), whereas PC3 (two SNPs), PC4 (one SNP), and PC5 (three SNPs) were less common. The most common RDA predictors were RDA4 (nine SNPs) and RDA2 (eight SNPs), whereas RDA1 (three SNPs) and RDA3 (five SNPs) were less common.

3.4 | Annotating the gene function of outlier loci

Ten out of the twenty-four outlier loci successfully blasted to the Yosemite toad transcriptome, and four of these had some gene functional annotation (Table S4). We briefly report their functional significance and discuss the implications below. Mitogen-activated protein kinase 5 (MAP3K5; https://www.uniprot.org/uniprot/Q99683) is a critical part of the MAP kinase signaling pathway and is important in cellular response to environmental change. Alpha-tocopherol transfer protein (TTPA; https://www.uniprot.org/uniprotkb/P41034) binds and stimulates release of vitamin E which can affect growth and development. Phospholipase A2 inhibitor and Ly6/PLAUR domain-containing protein (PINLYP; https://www.uniprot.org/uniprotkb/Q9CQD7) confers innate immune resistance against viral pathogens critical during embryonic development. Kinesin-like protein (KIF1C; https://www.uniprot.org/uniprotkb/O43896) controls transport of Golgi vesicles to the endoplasmic reticulum and may also influence immune response.

3.5 | Modeling future natural selection with GF

For the GF model of climatic-genetic association, 19 out of 24 SNPs had some predictive power ($R^2 > 0$), with a mean R^2 0.28 (range:

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0.09–0.52). We found the best hyperparameters were mtry of 8, maxLevel of 2, and corr.threshold of 0.5 (see Table S5 for full model ranking). We tried re-running the model with only the SNPs having $R^2 > 0.25$ (nine SNPs, mean $R^2 = 0.42$), and the results described below were not perceptibly changed; hence, we kept all SNPs in the model. We found that adaptive genetic variation tracks two primary clines: a cline in summer precipitation (bio17) that roughly increases with elevation, and a cline in snowpack and summer runoff that generally tracks latitude and increases sharply in northern YOSE (Figure 2a). The most important predictors as determined by R^2 values from conditional permutations were mean summer runoff (runsum_ave), mean and SD of April 1 snowpack water content (aprpck_ave; aprpck_std), and precipitation of the driest quarter, i.e., summer (bio17), and the nine most important variables were all related to moisture (Figure 2g). Snowpack and runoff variables were found to produce abrupt (non-linear) genetic turnover at the higher values of those predictors (i.e., ca. 900–1200 mm snowpack, 175–250 mm runoff) which occur in northern YOSE, whereas summer precipitation was found to have the most genetic turnover at the lower values of those predictors (i.e., ca. 40 mm precipitation), at lower elevation (Figures 2c–f, S13 and S14). Genetic turnover was a more linear function for most other predictors (Figures S13 and S14).

These three climatic drivers separate the park (YOSE) into three major adaptive zones that roughly correspond to ancestral lineage boundaries (Figure 1; Maier et al., 2019). Based on adaptive genetic PCA (Figure 2), the toads in the northern region appear particularly adapted to a robust snowpack and associated runoff that may last longer into the season, but with moderate summer precipitation (Y-North, East-North-A1). Toads in the eastern region appear adapted to a small to moderate snowpack with foreshortened runoff, but with the highest levels of summer precipitation at higher elevations (Y-East, East-South-A). The lower elevation toads (Y-South, Y-West) receive low to moderate April 1 snowpack, and the lowest amount of summer precipitation (despite having the highest winter precipitation). We found that $\delta(f)$, the predicted amount of allelic change required to remain in the adaptive optimum, was highest for Y-South, moderately high for Y-West, and variable for Y-North and its associated admixture zone (Figures 2b and S15). Y-East (and the southern admixture zone) had by far the lowest $\delta(f)$, for two reasons. First, snowpack and runoff levels are expected to decrease the least amount in Y-East (Figure 2c–e). Second, although summer precipitation is forecasted to increase everywhere, and increase maximally in the high elevation localities occupied by Y-East, the genetic turnover function is much shallower at these high values (Figure 2f). This means that less genetic change is expected to be necessary for the larger climatic changes in precipitation for Y-East.

3.6 | Estimated levels of neutral and adaptive genetic diversity

Neutral genetic diversity as measured by N_e was found to be vastly higher in Y-East compared with other ancestral lineages, particularly in the far eastern region (Figures 1 and 3; Table S1). Neutral diversity more broadly defined by meadow π was also high in Y-East, but high diversity was found across the high elevation meadows of Y-East, Y-North, and was maximal for the admixed meadows in the northern contact zone adjoining them (East-North-A1), and the southern contact zone (Figures 1 and 3). In both cases, diversity at the lower elevations (Y-South and Y-West) was minimal. However, adaptive genetic variation as defined by meadow π for outlier loci showed a somewhat different pattern. Highest levels of diversity were still observed in Y-East; however, a sharp drop-off was observed for Y-North. Instead, Y-West (which has previously been found to receive adaptive genetic introgression from Y-East; Maier, 2018) had moderate levels of diversity. Y-South remained the most genetically depauperate for adaptive variation.

3.7 | GEU delimitation

Both k-means and hierarchical clustering found the strongest support for three adaptive clusters, based on both the "elbow" and "silhouette" methods (Figures 4d, S16–S18). These anticipated future lineages ("YF" prefix) correspond to the three major adaptive zones described above, and largely coincide with historical phylogeographic lineages: YF-East overlaps with Y-East, YF-North with Y-North, and YF-Low-Elevation represents the combination of Y-West and Y-South (Figures 1 and 4a,d). One minor difference between historical and future lineage boundaries is that several meadows adapted to YF-North conditions are found in central and southern YOSE (at contact zones; Figure S18). However, we assigned the northern and southern contact zones (East-North-A1/East-North-A2, East-South-A) as intermediate and overlapping GEUs based on mixed clustering assignment, and high genome-wide diversity (π) that could contribute novel adaptive variation in the future (Figures 1, 3 and 4b,d).

3.8 | Geo-genomic simulations to model future lineage fitness and persistence

Our spatial genomic simulations generally predicted a positive adaptive and demographic outcome for YF-East, at least relative to the other lineages (Figure 5). Overall, toads in YOSE were reduced by a median of 29% (range: 19%–36%). Although YF-Low-Elevation had the largest population size throughout the 90-year climate shift, this is because it encompasses two ancestral lineages and twice the geographic area as either YF-East or YF-North. In terms of population density (individuals per km^2), YF-East was the most demographically stable throughout. Due to larger population density, YF-East experienced a more efficient selection coefficient ϕ as expected, resulting in a faster change in mean phenotype (z). Additionally, YF-East experienced weaker selection due to a slower-changing environment (e). Due to the combination of these two forces—smaller environmental mismatch ($|e - z|$) and stronger selection (ϕ)—YF-East mean fitness

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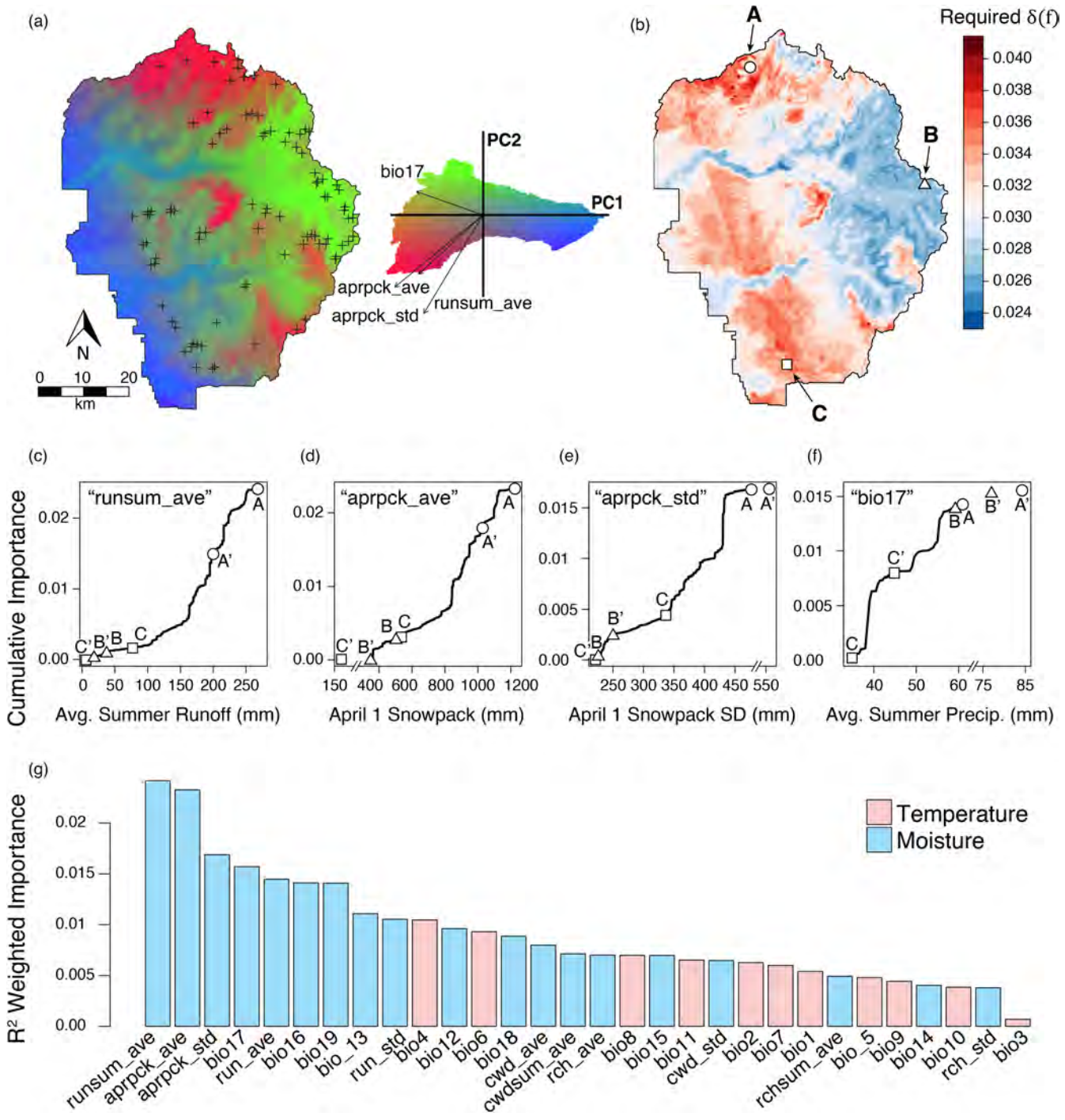

FIGURE 2 Projected future selection pressure by climate change. GF model of current adaptive genetic variation among 24 outlier loci identified by RDA/bayenv and forecasted into the years 2061–2099. (a) Regions in Yosemite National Park (YOSE) with similar colors represent populations expected to have similar adaptations given the underlying (non-linear) climatic gradient. Sampling locations are indicated by plus symbols. Specifically, colors represent scores along the first three principal components (PCs) of multi-dimensional allele frequency. The biplot shows their locations along the first two axes, along with vectors of the four most important variables. (b) Change in optimal allele frequency $\delta(f)$ as a consequence of climate is shown: red hues = values > mean, blue hues = values < mean. Sites representative of high (A and C) and low (B) change are shown by the circle, square and triangle. Larger changes to $\delta(f)$ would impose greater future selection pressure and require greater genetic diversity for populations to meet that challenge. (c–f) Cumulative importance curves (effect on allele frequency) for the four most important variables. Current climatic values for sites A, B, and C are indicated, as well as future values (A′, B′, and C′). Future values outside of the original environmental range do not have known importance values, but their placement on the (broken) X-axis is shown. (g) All climatic variables, ranked by R^2 weighted importance.

