

EFFECTIVENESS MONITORING PROGRAM
INITIAL CONCEPT PROPOSAL — FY 2026/2027
California State Board of Forestry and Fire Protection

Project Information

a. Date Submitted: May 18, 2026

b. Project Title: Integrating Aquatic and Riparian Monitoring to Evaluate Forest Practice Rule Effectiveness for WLPZ Function in the Sierra Nevada

c. Project #: [Leave blank — to be assigned by EMC]

d. Principal Investigator(s): Jeff Lauder, PhD, Executive Director; Dave Herbst, PhD, board member and BMI Lab Research Advisor; Christian Noack, Forest Ecologist

e. Affiliation(s) of PI(s) and Address(es): Sierra Streams Institute (SSI), [REDACTED]
[REDACTED]

f. Applying Organization: Sierra Streams Institute, a 501(c)(3) nonprofit organization

g. Primary Contact Phone Number(s): [REDACTED]

h. Primary Email Contact(s) of PI(s): [REDACTED]
[REDACTED]

i. Name(s) and Affiliation(s) of Collaborator(s):

- Nevada County Office of Emergency Services (grantee partner on the underlying Sierra Foothill Forest Climate Resilience Project, WCB-2340KM) as well as partner in the Nevada County Quarterly Wildfire Stakeholders Meeting (QWSM) group focusing on standardizing metrics and targets across Nevada County.
- Nevada City Rancheria Nisenan Tribe, partners on the Delta Research Project and prescribed burning and forest work as part of funded forest health work
- Bureau of Land Management (federal landowner on SFFCRP parcels)
- Yulica (home property of the Nevada City Rancheria Nisenan), Shady Creek Outdoor School, and Nevada City School of the Arts (private landowner partners)
- Jones Bar FireWise Community (private landowner partners where treatments are occurring)
- UC Cooperative Extension and California Department of Fish and Wildlife (regulatory and technical partners)
- Additional academic collaborators (CSU Monterey Bay, UC Davis) to be confirmed for the Full Proposal
- South Yuba River Citizens League (SYRCL) for collaboration on South Yuba Watershed Monitoring data and analysis
- Yuba Forest Network to spread awareness, findings, and increase local buy-in from other local organizations committed to forest health

j. Project Description

i) Project Duration

Two years and four months: December 2026 through March 31, 2029 (consistent with the FY 2026/27 cycle completion deadline).

ii) Background and Justification

California's Forest Practice Rules (FPRs) are the principal regulatory instrument governing how forest management activities interact with the aquatic systems they share the landscape with. Watercourse and Lake Protection Zone (WLPZ) prescriptions (14 CCR §§ 916.4–916.5, 936.4–936.5, 956.4–956.5) and the broader rules protecting beneficial uses of water (14 CCR §§ 916.2, 936.2, 956.2) define the structural and operational buffers between management activity and California's streams. These rules were designed to protect riparian function, water temperature, sediment regime, and downstream beneficial uses while permitting active forest management.

In the last decade, however, the management context has changed dramatically. Megafires — Dixie (2021), Caldor (2021), Mosquito (2022) — have burned millions of acres of Sierra Nevada forest, frequently at high severity within and adjacent to WLPZs. In response, the scale and pace of fuels treatments, prescribed fire, and post-fire restoration on California's mixed private-public timberland mosaic, particularly within the Wildland Urban Interface (WUI), has accelerated. Treatments are increasingly entering WLPZs themselves, where the FPRs are most prescriptive and the consequences for aquatic function are most direct.

These trends expose a critical evidence gap. The EMC's own Strategic Plan identifies the linkage between WLPZ management and aquatic biotic response — and the recovery trajectory of WLPZs and their associated streams after fire and after treatment — as high-priority knowledge needs. To date, most EMC-funded monitoring of WLPZ-relevant questions has focused on terrestrial vegetation metrics or single-parameter water-quality measures. Few projects have integrated standardized riparian and in-stream health metrics — benthic macroinvertebrate (BMI) assemblages, continuous water quality, and quantitative vegetation transects — in a single design spanning both planned-treatment and post-fire natural-experiment sites. BMI assemblages are widely recognized as among the most sensitive and ecologically integrative indicators of stream condition (and are used by the State Water Board's Surface Water Ambient Monitoring Program, or SWAMP), directly indexing the processes the WLPZ rules are designed to protect: temperature, sediment, organic matter inputs, and general stream health.