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ω declined at a slower rate than YF-North and YF-Low-Elevation. YF-North had the smallest population size and density, although the components of YF-Low-Elevation (Y-South and Y-West ancestral lineages) had even smaller population sizes and densities, if considered individually.

4 | DISCUSSION

4.1 | Relevance of the past for predicting the future

We have presented a novel conceptual workflow for assessing the adaptive potential of lineages, from contrasting temporal perspectives (Table 1; Figure 4). First, all ancestral lineages (ESUs) should be delineated and measured for past adaptive divergence to assess whether this unit of gene pool historically had the potential to adapt differentially. Previous work on Yosemite toads (Maier et al., 2019) found that contrasting glacial refugia during the Pleistocene forced low-elevation Yosemite toad lineages (Y-South and Y-West) to favor different environmental conditions than high-elevation lineages (Y-East and Y-North). This suggests that these four ESUs may contain sufficient adaptive genetic variation (h^2) to respond to divergent selection (S), and supports our prediction that future climatic pressure will favor similar allele frequencies in both low-elevation lineages (Figures 2 and 4a,d). Second, any inter-lineage contact zones should be identified (East-North-A1/A2, East-South-A lineages; Figures 1 and 4b), because they may harbor more extreme trait values through transgressive segregation and could spread some of this novel diversity by adaptive introgression. In previous research (Maier, 2018), six loci were found that putatively influence tadpole development and growth patterns, including one locus (LPIN3, a lipid metabolism gene) that was found introgressing from Y-East to Y-West. We found that northern and southern contact zones harbor high levels of genome-wide diversity (Figure 3b), in addition to moderate or high levels of climate-related diversity (Figure 3c), suggesting they could play a role in supplying novel variation into adjacent GEUs (Figure 4b,d). Third, the scale of current population boundaries and their main ecological pressures should be studied, because (1) demographic units are bulwarks maintaining genetic diversity for entire lineages, and (2) with appropriate selection pressures, these units could fuel incipient lineages with adaptive diversity needed to persist. It has previously been shown that most meadows are genetically independent populations (with only one large exception, a cluster of meadows in Y-East), and neighborhoods of adjacent meadows tend to exhibit asymmetrical gene flow into "hub" meadows (Figure 1c; Maier et al., 2022a). These hub meadows may be particularly important wells of diversity and stability. Our landscape genomic work built upon these delineated MUs by modeling patterns of selection (Figure 2) and standing diversity levels (Figure 3) in the appropriate population units (Figure 4c) and using their observed diversity levels to simulate population density, and efficacy of selection (Figure 5).

In short, many past (ESUs) and present-day (MUs) processes helped inform our delineation of future conservation units (GEUs). Based on this context, our workflow prescribes a future-predictive approach to anticipating GEUs, which are the true units of interest for conservation. This practice may build an understanding of how lineages of the focal species have diversified, will diversify, and how best to channel that process into the future based on management goals. We used four steps to accomplish this: (1) identifying candidate loci responding to climatic selection, (2) delineating

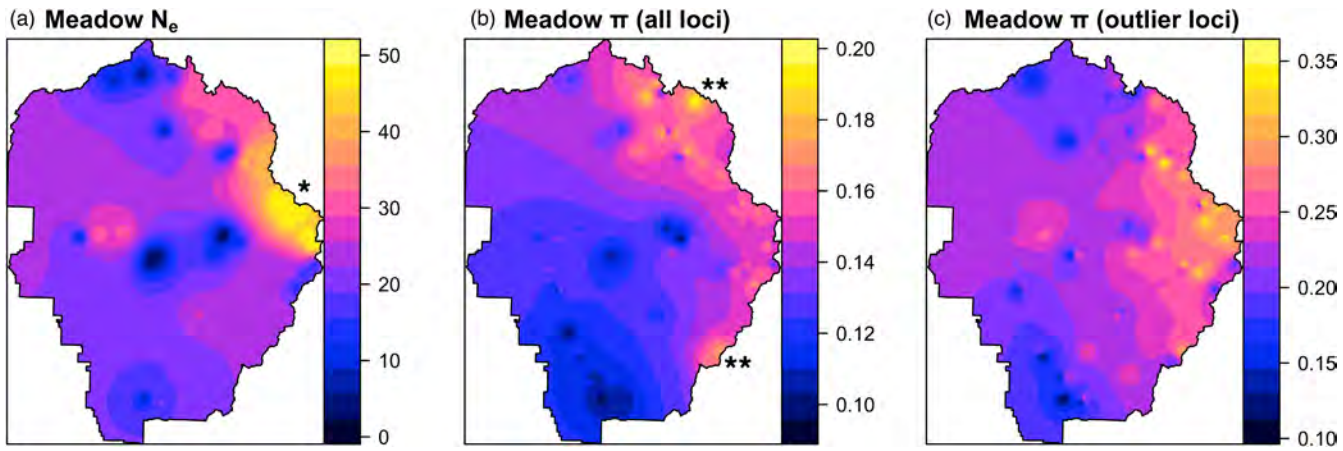

FIGURE 3 Current levels of overall and adaptive genetic diversity for Yosemite toads in Yosemite National Park (YOSE), shown using inverse-distance weighted interpolation. (a) Effective population size (N_e) calculated at the level of meadow neighborhoods (due to sample size limitations) and assigned to each meadow. Location shown by single (*) indicates the Tioga Pass region of eastern YOSE with highest N_e. (b) Meadow π at the level of SNPs, across all 2039 loci. Locations shown by (**) are the northern and southern contact zones containing high diversity from inter-lineage admixture (Maier et al., 2019). (c) Adaptive diversity estimated as meadow π at the level of SNPs, for only the 24 outlier loci identified by RDA and bayenv.

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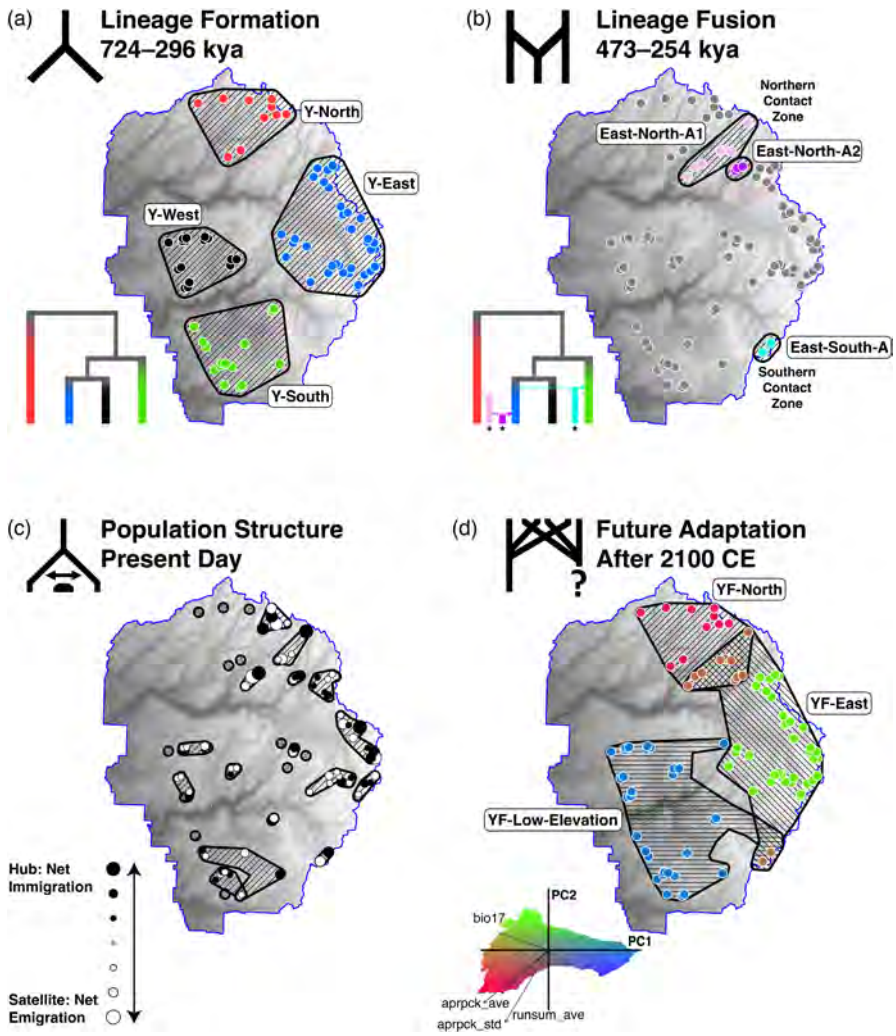

FIGURE 4 Contrasting temporal perspectives on Yosemite toad conservation units. Four possible strategies for defining conservation units in the Yosemite toad, based on previous research (panels a–c) and this study (panel d): retrospective Evolutionarily Significant Units (ESUs), present-day Management Units (MUs), and future-facing GEUs. (a) ESUs delimited based on ancient lineage formation (Maier et al., 2019). (b) More recent inter-lineage fusion and subsequent adaptive introgression, which can be interpreted as either ESUs or GEUs, since they are ancestral lineages, but also harbor recombinant genetic diversity potentially useful to future adaptation (Maier, 2018; Maier et al., 2019). (c) MUs delimited based on modern gene pool boundaries (Maier et al., 2022a). Gene pools are hierarchically structured as meadows (circles) within meadow neighborhoods (polygons), with directional gene flow occurring from satellites (white circles) to hubs (black circles). The MU approach might prioritize "hub" meadows as conservation priorities. (d) GEUs based on predicted future adaptation, which could lead to new lineage formation. Colors in (d) correspond only to the PCA biplot, whereas colors in (a) and (b) correspond to phylogenetic trees. Time ranges in (a–c) are quoted from the sources cited.

adaptive clusters as potential GEUs, (3) forecasting those GEUs into a plausible climate future to compare selection pressures, and (4) simulating relative fitness of each future lineage, to predict their fate. Our geo-genomic simulations performed in this last step are particularly important for teasing apart the strength of climate selection from how toads will respond to it. Our finding that the species may decline by 29% (under scenario RCP 8.5) over just 90 years is startling, but consistent with observations such as a nine-fold decline in breeding males over 20 years (Sherman & Morton, 1993). The disparity between low and high elevation outcomes is also consistent with an estimate that population density decreased at 69% of sites over 77 years, particularly at lower elevations (Drost & Fellers, 1996).