Sierra Streams Institute (SSI) is uniquely positioned to fill this gap at modest incremental cost. SSI is a community-based research, education, and restoration non-profit that has monitored Northern Sierra stream health through standardized benthic sampling for more than three decades. We currently operate two active, independently funded programs that can be leveraged here: (1) a Delta Stewardship Council-funded BMI and water-quality monitoring program at SSI sites across the Sierra — including reaches above, within, and below the Dixie, Caldor, and Mosquito fire footprints — creating a ready-made post-fire natural experiment with multi-year pre- and post-fire data; and (2) the active Sierra Foothill Forest Climate Resilience Project (SFFCRP, WCB Grant WC-2340KM, \$2.396M through March 2027), which funds mostly completed treatments on 625 acres of mixed-conifer-oak woodland across private and federal parcels in Nevada County (Yulica, Shady Creek Outdoor School, Nevada City School of the Arts, Jones Bar FireWise Community, and four BLM parcels), with baseline vegetative monitoring. SSI also maintains long-standing internal monitoring at sites overlapping with treatments.

We propose to leverage these projects, prior stream health data, in-place riparian infrastructure, and on-going treatments (prescribed fire, mastication, pile burning, hand-thinning, planting, herbicide) to translate existing monitoring into a test of Forest Practice Rule effectiveness through WLPZ-specific fuel transects, expanded WLPZ vegetation plots, targeted storm-event

sediment sampling, and the synthesis and policy-translation deliverables needed to improve WLPZ management under changing conditions.

iii) Objectives and Scope

The project's overarching objective is to quantitatively evaluate FPR effectiveness — particularly WLPZ prescriptions and the rules governing post-fire and fuels treatments — using integrated aquatic and terrestrial indicators across both planned-treatment and post-fire landscapes, leveraging two active SSI monitoring programs and adding the analytical and sampling components specific to FPR-effectiveness testing. Specific objectives:

- Leverage SSI's existing Delta Stewardship Council-funded BMI/water-quality monitoring network — including reaches above, within, and below the Dixie, Caldor, and Mosquito fire footprints — as a post-fire natural experiment dataset for FPR-effectiveness analysis, with multi-year pre-fire baseline data already in hand.
- Leverage the WCB-funded Sierra Foothill Forest Climate Resilience Project and its existing baseline monitoring to establish a before-after-control-impact (BACI) design across SFFCRP units, adding WLPZ-specific sampling not currently funded by SFFCRP.
- Add the incremental sampling effort required for rigorous FPR-effectiveness testing: WLPZ-specific Brown's fuel transects, expanded vegetation plots within WLPZ buffers in treatment areas, targeted storm-event turbidity sampling above and below treatment units, and additional BMI collection and identification.
- Synthesize the combined dataset to quantitatively address four FY 2026/27 prioritized Critical Monitoring Questions (CMQs 1h, 2a, 6e, 12a, see table in section K) plus additional CMQs across Themes 1, 5, 6, 11, and 12.
- Translate findings into policy-relevant deliverables: at least two peer-reviewed manuscripts, technical reports, and presentations to the Board and its Forest Practice Committee, and public-facing outreach products in our targeted treatment areas.

iv) Research Methods

Study Design

The monitoring backbone — BMI sampling sites, water-quality stations, and treatment units — is already in place and funded under SSI's Delta Stewardship Council program and the SFFCRP. For EMC-funded analysis, we will stratify existing sites into two pools: (1) SFFCRP-adjacent reaches at Shady Creek, Yulica, Nevada City School of the Arts, Jones Bar, and BLM parcels, where treatments are complete or scheduled and a BACI design with paired untreated reference reaches is feasible; and (2) Delta-program reaches across the Dixie, Caldor, and Mosquito footprints, where a natural-experiment design exploits multi-year pre-fire baselines and cross-sectional contrasts of severity, time-since-fire, and post-fire management. The EMC grant funds the incremental sampling and analytical effort needed to extract FPR-effectiveness inferences from these networks, plus additional BMI identification — the most time-intensive data generation step in these programs.

Aquatic Indicators

The following aquatic indicators are already collected through SSI's Delta program and SFFCRP baseline monitoring; the EMC grant funds the targeted additions (*italicized*):

- BMI assemblages via SWAMP-compliant protocols at fixed reach locations, identified to standard taxonomic effort with community scoring (Themes 1e, 2a, 5a) — already collected under Delta program.