4.2 | The geographic distribution of Yosemite toad adaptations to climate

The GF model predicted that April 1 snowpack, summer runoff, and summer precipitation are driving the most climatic adaptation for Yosemite toads (Figure 2). In addition, GF can model any nonlinear or threshold effects of climate, making it possible to pinpoint where these variables are most important. Snowpack and runoff had the most adaptive impact for Y-North and the northern admixture zone, whereas summer precipitation has an inordinate impact on low elevation lineages (Y-South and Y-West; Figures 2c–f, S13 and S14). Collectively, these results suggest three future adaptive genetic clusters (Figures 2a and 4d): YF-North (magenta color;

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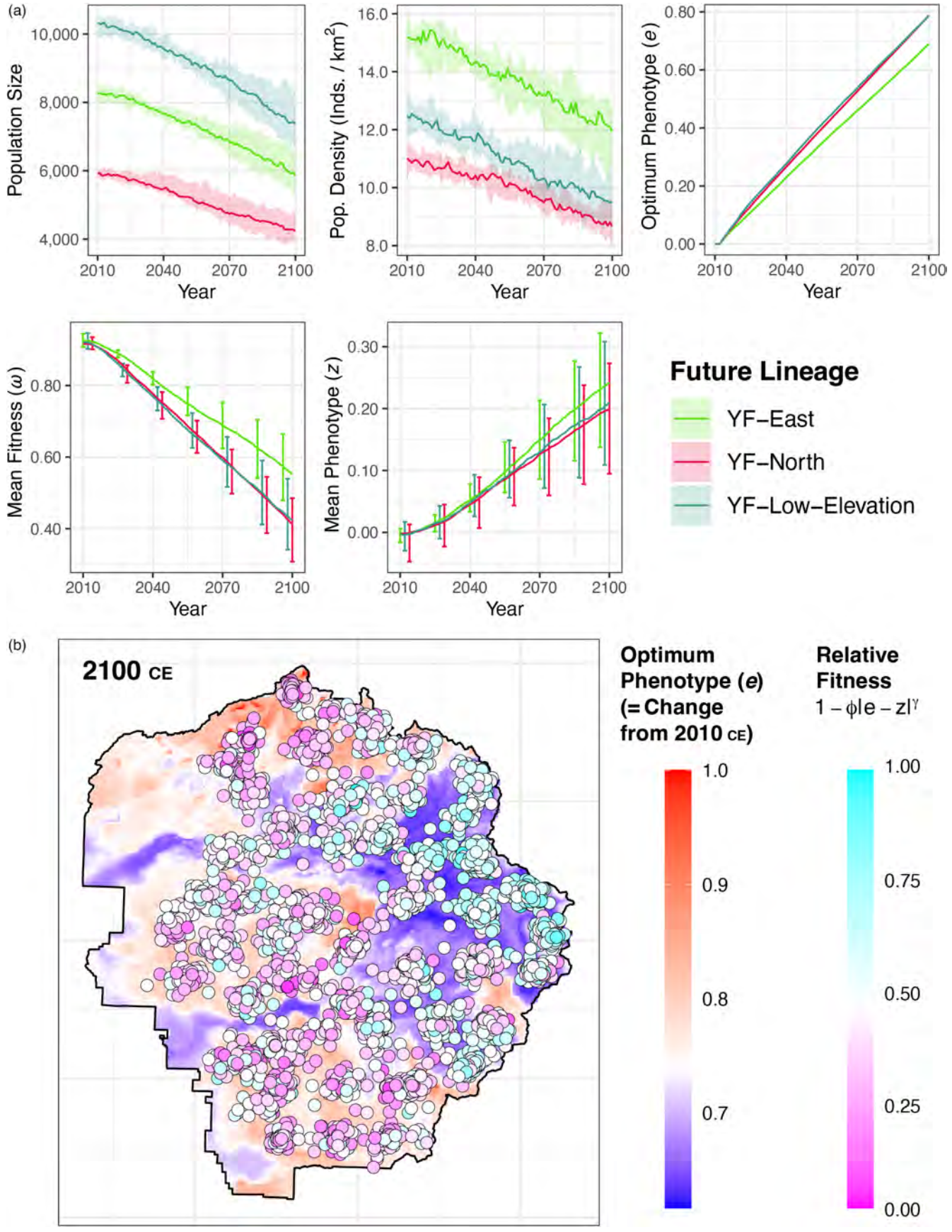

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FIGURE 5 Geo-genomic simulations of fitness and lineage persistence based on the predicted selection pressure from 90 years of climate change. (a) Demographic and evolutionary response to climate change. Simulated individuals are spatially grouped by future GEU lineages shown in Figure 4d. For each lineage, the mean raster value at each time point is shown for: population size, population density, optimum phenotype, mean fitness, and mean phenotype. Variation shown by ribbon and error bars indicates stochastic fluctuation among 10 iterations of the simulation. (b) The adaptive landscape after 90 years of climate change in year 2100 CE. Background value indicates the optimum phenotype, equivalent to the total amount of relative selective pressure since the beginning. Areas in blue experienced less selection than areas in red. Five thousand randomly chosen individuals are shown (circles) from the surviving cohort. Individuals in cyan are closer to the optimum phenotype than individuals in magenta.

high snowpack/runoff, moderate precipitation), YF-East (yellow color; small–moderate snowpack, high precipitation), and YF-Low-Elevation (teal color; low–moderate snowpack, low precipitation). It should be clarified that summer and winter precipitation patterns show opposite patterns: the former increases with elevation, and the latter decreases with elevation.

There are several possible reasons for an adaptive tradeoff between higher snowpack versus higher summer rainfall. The first concerns the general tendency of Yosemite toads to behaviorally select shallow pools ($M = 4.35$ cm), both as breeding adults and as swimming tadpoles (Karlstrom, 1962; Liang et al., 2017). Meadow pools continually fed by runoff from a robust snowpack (YF-North) are likely to retain water longer into the season, allowing tadpoles to invest metabolic resources more into growth than rapid development. Tadpoles in fast-drying pools that sporadically get replenished by summer rainfall (YF-East) may be adapted to the opposite strategy, with the added benefit of escaping predators sooner, and having a longer snow-free season with which to forage or disperse. Tadpole growth and development are generally seen as a life history tradeoff, where faster development comes at the expense of smaller size at metamorphosis (for a comparative analysis, see Richter-Boix et al., 2011). Yosemite toad tadpoles are known to aggregate together in the shallowest available habitat, in order to absorb maximum thermal energy and metamorphose more quickly (Brattstrom, 1962), and this explains their abundance of melanism compared to the closely related *Anaxyrus boreas* (Karlstrom, 1962). Tadpoles in YF-East also have the fastest observed development rates, and the smallest metamorphic size of any lineage in YOSE (Maier, 2018; P. Maier, unpublished data).

In contrast to these two strategies, the low-elevation adaptive advantage is less clear. Tadpoles in mid-elevation montane meadows receive low to moderate snowmelt, and the lowest summer precipitation, although they experience the most winter precipitation. Thus, their early phenology may benefit from high winter and spring moisture and afford them a much longer growing season. These low-elevation tadpoles are among the largest recorded in YOSE, supporting this hypothesis (Maier, 2018). Amphibians at lower elevation are also adapted to higher critical thermal maxima than high-elevation conspecifics, and this has been shown in *A. boreas* (Brattstrom, 1968; Snyder & Weathers, 1975). Given their higher tolerance for much higher temperatures, they may be much more efficient at growing large (i.e., converting phytoplankton into biomass).

The functional gene annotations give clues about the nature of climate adaptation in Yosemite toads (Table S4). The MAP3K5 gene had the strongest environmental association ($R^2 = 0.31$) out of all four annotated genes, and is involved in the mitogen-activated protein kinase (MAPK) signaling pathway, helping to mitigate environmental stress such as eutrophication in goldfish (Ren et al., 2018). The MAPK signaling pathway can adapt to myriad stresses, ranging from fasting, to insulin dysregulation, or adipose metabolism (Gehart et al., 2010). In amphibians, they likely act along with heat shock proteins in a cell protective manner during recovery from hibernation, metabolic depression, or extreme temperature fluctuations (Feidantsis et al., 2012; Greenway & Storey, 2000), which is supported by their high loading on RDA2 (temperature and elevation). TTPA induces secretion of vitamin E from the liver, and its evolution may be influenced by oxidative stress (Ulatowski et al., 2012), often experienced by tadpoles in desiccating ponds (Burraco et al., 2017), which is consistent with its high loading on groundwater recharge and precipitation variables. Vitamin E is also known to expedite growth and development in tadpoles (Fischer, 1947; Muller & Mislin, 1945). PINLYP may similarly influence breeding behavior and/or fecundity related to drought conditions, because it is also associated with groundwater recharge. The gene inhibits phospholipase A2, known to influence oocyte activation in an Argentinean species of toad (Ajmat et al., 2013), and may also be critical to innate immunity required for normal embryonic development (Liu et al., 2022). KIF1C is relatively unstudied in amphibians, but follows the same environmental pattern as PINLYP, and other kinesin-like proteins are known to influence amphibian embryonic development (Robb et al., 1996). Altogether, these patterns suggest that Yosemite toads are adapting to climate via metabolic, developmental, and immunity pathways that affect tadpoles but perhaps hibernating adults too.

4.3 | Relative impact of future climate change to different regions

We estimated values of $\delta(f)$, or the predicted amount of allelic change required to remain in the adaptive optimum. This is analogous to "response to selection" (S) in the breeder's equation, or the amount of genetic change needed to maintain current associations between alleles and climate. We use the notation $\delta(f)$, because our method does not actually measure a shift in phenotype with

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experimentally validated levels of heritability and should be taken as a relative rather than absolute measure. We found the largest $\delta(f)$ for YF-Low-Elevation, moderate or mixed $\delta(f)$ for YF-North, and relatively low values of $\delta(f)$ for YF-East (Figures 2b, S15 and S18). This pattern of climate refugia being at higher elevation, and especially concentrated in the Tioga Pass region of eastern YOSE, has also been observed for Belding's ground squirrels (*Urocitellus beldingi*; Maher et al., 2017; Morelli et al., 2017). Those authors observed that meadows with relatively low 20th century change in temperature and precipitation also have highest allelic richness and meadow connectivity for squirrels. Yosemite toad climate refugia have been forecast into the future by a previous study, although only based on species distribution modeling, and with now-outdated models of future climate (IPCC, 2014; Viers et al., 2013). Although previous species distribution modeling assumed that occupancy is binary, predictions can be significantly improved by incorporating the heterogeneity of adaptation (Bush et al., 2016). Nevertheless, that study found an 89% range contraction by 2050–2070, with most refugia distributed at lower latitudes and higher elevations in the Sierra Nevada. Interestingly, the five most important variables in their boosted regression tree model were in the same categories as our three most important variables: snowpack, runoff, and precipitation (Viers et al., 2013).

Our results show that YF-East and the southern admixture zone are protected primarily because summer snowpack and runoff have the smallest future decline (Figure 2). Although change in summer precipitation was predicted to be largest at higher elevations (particularly for YF-North), the GF models showed much shallower genetic turnover at those values. This means that lower elevation sites may be more sensitive to changes in precipitation. In addition, the lower elevation sites are faced with the dual challenge of reduced snowpack and relatively little increase of summer rainfall, which may have drastic phenological consequences for breeding. The relative contributions of these two hydrological sources to breeding pool water retention are likely non-linear, and may have complex consequences, not only for tadpole survival, but also lipid and liver stores of hibernating adults (Licht, 1975; Morton, 1981). Thus, overall phenological shifts are predicted to inordinately impact the lower elevations and make YF-East a climate refugium.

For the Sierra Nevada in general, climate change is anticipated to inordinately impact the mid-elevations. Under the same "business-as-usual" RCP 8.5 scenario that we used, Reich et al. (2018) predicted that by the end of the 21st century, there will be a 7°C rise in average springtime temperature, 64% drop in springtime snowpack volume, and 50 day phenological shift to earlier runoff of snowmelt. They also found that the most vulnerable elevations were 5000–8000 ft. due to high snow albedo feedback (warming, snowmelt, less reflectivity). This range overlaps with much of the elevational range of Y-South ($M = 7962 \pm 1560$ ft.) and Y-West ($M = 7986 \pm 963$ ft.). The higher elevation lineages Y-East ($M = 9991 \pm 1109$ ft.) and Y-North ($M = 9682 \pm 739$ ft.) are comparatively protected. For example, many of these meadows have a projected 70–90 day earlier mean runoff, compared to only 30–40 days for many high elevation toad meadows (Reich et al., 2018). Thus, Yosemite toad patterns of future adaptive change are expected to parallel patterns in climate change in the Sierra Nevada.

4.4 | Factors influencing adaptive genetic variation

Response to selection depends on both selection pressure and additive genetic variation for the trait(s) involved ($R = h^2S$; Lande, 1976; Lush, 1937). Thus, it offers a useful conceptual tool for predicting future outcomes, by unifying the demand of environmental change (S) with the supply of adaptive genetic variation (h^2). Conversely, if the required genetic response for climate adaptation (R) can be anticipated, one may ask whether sufficient regional genetic variation exists to meet that demand.

Admittedly, without observational data on the true values of h^2 or S, our result is a relative one, highlighting which regions deserve the most attention. We assessed relative h^2 by directly measuring neutral and adaptive genetic diversity. Over the time scale of ~100 years, and for a species with very low $\overline{N_e}$ of ~20 (Maier et al., 2019; Wang, 2012), genetic migrants ($N_e m$) are likely to replenish h^2 much more quickly than new mutations ($N_e \mu$). Indeed, under the same CCSM v4 model of climate change, Yosemite toads are projected to experience a net migration upward from YF-Low-Elevation to YF-East (Maier et al., 2022b). It should be noted that gene flow can swamp out local adaptation (Lenormand, 2002), but since adaptation likely occurs at broader scales than one meadow, this effect may be negligible compared to the effect of genetic rescue (Orr & Unckless, 2014).

We found that N_e and adaptive genetic diversity (π) were higher in YF-East than anywhere else, although neutral π was highest within the northern admixture zone between YF-East and YF-North (Figure 3). Other Sierra Nevada amphibians also reach their apex of diversity in this region (Rovito, 2010), and possible explanations for this have been discussed elsewhere (Maier et al., 2019). This suggests that YF-East currently has the largest h^2 for climate-related traits but highlights the potential for admixture zones to produce novel genetic diversity that may become useful in the future. The low-elevation lineages had the lowest neutral genetic diversity (N_e and π); however, Y-West had moderate levels of adaptive genetic diversity. This may be related to the adaptive introgression that was previously observed between Y-East and Y-West (Maier, 2018). Finally, YF-North had a conspicuous dearth of adaptive genetic diversity at the loci examined, compared to relatively high neutral genetic diversity. One possibility is that climatic selection has recently depleted this variation, which can happen after just a few generations of strong selection (Barton, 1989). YF-North is the least connected lineage in YOSE, because it contains meadows that are highly fragmented by rugged terrain. Therefore, recently depleted h^2 would not be replenished by gene flow very quickly.

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4.5 | Phenotypic plasticity may confound predictions and slow adaptation

Weak selection due to low levels of h^2 at low elevation may be reinforced by the tendency for individual phenotypic plasticity to become more prevalent there. For example, if tadpole body size at lower elevation is poorly matched to the climate, this could be partly due to low genetic diversity, but also because plasticity is being selected. Larval body size at metamorphosis is an important predictor of successful recruitment, which may be an important determinant of population growth rate (Altwegg & Reyer, 2003; Berven, 1990; Grosberg & Levitan, 1992; Hughes, 1990; Smith, 1987), although variation in adult survival is probably an equally large or larger predictor in low population sizes (Schmidt et al., 2005). For the wood frog (*Rana sylvatica*), body size at metamorphosis is strongly heritable at high elevation ($0.66 \pm$SE 0.31), yet is not significant at lower elevation (Berven & Berven, 1987). Therefore, in addition to the low levels of h^2 we anticipate for Yosemite toads in YF-Low-Elevation based on lower adaptive genetic diversity, these populations may additionally be selecting for higher phenotypic plasticity, further weakening the effect of natural selection. This strategy may have been adequate in the past but will likely be maladaptive in the future. Nunney (2015) showed that for models of directional selection by climate change, plasticity was a double-edged sword: environmental tolerance increased because it was favored by selection in the short-term, but led to extirpations in the long-run, if the trait under selection was determined by multiple loci. This is supported by field studies: plasticity has generated a mixture of adaptive and maladaptive responses to climate change, and is insufficient to keep up to speed with phenology changes (Phillimore et al., 2010; Urban et al., 2014). If plasticity is appreciable, it may cause our simulated projections of demographic outcome to be too optimistic, as individuals adapt more slowly.

4.6 | Are other selective pressures relevant to the future of Yosemite toads?

An important question for future population ecological studies to address is the relative extent to which climate change and disease are impacting local growth rates and demographic connectivity. While YF-East is the most genetically robust and ecologically vibrant region of YOSE for the Yosemite toad, the only recorded demographic bottleneck for the species occurred there in meadows surrounding Tioga Pass (Sherman & Morton, 1993). Massive extirpations were witnessed, and although only a handful of specimens showed histological evidence of *Bd* infections, Dodge et al. (2012) later found a correlation between specimen infection intensity and phase of bottleneck. However, they also found that prevalence (0–25%) and infection intensity are currently low, more so in adults than subadults. It has later been shown that *Bd* is deadly to Yosemite toad metamorphs if zoospore equivalents are large enough, especially if those metamorphs were subjected to desiccating pond conditions as tadpoles (Lindauer, 2018; Lindauer et al., 2020; Lindauer & Voyles, 2019). Certainly, chytridiomycosis is driving declines in a nearby species of alpine toad (Muths et al., 2003), and although disease refugia seem to exist at extreme temperatures, population persistence seems to depend on the interaction between disease, climate, and demography (Lambert et al., 2016; Mosher et al., 2018). Given that there is likely a synergistic effect between *Bd* and climate change for Yosemite toads (Lips et al., 2008; Rohr & Raffel, 2010), future work should extend our method with a plausible model of future disease dynamics and demography.

4.7 | The importance of simulation in landscape genomics

For the conservation goal of predicting broad landscape patterns of lineage evolution, the breeder's equation ($R = h^2S$; Lush, 1937) offers a conceptual model for understanding "supply" and "demand" of future adaptive change. Information about where selection is expected to be highest, in concert with which populations are adapting in similar ways, is valuable information for delineating future conservation units (GEUs; Bowen, 1998, 1999). Depending upon how "hard" or "soft" selection is, h^2 relative to S is also informative about whether the number of selective deaths required for adaptation is compatible with population persistence (Haldane, 1957; Nunney, 2003; Reznick, 2016; Wallace, 1975). However, the breeder's equation cannot take into account causality between the trait(s) and fitness, and also assumes constant h^2, which is of course violated as selection depletes adaptive genetic variation (Houchmandzadeh, 2014; Pigliucci & Schlichting, 1997; Roff, 2000). Follow-up common garden experiments are one way to connect future adaptive predictions with a phenotype-fitness function (Fitzpatrick et al., 2021), however, are difficult to perform for most species. Simulations are an attractive way to explicitly test the viability and fitness of future lineages in a landscape genomics context (Terasaki Hart et al., 2021).

Geonomics simulations offered several genomic and spatial complexities that helped to accurately model the biology of Yosemite toads. We utilized known natural history parameters, such as sex-specific age of maturity, longevity, dispersal kernel, and per-pixel population carrying capacity (Liang, 2010; Maier et al., 2022a; Sherman, 1980). We also used the raster representation of migrational "conductance" from a recent landscape genetic study (Maier et al., 2022b) to weight the probability of movement between pixels. Spreading climate change across 90 yearly rasters allowed a fine-resolution simulation of directional selection; however, the short-term interannual stochasticity missing from our model may be an important factor to consider in the future. One feature that is not currently native to Geonomics is the interaction between drift and selection (Gravel, 2016; $N_e s$); however, we accommodated more efficient selection in larger populations by using a spatially contingent selection coefficient $\phi_{x,y}$ that varied with carrying capacity. Our

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simulation results predict that YF-East will respond faster to climate change, despite experiencing less of it (i.e., both "supply" and "demand" sides of adaptation will bestow higher mean fitness). This may come at some cost of additional selective mortality, although larger populations, such as YF-East, may be more robust to short-term demographic flux.

4.8 | Implications for GEA methods to detect patterns of adaptation

Regions of the genome that are adapting in response to natural selection can be identified in several different ways. Traditionally, the genome scan approach was the most popular for anonymous loci, because it works from a very simple assumption: selection will produce loci with unusual values of population differentiation (e.g., F_{ST}) relative to genetic diversity (e.g., H_E; Beaumont & Nichols, 1996; Bonhomme et al., 2010; Lewontin & Krakauer, 1973). However, with a few recent exceptions (Duforet-Frebourg et al., 2014; Luu et al., 2017), many of these methods do not explicitly control for the effect demographic structure has in generating unusual F_{ST} distributions (Lotterhos & Whitlock, 2014, 2015), or identify a potential cause of natural selection. The major alternative to genome scans are GEA methods, which take advantage of the long-standing observation that phenotypic and genetic patterns often trace environmental gradients (De Mita et al., 2013; Endler, 1986; Huxley, 1939; Joost et al., 2007), and many methods also control for neutral genetic structure (Coop et al., 2010; Frichot et al., 2013; Guillot et al., 2014; Günther & Coop, 2013).

In our analysis of Yosemite toads, we took population structure into account in four separate ways: (1) the partial RDA model was conditioned on a genetic structure matrix consisting of MEMs and a PCA of allele frequencies, (2) bayenv used a genome-wide covariance matrix (X^TX) to form a null distribution for outlier detection, (3) bayenv loci were thrown out if they correlated with MEMs which represent phylogeographic structure, and (4) an outgroup of samples from outside the study area (KICA) was included to ensure correlations were not limited to the main study area. The potential risk of outgroups is that their potentially extreme environmental values could introduce an outlier effect on GEA methods. However, this can be effectively mitigated by using non-parametric measures, such as Spearman's correlation coefficient, and 95% quantiles. Their benefit may outweigh their cost: capturing a full representation of environmental conditions is critical for reducing false positives and increasing power to detect true positives (Selmoni et al., 2020). Our sampling scheme was robust (n = 644 individuals; n = 102 populations) and far exceeds the statistical recommendations based on simulations (n = 400 individuals; n = 50 populations; Selmoni et al., 2020). Overall, the GEA approach has high power to detect true outliers when the spatial sampling of populations is large and captures the full distribution of environmental conditions.

Although our analysis is robust to population effects and spatial extent, certain limitations in our analysis are important to consider. Using MAF and missing data cutoffs to produce RADseq datasets is necessary when assembling alleles without a reference genome. Otherwise, repetitive, or error-prone reads are likely to be assembled from different locations in the genome as paralogs, potentially introducing false patterns. However, MAF cutoffs can reduce the dataset significantly and hence can remove genuinely adaptive loci. Therefore, low MAF variants should be included if sampling is extensive enough (Ahrens et al., 2021). We avoided the bulk of this problem by choosing a very low MAF rate of 0.005 (typically 0.05 is chosen), which was possible due to our extensive sampling (i.e., with n = 644 samples and missing data <0.25, a MAF of 0.005 still requires at least 5–7 copies of an allele to corroborate its existence). Our extremely high read depth (M = 81.8; min. = 10) also mitigates this problem by ensuring genotypes are accurately called (Han et al., 2014).

Another limitation of RADseq datasets in general is that they sample <<1% of the genome, which might overlook many potential loci of interest, and/or fail to achieve sufficient power to detect weakly selected loci. Such "phantom" selection could subtly alter the landscape of climatic adaptation, and hence shift the boundaries and possibly even number of GEUs. Local adaptation probably includes many polygenic traits of very small effect, potentially with spatiotemporal shifts in their contributions (Hoban et al., 2016; Yeaman, 2015). This is also a general limitation of univariate GEA approaches, such as bayenv, which assume that selection exerted by one environmental variable on one locus is strong enough to produce a signal. In reality, most heritable adaptations are polygenic, epistatic, and involve complex environmental interactions (De La Torre et al., 2019; Yeaman, 2015). Although we may have an incomplete sampling of genomic adaptation, we effectively reduced the opposite problem, that of false discovery. Simulations show that constrained ordination methods such as redundancy analysis and canonical discriminant analysis reduce false discovery rate of outliers, particularly when combining methods (Bourret et al., 2014; Capblancq & Forester, 2021; Forester et al., 2016; Hoban et al., 2016). Future initiatives such as the California Conservation Genomics Project could ameliorate the issue of low genomic sampling and other limitations of RADseq and genotype-by-sequencing (GBS) datasets by using whole genome sequencing; more and longer loci could be assembled into haplotypes, statistically phased, and more easily annotated (Shaffer et al., 2022). This may reveal a more complete picture of Yosemite toad adaptation and its architecture. However, such studies are expensive and may increase genomic sampling at the cost of spatial sampling, causing lower power to detect patterns. The present study effectively balances moderate to large sample sizes of loci, samples, populations, and environments. Future studies could use a two-pronged approach: first sequencing whole genomes and applying linkage methods to detect patterns of adaptation in a limited number of samples, and then resequencing those loci across a wider swath of geography and climate.

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4.9 | Conclusions and application for conservation management

Climate change is ostensibly one of the greatest threats to Yosemite toad persistence (Brown et al., 2015; Maier, 2018; U.S. Fish & Wildlife Service, 2014; Viers et al., 2013), and our landscape genomics study elucidates how and where toads will need to adapt to remain viable into the future. Altogether, we summarize the future of adaptation and persistence for Yosemite toad lineages as follows. Three adaptive genetic regions exist in YOSE (YF-North, YF-East, and YF-Low-Elevation). We circumscribe these regions as the three GEUs and rank them in the following order of vulnerability: YF-Low-Elevation, YF-North, and YF-East. The YF-East lineage has the most future adaptive potential and viability, owing to weaker climate change pressures, and much higher capacity for adaptive response. Since the northern admixture zone contains large amounts of neutral genetic variation, and no evidence of outbreeding depression, this region should be protected as a potentially critical corridor for replenishing lost variation in the YF-North GEU. Admixed toads might serve as important stock for reintroduction efforts, but further experimental work is needed to verify their viability under realistic ecological conditions. The YF-Low-Elevation GEU consists of two ancestral lineages that are not each other's closest relatives. They are exchanging very few genetic migrants, yet are adapted to similar climates, and experiencing similar selective pressure. Therefore, if reintroductions are deemed necessary, these lineages may be considered interchangeable. Admixing these genetically depauperate toads may have beneficial effects on their response to selection. Overall, our simulations present a bleak outlook on climate change, forecasting a 29% reduction (under scenario RCP 8.5) in Yosemite toad population size over just 90 years; however, our results provide some guidance on how to manage this challenge. The workflow provided in Table 1 and Figure 4 gives a forward-looking perspective on adaptive genetic cohesion, and provides an example of modeling tools (i.e., GF) for grouping populations into conservation units. This is particularly valuable for species such as the Yosemite toad for which molecular data are more accessible than experimental or long-term ecological data, due to rarity and/or difficulty accessing remote habitat. We suggest our approach as a useful toolkit for planning conservation efforts on poorly studied and non-model species of concern.

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CONFLICT OF INTEREST

The authors declare no competing interests.

DATA AVAILABILITY STATEMENT

No original genetic data were produced in this study. Demultiplexed fastq files of double-digest RADseq data are available at NCBI GenBank SRA under BioProject PRJNA558546 (https://www.ncbi.nlm.nih.gov/sra/PRJNA558546). Environmental data, genotype files and R scripts for extracting climatic variables and performing all landscape genomic analyses are deposited at Dryad (https://doi.org/10.5061/dryad.6m905qg3r). Supplemental tables, figures, and methods are available in the Supporting Information.

ORCID

Paul A. Maier https://orcid.org/0000-0003-0851-8827
Amy G. Vandergast https://orcid.org/0000-0002-7835-6571
Andrew J. Bohonak https://orcid.org/0000-0002-5429-2331

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Lauren Rosenkranz

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, December 14, 2022 3:03 PM
To: Chad_Mellison@fws.gov
Cc: Matthew Woodhall; Brad Blood; Shannon Luoma; Carissa Shoemaker; Lauren Rosenkranz; James.Erdman@wildlife.ca.gov; Sarah Berryman
Subject: Lee Vining Hydroelectric Relicensing Project - proposed 2023 Yosemite toad field survey updates

Hi Chad,
Are you available anytime in the first few weeks of January for a brief conference call to discuss our proposed 2023 survey efforts for Yosemite toad along the Lee Vining Hydroelectric Relicensing Project? We have been talking with Jim Erdman about our thoughts and wanted to loop you in to our current status.

I will be picking the brains of minds much smarter than mine at the amphibian conference on Thursday and Friday (Jan 12 and 13), but I am otherwise free during for those weeks in January.

Let me know and I will send a meeting invite to the group copied here.
Thank you and happy holidays!
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Lauren Rosenkranz

From: Steve Norton <steve.norton@psomas.com>
Sent: Saturday, December 17, 2022 5:43 PM
To: Erdman, James@Wildlife; Matthew Woodhall; Shannon Luoma; Brad Blood; Sarah Berryman
Cc: Carissa Shoemaker; Lauren Rosenkranz; Finlay Anderson; Black, Russell@Wildlife; Marquez, Alyssa@Wildlife
Subject: Re: Meeting Minutes for Lee Vining CDFW Call on December 12

Jim,
Thanks for getting back to us so quickly. I really appreciate it and look forward to continuing to collaborate with you and CDFW on this project.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Saturday, December 17, 2022, 4:59 PM
To: Steve Norton <steve.norton@psomas.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Sarah Berryman <sarah.berryman@psomas.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com <lauren.rosenkranz@kleinschmidtgroup.com>; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: RE: Meeting Minutes for Lee Vining CDFW Call on December 12

Hi Steve (and all),
I hope you are all well. I wanted to be sure and have this response out as soon as possible. I will be out of the office through Jan. 3.
I spoke with my supervisor and program manager regarding the collection of DNA samples from Yosemite Toad larvae (tail clips) or adult swabbing by CDFW for the FERC effort.
CDFW encourages you to apply for the USFWS Take Permit and the CDFW Scientific Collecting Permit necessary for collecting samples of ESA/CESA listed species.
The request to collect tissue samples was not included in the original final study plan. Requests to study movement and Bd during the study comment period were deemed unnecessary and non-project related. CDFW considers the Yosemite Toads in and around the Upper Lee Vining Creek drainage to be genetically similar to the Yosemite Toads within Yosemite National Park at Dana Meadows. This area abuts the Tioga Pass area and inlet to Tioga Lake at a low meadowy pass allowing easy movement and gene exchange. CDFW does not consider genetic testing of the toads at Saddlebag Lake or Tioga Lake necessary.
Collection can not be made by CDFW or under CDFW supervision for this effort.

I have not gotten a response back from the Sierra Nevada Aquatic Research Lab in regards to their ability or expertise in running genetic samples.
I will let you know as soon as possible.
Thank you for your time and consideration.

Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, December 14, 2022 11:29 AM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Sarah Berryman <sarah.berryman@psomas.com>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: Meeting Minutes for Lee Vining CDFW Call on December 12

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Good morning,
Please review the attached meeting minutes from our Monday call and let me know if you have any edits or changes.
Thanks!
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

Lauren Rosenkranz

From: Steve Norton <steve.norton@psomas.com>
Sent: Friday, December 16, 2022 4:25 PM
To: Erdman, James@Wildlife; Matthew Woodhall; Shannon Luoma; Brad Blood; Sarah Berryman
Cc: Carissa Shoemaker; Lauren Rosenkranz; Finlay Anderson; Black, Russell@Wildlife; Marquez, Alyssa@Wildlife
Subject: RE: (External):Meeting Minutes for Lee Vining CDFW Call on December 12
Attachments: Minutes Lee Vining YOTO CDFW_Meeting_121622.pdf

Attached are the updated meeting minutes.

Also I forgot to answer your question, Jim. There have been some studies done analyzing DNA using skin and mouth swabs. It was only used on adults as it wasn't reliable for tadpoles. Sarah elaborate further during our next call.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Sent: Friday, December 16, 2022 1:40 PM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>; Steve Norton <steve.norton@psomas.com>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Sarah Berryman <sarah.berryman@psomas.com>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>; Black, Russell@Wildlife <Russell.Black@wildlife.ca.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Subject: RE: (External):Meeting Minutes for Lee Vining CDFW Call on December 12

Hi Steve (and all),
Thank you for providing the minutes from our call/meeting on 12/12/2022.
I have a quick correction to the meeting minutes. The line, "CDFW received low priority processing results in Fall of the same year (less than 6 months)" should read "received low priority results for Bd swab analysis in fall of the same year".
Also, eDNA and tail clips are utilized for genetics but are the swabs strictly for Bd?
I'll follow up with information on DNA collection and analysis later today.
Sierrally

James Erdman
California Department of Fish & Wildlife
Recreational Fisheries & High Mountain Lakes
Office Phone (760)-873-6071
CDFW Cell (760)-567-0413

From: Matthew Woodhall <Matthew.Woodhall@sce.com>
Sent: Wednesday, December 14, 2022 12:38 PM
To: Steve Norton <steve.norton@psomas.com>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Sarah Berryman <sarah.berryman@psomas.com>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: RE: (External):Meeting Minutes for Lee Vining CDFW Call on December 12

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Steve,

I believe another action item was that Jim was going to inquire if SNARL can do DNA samples? If not, we still have not identified a lab.

Matthew C. Woodhall
Southern California Edison
Generation-Regulatory Support Services
909-362-1764 - Cell
626-302-9596 - Office

From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, December 14, 2022 11:29 AM
To: Matthew Woodhall <Matthew.Woodhall@sce.com>; Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Brad Blood <bblood@psomas.com>; Sarah Berryman <sarah.berryman@psomas.com>; James.Erdman@wildlife.ca.gov
Cc: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; lauren.rosenkranz@kleinschmidtgroup.com; Finlay Anderson <finlay.anderson@kleinschmidtgroup.com>
Subject: (External):Meeting Minutes for Lee Vining CDFW Call on December 12

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Good morning,
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Thanks!
-Steve

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714.481.8037 (Office/Mobile)
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MEETING MINUTES

MEETING: December 12, 2022, conference call between Project Team (SCE, Kleinschmidt, and Psomas), and California Department of Fish and Wildlife (CDFW)

SUBJECT: 2023 Proposed Yosemite Toad Field Survey and Research Efforts for the Lee Vining Hydroelectric Relicensing Project

ATTENDEES:
Jim Erdman, CDFW
Matt Woodhall, SCE
Shannon Luoma, Kleinschmidt
Steve Norton, Psomas
Brad Blood, Psomas
Sarah Berryman, Psomas

DISCUSSION SUMMARY:

- Project Team presented proposed Yosemite toad survey locations for 2023 survey effort.
    - Identified 5 first priority locations (consistent with 2022 survey locations); 4 second priority locations (new locations identified as having potentially breeding habitat during 2023 survey); and 2 third priority locations (remote locations with potential breeding habitat well outside FERC boundary).
    - First priority locations will be surveyed in 2023; Second priority locations are likely to be included in 2023 survey where time allows; Third priority locations have low likelihood of inclusion in the 2023 survey effort, but will be included if time allows.
    - CDFW agreed with assessment of potential breeding habitat locations and approved of prioritization approach.
- Project Team and CDFW discussed potential options for authorizing DNA collection of Yosemite toad observed during proposed surveys.
    - Project Team asked if DNA collection could be conducted under CDFW supervision or authorization.
    - CDFW to investigate potential options further and update Project Team of findings via email before December 21st.
- Project Team presented the methods proposed for DNA collection.
    - Project Team anticipates collection of toad DNA using eDNA, tail clips, and adult swabbing.
    - CDFW discussed potentially utilizing Sierra Nevada Aquatic Research Lab (SNARL) for DNA analysis. CDFW received low priority results for Bd fungal swab analysis in Fall of the same year (less than 6 months).
- CDFW and Project Team both noted they are working on maps showing observations of Yosemite toad in greater vicinity of Lee Vining Hydroelectric Project.
    - CDFW map to include collection of confirmed locations, Project Team map to include previously documented locations (museum records, iNaturalist, etc.).
    - CDFW and Project Team to share respective maps with each other.
    - CDFW noted Inyo National Forest has records of Yosemite toad occurring in meadow along Slate Creek adjacent to Project site.
- Action Items
    - CDFW to email Project Team an update on options for DNA collection authorization.

- CDFW to contact SNARL to see if they can process amphibian DNA samples rather than just Bd testing. CDFW also to ask about the anticipated processing time.
- Project Team to schedule a meeting with USFWS in early January to provide update of discussions with CDFW. CDFW to be invited to this meeting.

B-49_Agenda for Yosemite Toad call with CDFW and USFWS

From:	Steve Norton
To:	Chad_Mellison@fws.gov; James.Erdman@wildlife.ca.gov; Matthew Woodhall; Brad Blood; Shannon Luoma; Carissa Shoemaker; Lauren Rosenkranz; Finlay Anderson; Sarah Berryman
Subject:	Agenda for Tuesday"s Conference Call regarding the Lee Vining Hydroelectric Relicensing Project
Date:	Friday, January 6, 2023 3:45:41 PM
Attachments:	image001.png image002.png image003.png Agenda Lee Vining YOTO Agency Meeting_010623.pdf

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Please see the attached agenda and I look forward to speaking with you all on Tuesday at 10:00!
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

MEETING AGENDA

January 10, 2023

Conference call between SCE, Kleinschmidt, Psomas, CDFW, and USFWS

SUBJECT:

2023 Proposed Yosemite Toad Field Survey and Research Efforts for the

Lee Vining Hydroelectric Relicensing Project

1) Brief summary of 2022 Yosemite toad survey results.
2) General inquiry on the anticipated Section 7 Consultation: any additional input from USFWS?
3) Discuss revised survey locations for 2023.
4) Discuss additional data collection efforts proposed.
    a. DNA collection
        i. tail clips and mouth swabs for assessing Anaxyrus canorus v. A. boreas
        ii. eDNA for presence/absence in potential breeding ponds
5) Discuss available options for authorizing DNA collection (permitting options).

B-50.1_Discussion re 2022 progress report meeting and list of project infrastructure

From:	Shannon Luoma
To:	McNeill, Richard - FS, CA; Carissa Shoemaker; Barnett, Adam - FS, CA; Blythe Haverstock, Ashley - FS, CA; Ellsworth, Todd - FS, CA; Engelhardt, Blake - FS, CA; nora.gamino@usda.gov; Irons, Sheila - FS, CA; Leong, Tristan - FS, CA; Mullowney, Megan - FS, CA; Sanchez, Monique - FS, CA; Sill, Nathan - FS, CA; Torres, Thomas - FS, CA; Washington, Jameisha - FS, CA; Wiese, Michael - FS, CA
Cc:	Lauren Rosenkranz
Subject:	RE: [External Email]Lee Vining 2022 Progress Report Meeting - USFS
Date:	Monday, January 30, 2023 4:23:00 PM
Attachments:	image002.png image003.png

Hi Rick!

Thanks for checking in! Updating and confirming the list of Project-related hydro infrastructure is ongoing and one of the focuses of the LAND-1 study plan, which is really going to be kicked off this year, in 2023. Below is the current listing of infrastructure we're using as our starting point. Please let me know if you have other questions. Thanks!

- Saddlebag Lake
- Saddlebag Dam and spillway
- Saddlebag valve house
- Saddlebag gate valve, steel pipe, trash screen, remote antenna
- Tioga Lake
- Tioga Dam and spillway
- Tioga Auxiliary Dam
- Tioga valve house
- Tioga boat barriers
- Tioga gate valve, steel pipe, trash screen, remote antenna
- Ellery Lake
- Rhinedollar Dam and spillway with radial gates
- Rhinedollar valve house
- Tunnel intake with trashracks
- Rhinedollar boat barrier
- Rhinedollar gate valve, Pelton butterfly valve, trash screens, dam remote antenna pole
- Flowline (pipeline and penstock)
- Below Rhinedollar:
    - Steel flowline / steel pressure line
    - Main gate
    - Sluice valve
    - Venturi meter
    - Manhole and standpipe
    - Air valve
- Poole Powerhouse
    - One turbine
    - Motor-operated gate valve and bypass
    - Tailrace
- Switchyard
- Ancillary and Support Facilities next to PH:
    - Historic housing apartment complex
    - Equipment garage

    - Shop/storage garage
- Seven SCE/USGS Gaging stations
- *Non-Project Transmission Facilities – None, transmission line was removed from license in 2001*

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, CA <Richard.McNeill@usda.gov>
Sent: Thursday, January 26, 2023 7:33 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Barnett, Adam - FS, CA <adam.barnett@usda.gov>; Blythe Haverstock, Ashley - FS, CA <ashley.blythehaverstock@usda.gov>; Ellsworth, Todd - FS, CA <todd.ellsworth@usda.gov>; Engelhardt, Blake - FS, CA <blake.engelhardt@usda.gov>; nora.gamino@usda.gov; Irons, Sheila - FS, CA <sheila.irons@usda.gov>; Leong, Tristan - FS, CA <tristan.leong@usda.gov>; Mullowney, Megan - FS, CA <megan.mullowney@usda.gov>; Sanchez, Monique - FS, CA <monique.sanchez@usda.gov>; Sill, Nathan - FS, CA <nathan.sill@usda.gov>; Torres, Thomas - FS, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, CA <Jameisha.Washington@usda.gov>; Wiese, Michael - FS, CA <michael.wiese@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: Re: [External Email]Lee Vining 2022 Progress Report Meeting - USFS

Hi Carissa

Has there been an update to the list of hydroelectric infrastructure?

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Wednesday, January 25, 2023 19:38
To: Barnett, Adam - FS, CA <adam.barnett@usda.gov>; Blythe Haverstock, Ashley - FS, CA <ashley.blythehaverstock@usda.gov>; Ellsworth, Todd - FS, CA <todd.ellsworth@usda.gov>; Engelhardt, Blake - FS, CA <blake.engelhardt@usda.gov>; nora.gamino@usda.gov <nora.gamino@usda.gov>; Irons, Sheila - FS, CA <sheila.irons@usda.gov>; Leong, Tristan - FS, CA <tristan.leong@usda.gov>; McNeill, Richard - FS, CA <Richard.McNeill@usda.gov>; Mullowney, Megan - FS, CA <megan.mullowney@usda.gov>; Sanchez, Monique - FS, CA <monique.sanchez@usda.gov>; Sill, Nathan - FS, CA <nathan.sill@usda.gov>; Torres, Thomas - FS, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, CA <Jameisha.Washington@usda.gov>; Wiese, Michael - FS, CA <michael.wiese@usda.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Lauren Rosenkranz <lauren.rosenkranz@kleinschmidtgroup.com>
Subject: [External Email]Lee Vining 2022 Progress Report Meeting - USFS

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Hello USFS Lee Vining team,

I just wanted to check in quickly to ensure that you received the agenda (attached) for our Progress Report meeting next Wednesday 2/1 and make sure you have the invite on your calendar.
I have received “accepted” notifications from several of you already.

Let me know if you have any questions.
Thanks!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

My part-time work schedule is generally as follows: Tuesday morning, Thursday morning, and all day Friday.
I can be available outside of these times if given advanced notice.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

Click here to view the 2021 ERM Sustainability Report and the ERM Foundation Annual Review

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B-50.2_Further discussion re report comments and spatial data 2022 botanical surveys

From:	Shannon Luoma
To:	McNeill, Richard - FS, CA; Carissa Shoemaker; Barnett, Adam - FS, CA; Blythe Haverstock, Ashley - FS, CA; Ellsworth, Todd - FS, CA; Engelhardt, Blake - FS, CA; nora.gamino@usda.gov; Irons, Sheila - FS, CA; Leong, Tristan - FS, CA; Mullowney, Megan - FS, CA; Sanchez, Monique - FS, CA; Sill, Nathan - FS, CA; Torres, Thomas - FS, CA; Washington, Jameisha - FS, CA; Wiese, Michael - FS, CA
Cc:	Lauren Rosenkranz
Subject:	RE: [External Email]Lee Vining 2022 Progress Report Meeting - USFS
Date:	Tuesday, February 28, 2023 3:46:00 PM
Attachments:	image001.png image002.png

Hi Richard!
Please use this link to grab the spatial data for the 2022 Botanical surveys. Let me know if you have any questions or trouble accessing the data. https://kleinschmidt.sharefile.com/d-sd09a13fa1b0d4646aff50ca488cb657a
Thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: McNeill, Richard - FS, CA <Richard.McNeill@usda.gov>
Sent: Tuesday, February 21, 2023 8:09 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Barnett, Adam - FS, CA <adam.barnett@usda.gov>; Blythe Haverstock, Ashley - FS, CA <ashley.blythehaverstock@usda.gov>; Ellsworth, Todd - FS, CA <todd.ellsworth@usda.gov>; Engelhardt, Blake - FS, CA <blake.engelhardt@usda.gov>; nora.gamino@usda.gov; Irons, Sheila - FS, CA <sheila.irons@usda.gov>; Leong, Tristan - FS, CA <tristan.leong@usda.gov>; Mullowney, Megan - FS, CA <megan.mullowney@usda.gov>; Sanchez, Monique - FS, CA <monique.sanchez@usda.gov>; Sill, Nathan - FS, CA <nathan.sill@usda.gov>; Torres, Thomas - FS, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, CA <Jameisha.Washington@usda.gov>; Wiese, Michael - FS, CA <michael.wiese@usda.gov>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: Re: [External Email]Lee Vining 2022 Progress Report Meeting - USFS

Hi Shannon

No worries, I am fine extending the review deadline for as long as it takes for your team to get the data to me.

rick

Rick McNeill (he/him/his)
Assistant Forest Botanist

Forest Service

Inyo National Forest

cell: 760-920-7579

fax: 760-873-2458
richard.mcneill@usda.gov

351 Pacu Lane
Bishop, CA 93514
www.fs.fed.us

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Monday, February 20, 2023 14:02
To: McNeill, Richard - FS, CA <Richard.McNeill@usda.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Barnett, Adam - FS, CA <adam.barnett@usda.gov>; Blythe Haverstock, Ashley - FS, CA <ashley.blythehaverstock@usda.gov>; Ellsworth, Todd - FS, CA <todd.ellsworth@usda.gov>; Engelhardt, Blake - FS, CA <blake.engelhardt@usda.gov>; nora.gamino@usda.gov <nora.gamino@usda.gov>; Irons, Sheila - FS, CA <sheila.irons@usda.gov>; Leong, Tristan - FS, CA <tristan.leong@usda.gov>; Mullowney, Megan - FS, CA <megan.mullowney@usda.gov>; Sanchez, Monique - FS, CA <monique.sanchez@usda.gov>; Sill, Nathan - FS, CA <nathan.sill@usda.gov>; Torres, Thomas - FS, CA <thomas.torres@usda.gov>; Washington, Jameisha - FS, CA <Jameisha.Washington@usda.gov>; Wiese, Michael - FS, CA <michael.wiese@usda.gov>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: RE: [External Email]Lee Vining 2022 Progress Report Meeting - USFS

Hi Rick!
We're about to send a reminder about tech memo comments being due back to us by Wednesday, but I also wanted to circle back with you and let you know that we're in the process of gathering the spatial data for the botanical surveys and will get it to you asap. We had hoped to have it to you before the comment window ended but it hasn't worked out that way. We did a cursory review with Allison and at first glance it doesn't look like we missed anything around Project facilities. However, once you've received the data we're happy to get on the phone and look at maps together to make sure we're in agreement.

Thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

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Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: Re: [External Email]Lee Vining 2022 Progress Report Meeting - USFS

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Assistant Forest Botanist

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Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Lauren Rosenkranz <lauren.rosenkranz@kleinschmidtgroup.com>
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Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

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I can be available outside of these times if given advanced notice.

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B-50.2_Further discussion re report comments and spatial data 2022 botanical surveys

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From:	Carissa Shoemaker
To:	Marquez, Alyssa@Wildlife; Shannon Luoma
Cc:	Lauren Rosenkranz
Subject:	RE: Lee Vining 2022 Progress Report Meeting - CDFW
Date:	Tuesday, January 31, 2023 1:06:44 PM
Attachments:	image001.png

Thanks Alyssa, I've added Nick back to our contact list and ensured he's still invited to the upcoming meetings.

Carissa Shoemaker

My part-time work schedule is generally as follows: Tuesday morning, Thursday morning, and all day Friday.
I can be available outside of these times if given advanced notice.

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M 907 575 0294

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Friday, January 27, 2023 11:18 AM
To: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

EXTERNAL MESSAGE

Shannon,

Looks like we had miscommunication on our side. Nick would like to remain on the email list until he can delegate to somebody else. Sorry for any confusion.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Thursday, January 26, 2023 10:18 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>

Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

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Thanks Alyssa, worth noting that Nick's primary role on the REC LAND TWG was for his input on the creel surveys, so it is still related to fish and aquatics. Mentioning this to help you decide who to include and obviously, you can have more than one CDFW staff on the TWG if desired.

Thanks!

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Thursday, January 26, 2023 10:13 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

Hi Carissa,

I'll get back to you on if and who would be a replacement for those TWG's.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Thursday, January 26, 2023 10:09 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Lauren Rosenkranz <lauren.rosenkranz@kleinschmidtgroup.com>
Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

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Hi Alyssa,

I believe Nick was also involved with the Recreation and Land Use TWG for Lee Vining. Should I add you and Amy in his place for that TWG, or is there another CDFW rep that would like to be included? We have a Rec TWG meeting scheduled for March 1 at 9am to discuss 2023 studies.

Thanks

Carissa Shoemaker

My part-time work schedule is generally as follows: Tuesday morning, Thursday morning, and all day Friday.
I can be available outside of these times if given advanced notice.

ERM
M 907 575 0294

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Thursday, January 26, 2023 8:53 AM
To: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Tovar, Michael@Wildlife <Michael.Tovar@Wildlife.ca.gov>; Chandos, Amy@Wildlife <Amy.Chandos@Wildlife.ca.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

EXTERNAL MESSAGE

Thank you Shannon.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>
Sent: Thursday, January 26, 2023 8:45 AM
To: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>; Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Tovar, Michael@Wildlife <Michael.Tovar@Wildlife.ca.gov>; Chandos, Amy@Wildlife <Amy.Chandos@Wildlife.ca.gov>; Buckmaster, Nick@Wildlife

<Nick.Buckmaster@wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>
Cc: Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

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Good morning, Alyssa!
I sent out the progress report link in an email at the end of the day on Monday (attached). You can find them in this link: https://kleinschmidt.sharefile.com/d-s23bdf91282914defa74ff61ce4e8fb58

Please let us know if you have trouble access them.
Thanks!
Shannon

Shannon Luoma
Licensing and Regulatory Section Manager
Office: 425.528.1614

From: Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Sent: Thursday, January 26, 2023 8:31 AM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>; Tovar, Michael@Wildlife <Michael.Tovar@Wildlife.ca.gov>; Chandos, Amy@Wildlife <Amy.Chandos@Wildlife.ca.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Lauren Rosenkranz <Lauren.Rosenkranz@KleinschmidtGroup.com>
Subject: RE: Lee Vining 2022 Progress Report Meeting - CDFW

Hi Carissa,

Thank you for checking in. I've received the Agenda but I don't see the Progress Reports. Additionally, can you please remove Nick Buckmaster from further emails on the Lee Vining FERC Project.

Alyssa Marquez

Environmental Scientist, Inland Deserts Region 6
California Department of Fish and Wildlife
787 North Main Street Suite 220
Bishop, CA 93514
(760) 567-0332
Alyssa.Marquez@Wildlife.ca.gov

From: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Sent: Wednesday, January 25, 2023 7:38 PM
To: Tovar, Michael@Wildlife <Michael.Tovar@Wildlife.ca.gov>; Chandos, Amy@Wildlife <Amy.Chandos@Wildlife.ca.gov>; Buckmaster, Nick@Wildlife <Nick.Buckmaster@wildlife.ca.gov>; Erdman, James@Wildlife <James.Erdman@wildlife.ca.gov>; Lawson, Beth@Wildlife <Beth.Lawson@wildlife.ca.gov>; Marquez, Alyssa@Wildlife <Alyssa.Marquez@Wildlife.ca.gov>
Cc: Shannon Luoma <Shannon.Luoma@KleinschmidtGroup.com>; Lauren Rosenkranz <lauren.rosenkranz@kleinschmidtgroup.com>
Subject: Lee Vining 2022 Progress Report Meeting - CDFW

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Hello CDFW Lee Vining team,

I just wanted to check in quickly to ensure that you received the agenda (attached) for our Progress Report meeting next Wednesday 2/1 and make sure you have the invite on your calendar.
I have received "accepted" notifications from a couple of you already.

Let me know if you have any questions.
Thanks!

Carissa Shoemaker
Senior Project Scientist
Pronouns: she/her

My part-time work schedule is generally as follows: Tuesday morning, Thursday morning, and all day Friday.
I can be available outside of these times if given advanced notice.

ERM
1050 SW 6th Ave, Suite 1650 | Portland, OR 97204
M 907 575 0294
E carissa.shoemaker@erm.com | **W** www.erm.com

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B-52_Meeting minutes re 2023 Yosemite Toad Field Season Update to INF

From:	Steve Norton
To:	Carissa Shoemaker; Shannon Luoma; Matthew Woodhall
Cc:	Lauren Rosenkranz; Brad Blood
Subject:	Meeting Minutes - Lee Vining Hydro Relicensing - 2023 Amphibian Survey
Date:	Wednesday, February 8, 2023 4:19:33 PM
Attachments:	image001.png image002.png image003.png Minutes Lee Vining YOTO INF_Meeting_020123.docx

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Hello all,

Please review and approve the meeting minutes from our meeting with the INF. Please also note, I hope to meet up with Thomas in person this week. I will let you know if anything substantive comes out of it.

-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

MEETING MINUTES

MEETING: February 2, 2023, conference call between Project Team (SCE, ERM, and Psomas), and Inyo National Forest (INF)

SUBJECT: Lee Vining Hydroelectric Relicensing Project 2023 Yosemite Toad Field Season Update to INF

ATTENDEES:
Thomas Torres, INF
Matt Woodhall, SCE
Steve Norton, Psomas
Brad Blood, Psomas
Carissa Shoemaker, ERM

MEETING AGENDA

- Introductions
- Discuss shared YOTO observations
    - 2022 YOTO survey results (Project Team)
    - Additional YOTO observations (INF)
- Discuss revised anticipated 2023 survey locations
- Discuss additional data collection proposed: DNA
    - General methods
    - Potential Partners
- Next Steps

DISCUSSION SUMMARY:

- Project Team presented detailed findings from 2022 amphibian surveys.
    - Thomas discussed observations of breeding near northern shore of Saddlebag Lake (downhill of USFS cabin) in years past and also near northwest inlet into Saddlebag Lake but none observed in 2022. Steve also confirmed looking but not seeing any breeding in these locations.
    - Thomas noted no previous observations of breeding near Project Team observation along Lee Vining Creek.
- Project Team discussed preliminary plans to collect DNA of toads within the Study Area to assess potential presence of western toads and potential hybridization.
    - Project Team discussed preliminary outreach efforts to determine study feasibility. Prior to furthering discussions with potential partners, Project Team sought to update and engage INF.
- Thomas stated he has a current permit to collect DNA via toe clips and tail clips from YOTO.
- Thomas expressed interest in the preliminary study proposed by the Project Team, however, he cannot commit without first reviewing draft methods and checking in with Jim Erdman and additional INF staff. Thomas to update Project Team on his discussions following his return from the Wildlife Society meeting next week.
- Thomas noted that among other responsibilities, he has time allotted during the 2023 field season to conduct amphibian survey efforts.

- Psomas to outline proposed methods and how we can collaborate with INF.
- Thomas noted collaborating with Alexa Lundberg and Roland Knapp with the Sierra Nevada Aquatic Resource Laboratory (SNARL). Thomas to reach out to Alexa to discuss.
- SCE offered potentially funding supplies for the survey efforts if done exclusively by INF.
- Unrelated to amphibians, at the request of Psomas, INF to suggest additional potential wildlife camera locations for 2023 deployment.

From:	Carissa Shoemaker
To:	Lauren Rosenkranz
Subject:	FW: Yosemite Toad & LV FERC
Date:	Tuesday, February 7, 2023 2:57:40 PM
Attachments:	image001.png image002.png image003.png image004.png image005.png image006.png image007.png

---

Carissa Shoemaker

My part-time work schedule is generally as follows: Tuesday morning, Thursday morning, and all day Friday. I can be available outside of these times if given advanced notice.

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M 907 575 0294

From: Steve Norton <steve.norton@psomas.com>
Sent: Tuesday, February 7, 2023 1:42 PM
To: Carissa Shoemaker <Carissa.Shoemaker@erm.com>
Cc: Shannon Luoma <Shannon.Luoma@Kleinschmidtgroup.com>; Matthew Woodhall <Matthew.Woodhall@sce.com>; Brad Blood <bblood@psomas.com>
Subject: FW: Yosemite Toad & LV FERC

EXTERNAL MESSAGE

Hi Carissa,
Please add the following correspondence to the project files.
Thank you,
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Steve Norton
Sent: Tuesday, February 7, 2023 12:55 PM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: RE: Yosemite Toad & LV FERC

That's actually great news: I talked with both Paul and Jeff at the Sebastopol Conference last month about just this (Jeff is the Forest biologist I was referencing on our call). I have a few outstanding

questions for both of them, but wanted to get you in the loop before I kept moving forward with any other discussions.

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Sent: Tuesday, February 7, 2023 12:09 PM
To: Steve Norton <steve.norton@psomas.com>
Subject: Yosemite Toad & LV FERC

Hi Steve,

Please read the trailing emails. I have been in touch with Alexa Lindauer from SNARL. I posed a question to her asking if there were already genetic samples you could use for the proposed genetics study.

Lets discuss.

Thomas Torres
Wildlife Biologist
Forest Service
Inyo National Forest, Mammoth Lakes Ranger District
p: 760-924-5532
c: 760-965-9671
thomas.torres@usda.gov
2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546
www.fs.fed.us
Caring for the land and serving people

From: Alexa Lindauer <alexalindauer@gmail.com>
Sent: Tuesday, February 7, 2023 9:28 AM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: Re: [External Email]successful tadpole collection in Humphrey's Basin

I realize I had a similar question from Jim Erdman earlier this year, I assume he is involved in the same permit process. His questions received the following response from Paul Maier and Jeff Mabe (do you know Jeff on the Eldorado?):

Jeff and I are working to develop an Anaxyrus boreas × canorus hybrid panel. Once completed, we hope it will more definitively answer questions about species boundaries, and dual ancestry in questionable individuals. Our project is focusing on the northern hybrid zone, but we would welcome any sample contributions of likely hybrids from other regions (e.g., Frog Lakes, Kaiser Pass, etc.). Please contact Jeff and myself directly if you want to send us your samples.

I'm happy to connect you with Paul and Jeff directly. Their emails are below if you'd like to connect. Happy to be cc-ed if helpful. Let me know what works best.

paulm@genebygene.com
jeffrey.mabe@usda.gov

I think general consensus (Cathy Brown, others) is that toads at Tioga, Ellery, Saddlebag are canorus, but I'm not sure where that consensus comes from.

Hope this helps,
Alexa

On Tue, Feb 7, 2023 at 8:16 AM Torres, Thomas - FS, CA <thomas.torres@usda.gov> wrote:

> HI Alexa,
> Thank you for the thorough response!
>
> The reason Im inquiring about toads in this area is because I am working with the Federal Energry Regulation Commission on renewing the Lee Vining hydro plan permit. I am working with their contracted biologists and they brought up the idea of collecting toe clips or tail clips to do some genetic testing to determine if they are hybridized or not (with Western toad).
>
> Rather than go through the process of collecting data ourselves, I was curious if you thought we had any samples or data that would suffice for this kind of work.
>
> Please do let me know. Thank you!

Thomas Torres
Wildlife Biologist

Forest Service
Inyo National Forest, Mammoth Lakes Ranger District

p: 760-924-5532
c: 760-965-9671
thomas.torres@usda.gov

2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546
www.fs.fed.us

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From: Alexa Lindauer <alexalindauer@gmail.com>
Sent: Monday, February 6, 2023 1:14 PM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: Re: [External Email]successful tadpole collection in Humphrey's Basin

Hi Thomas,

Are you interested in analyses of genetic samples, or preserved tissues or extracts for future analyses? And if the latter, what types of samples are you looking for?

Paul Maier collected tadpoles and tadpole tails for his genomic research (which is published - I am happy to forward you links if you are unfamiliar with his work). I'm not sure if they were destructively sampled for his PhD, or if there are still extracts in a freezer somewhere at UCSD/UC Riverside.

Dave Daversa has been swabbing toads for his postdoc at UCLA the past two summers. I saved the swab extracts, and these container coarser DNA for toads but I'm not sure which labs other than the Rosenblum Lab at Berkeley run these sorts of lab analyses with DNA from swab extracts. Many of Dave's samples are from Dana meadows and other populations within maybe a 7mi radius of Tioga Pass. He may also have collected dead animals he found and froze them, I'm not sure.

The last person to ask would be Rob Grasso in YOSE. He may have the occasional collected specimen here and there.

MVZ Berkeley also has preserved yotoads, not sure from where, and I am no expert in extracting DNA from specimens preserved in formaldehyde.

Hope this helps?? I am happy to connect you with Dave and Paul (I am assuming you know Rob).

On Fri, Feb 3, 2023 at 10:52 AM Torres, Thomas - FS, CA <thomas.torres@usda.gov> wrote:

> Thanks for getting back to me, Alexa. I just had a quick question about Yosemite Toad. Do you know if we have any genetic samples from individuals off of Tioga Road (Saddlebag and Dana meadows)?

Thomas Torres
Wildlife Biologist
Forest Service
Inyo National Forest, Mammoth Lakes Ranger District
p: 760-924-5532
c: 760-965-9671
thomas.torres@usda.gov
2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546
www.fs.fed.us

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From: Alexa Lindauer <alexalindauer@gmail.com>
Sent: Friday, February 3, 2023 10:08 AM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: Re: [External Email]successful tadpole collection in Humphrey's Basin

Hi Thomas,

Thanks for reaching out. Can we schedule a time on Monday? I'm pretty booked today with calls but am totally free on Monday. Free Tuesday and Wednesday as well if that works better.

Hope you've been getting out and playing in the mountains with all this snow, and finally a clear weather window (and clearer roads)!
-Alexa

On Thu, Feb 2, 2023 at 2:00 PM Torres, Thomas - FS, CA <thomas.torres@usda.gov> wrote:

> Hi Alexa, could you give me a call at your earliest convenience? I was hoping to pick your brain about YOTO. Hope youre well.
>
> 760-965-9671
>
> **Thomas Torres**
> **Wildlife Biologist**
> **Forest Service**
> **Inyo National Forest, Mammoth Lakes Ranger District**
> **p: 760-924-5532**
> **c: 760-965-9671**
> **thomas.torres@usda.gov**
> 2510 Hwy 203/P.O. Box 148
> mammoth lakes, CA 93546
> www.fs.fed.us
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--
Alexa Lindauer (she/her)
Project and Laboratory Manager
Sierra Nevada Aquatic Research Laboratory
University of California, Santa Barbara
alindauer@ucsb.edu | *alexalindauer@gmail.com*
http://mountainlakesresearch.com/

--
Alexa Lindauer (she/her)
Project and Laboratory Manager
Sierra Nevada Aquatic Research Laboratory
University of California, Santa Barbara
alindauer@ucsb.edu | *alexalindauer@gmail.com*
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--
Alexa Lindauer (she/her)
Project and Laboratory Manager
Sierra Nevada Aquatic Research Laboratory
University of California, Santa Barbara
alindauer@ucsb.edu | *alexalindauer@gmail.com*
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TJ Wiggs

From: Steve Norton <steve.norton@psomas.com>
Sent: Thursday, February 23, 2023 11:23 AM
To: Torres, Thomas - FS, CA
Cc: Schlick, Kary - FS, CA; Matthew Woodhall; Shannon Luoma; Carissa Shoemaker
Subject: RE: Yosemite Toad & LV FERC

Thanks for the update!
Let me know how your permit progresses but please send me the names of the other folks as well. I can reach out during the interim.
-Steve

Steve Norton
P S O M A S | Balancing the Natural and Built Environment
Senior Biologist / Project Manager / Associate
Resource Management
714.481.8037 (Office/Mobile)
www.Psomas.com

From: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Sent: Thursday, February 23, 2023 7:58 AM
To: Steve Norton <steve.norton@psomas.com>
Cc: Schlick, Kary - FS, CA <kary.schlick@usda.gov>
Subject: RE: Yosemite Toad & LV FERC

Hi Steve, thanks for reaching out!

I contacted our regional aquatics program manager with a suite of questions regarding the permit. I have yet to hear back from her, however. But I have thought more about it and have had some conversations with m counterparts. It seems that this project/genetic analysis is a standalone project and perhaps belongs outside of the FERC technical study process.

I would still like to get this done at some point though and am looking into working with our staff at a few research stations. Kary Schlick my coworker on the south zone gave me a few names of individuals who may be interested in taking this on.

That is where I currently stand – but lll let you know if anything changes once the aquatics program manager gets back to me?

Thomas Torres
Wildlife Biologist
Forest Service
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2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546

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From: Steve Norton <steve.norton@psomas.com>
Sent: Wednesday, February 22, 2023 3:26 PM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: RE: Yosemite Toad & LV FERC

Hey Thomas,
Have you heard anything back from Vallejo regarding potential DNA collection as part of your permit?
I hope all is well and that you're stocked up on food for the next week or so.
Stay warm!
-Steve

Steve Norton
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From: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Sent: Tuesday, February 7, 2023 12:09 PM
To: Steve Norton <steve.norton@psomas.com>
Subject: Yosemite Toad & LV FERC

Hi Steve,

Please read the trailing emails. I have been in touch with Alexa Lindauer from SNARL. I posed a question to her asking if there were already genetic samples you could use for the proposed genetics study.

Lets discuss.

Thomas Torres
Wildlife Biologist
Forest Service
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thomas.torres@usda.gov
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From: Alexa Lindauer <alexalindauer@gmail.com>
Sent: Tuesday, February 7, 2023 9:28 AM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: Re: [External Email]successful tadpole collection in Humphrey's Basin

I realize I had a similar question from Jim Erdman earlier this year, I assume he is involved in the same permit process. His questions received the following response from Paul Maier and Jeff Mabe (do you know Jeff on the Eldorado?):

Jeff and I are working to develop an Anaxyrus boreas × canorus hybrid panel. Once completed, we hope it will more definitively answer questions about species boundaries, and dual ancestry in questionable individuals. Our project is focusing on the northern hybrid zone, but we would welcome any sample contributions of likely hybrids from other regions (e.g., Frog Lakes, Kaiser Pass, etc.). Please contact Jeff and myself directly if you want to send us your samples.

I'm happy to connect you with Paul and Jeff directly. Their emails are below if you'd like to connect. Happy to be cc-ed if helpful. Let me know what works best.

paulm@genebygene.com
jeffrey.mabe@usda.gov

I think general consensus (Cathy Brown, others) is that toads at Tioga, Ellery, Saddlebag are canorus, but I'm not sure where that consensus comes from.

Hope this helps,
Alexa

On Tue, Feb 7, 2023 at 8:16 AM Torres, Thomas - FS, CA <thomas.torres@usda.gov> wrote:

> HI Alexa,
>
> Thank you for the thorough response!
>
> The reason Im inquiring about toads in this area is because I am working with the Federal Energry Regulation Commission on renewing the Lee Vining hydro plan permit. I am working with their contracted biologists and they brought up the idea of collecting toe clips or tail clips to do some genetic testing to determine if they are hybridized or not (with Western toad).
>
> Rather than go through the process of collecting data ourselves, I was curious if you thought we had any samples or data that would suffice for this kind of work.
>
> Please do let me know. Thank you!

Thomas Torres
Wildlife Biologist
Forest Service

Inyo National Forest, Mammoth Lakes Ranger District
p: 760-924-5532
c: 760-965-9671
thomas.torres@usda.gov
2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546
www.fs.fed.us

Caring for the land and serving people

From: Alexa Lindauer <alexalindauer@gmail.com>
Sent: Monday, February 6, 2023 1:14 PM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: Re: [External Email]successful tadpole collection in Humphrey's Basin

Hi Thomas,

Are you interested in analyses of genetic samples, or preserved tissues or extracts for future analyses? And if the latter, what types of samples are you looking for?

Paul Maier collected tadpoles and tadpole tails for his genomic research (which is published - I am happy to forward you links if you are unfamiliar with his work). I'm not sure if they were destructively sampled for his PhD, or if there are still extracts in a freezer somewhere at UCSD/UC Riverside.

Dave Daversa has been swabbing toads for his postdoc at UCLA the past two summers. I saved the swab extracts, and these container coarser DNA for toads but I'm not sure which labs other than the Rosenblum Lab at Berkeley run these sorts of lab analyses with DNA from swab extracts. Many of Dave's samples are from Dana meadows and other populations within maybe a 7mi radius of Tioga Pass. He may also have collected dead animals he found and froze them, I'm not sure.

The last person to ask would be Rob Grasso in YOSE. He may have the occasional collected specimen here and there.

MVZ Berkeley also has preserved yotoads, not sure from where, and I am no expert in extracting DNA from specimens preserved in formaldehyde.

Hope this helps?? I am happy to connect you with Dave and Paul (I am assuming you know Rob).

On Fri, Feb 3, 2023 at 10:52 AM Torres, Thomas - FS, CA <thomas.torres@usda.gov> wrote:

Thanks for getting back to me, Alexa. I just had a quick question about Yosemite Toad. Do you know if we have any genetic samples from individuals off of Tioga Road (Saddlebag and Dana meadows)?

Thomas Torres
Wildlife Biologist
Forest Service

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c: 760-965-9671
thomas.torres@usda.gov
2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546
www.fs.fed.us

Caring for the land and serving people

From: Alexa Lindauer <alexalindauer@gmail.com>
Sent: Friday, February 3, 2023 10:08 AM
To: Torres, Thomas - FS, CA <thomas.torres@usda.gov>
Subject: Re: [External Email]successful tadpole collection in Humphrey's Basin

Hi Thomas,

Thanks for reaching out. Can we schedule a time on Monday? I'm pretty booked today with calls but am totally free on Monday. Free Tuesday and Wednesday as well if that works better.

Hope you've been getting out and playing in the mountains with all this snow, and finally a clear weather window (and clearer roads)!

-Alexa

On Thu, Feb 2, 2023 at 2:00 PM Torres, Thomas - FS, CA <thomas.torres@usda.gov> wrote:

> Hi Alexa, could you give me a call at your earliest convenience? I was hoping to pick your brain about YOTO. Hope youre well.
>
> 760-965-9671

Thomas Torres
Wildlife Biologist
Forest Service

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c: 760-965-9671
thomas.torres@usda.gov
2510 Hwy 203/P.O. Box 148
mammoth lakes, CA 93546
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Alexa Lindauer (she/her)

Project and Laboratory Manager

Sierra Nevada Aquatic Research Laboratory

University of California, Santa Barbara

alindauer@ucsb.edu | *alexalindauer@gmail.com*

http://mountainlakesresearch.com/

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Alexa Lindauer (she/her)

Project and Laboratory Manager

Sierra Nevada Aquatic Research Laboratory

University of California, Santa Barbara

alindauer@ucsb.edu | *alexalindauer@gmail.com*

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Alexa Lindauer (she/her)
Project and Laboratory Manager
Sierra Nevada Aquatic Research Laboratory
University of California, Santa Barbara
alindauer@ucsb.edu | *alexalindauer@gmail.com*
http://mountainlakesresearch.com/