- Continuous water temperature via in-stream HOBO loggers (Themes 1a, 1b) — existing at most sites; modest EMC line for additional loggers at new WLPZ transect locations.
- Continuous turbidity at strategic monitoring points plus *targeted storm-event grab sampling above and below randomly selected subset of SFFCRP treatment units* (Theme 2a) — storm-event sampling is the EMC-funded addition.
- Standard water chemistry: dissolved oxygen, pH, conductivity, nutrients (N, P) — already collected.
- *Channel substrate composition via Wolman pebble counts and embeddedness assessment* to detect management-related sediment signals at randomly stratified subset of sites based on treatments and fire severity (Themes 2a, 3a) — EMC-funded addition.
- Streamflow measurements at established gauging cross-sections to normalize loading estimates — existing.

Riparian and Upland Indicators

Riparian and upland monitoring is where the EMC investment adds the most new sampling effort, since SSI's existing programs are aquatic-focused and SFFCRP funds general project monitoring rather than WLPZ-specific transects.

- Permanent vegetation transects within and adjacent to each monitored WLPZ, recording overstory canopy closure (densiometer plus hemispherical photo analysis), basal area by species, large woody debris counts, and snag inventory (Themes 1a, 1c, 1d, 10a).
- Understory cover plots documenting native and invasive species composition, with attention to hardwood sprouting and seedling establishment post-treatment and post-fire (Themes 6e, 11a, 11b).
- Modified Brown's fuel transects measuring pre- and post-treatment fuel loading by class — the direct empirical test of whether the WLPZ prescription is achieving the fuel-reduction outcome implied by the rules (Themes 1h, 6c, 6d).
- Spatial analysis and remote sensing of canopy, soil moisture and topographic wetness, and drought projections.

Statistical Analysis

Treatment effects will be tested with mixed-effects models including random effects for site and year and corrections for repeated measures and spatial autocorrelation. BMI assemblage shifts will be analyzed via ordination (NMDS), community metrics (e.g., % EPT — Ephemeroptera, Plecoptera, Trichoptera), and indicator species analysis. Sediment and turbidity dynamics will be modeled against storm intensity, antecedent moisture, and treatment status to isolate management-related signals from background variability. Post-fire recovery trajectories will be analyzed across time-since-fire and severity gradients.

Community Science Integration

SSI's long-running community science program will support sampling frequency at modest marginal cost. All data collection contributing to analyses or reports will be conducted under the QA/QC framework of SSI's research staff and our State Water Board-sponsored Quality Assurance Project Plan (QAPP), consistent with the EMC's requirement (Section V.E) that data collection and analysis remain with research institutions.

v) Scientific Uncertainty and Geographic Application

As fire severity and frequency increase over time, uncertainty continues to grow around whole-ecosystem response to both fire and treatment. The project addresses three convergent

uncertainties identified in the EMC Strategic Plan §3.1: (1) the effectiveness of WLPZ prescriptions when treatments include prescribed fire and when applied across the public/private (and WUI) interface; (2) the integrated aquatic-biotic response (not merely terrestrial vegetation response) to WLPZ-adjacent management; and (3) post-fire recovery trajectories of WLPZ and stream ecosystem function under contrasting management regimes. By pairing planned-treatment monitoring with post-fire natural experiments, the design provides inferential power that neither approach alone can match. Further, while riparian restoration practice has increasingly shifted toward “process-based restoration” emphasizing dynamic stream systems and woody debris inputs, the linkage between upland forest treatment response and in-stream woody-debris-based modification remains poorly characterized — a gap this proposal helps address within WLPZ prescriptions.

Findings will apply most directly to the Sierra Nevada mixed-conifer and oak woodland systems of the Northern and Central Sierra (roughly Nevada, Yuba, Sierra, Plumas, Placer, El Dorado, and Amador Counties; approximately 500–4,500 feet elevation). The methodological framework — and many specific conclusions about integrated aquatic-terrestrial response to WLPZ treatments and post-fire recovery — will have statewide relevance to similar mid-elevation forested watersheds on private timberlands across the state.

vi) Collaborations and Project Feasibility

SSI has operated continuously since 1995 and has successfully managed multi-year grants from the Wildlife Conservation Board, the National Science Foundation, the Sierra Nevada Conservancy, the U.S. EPA, the Delta Stewardship Council, and others. SSI maintains a permanent QA/QC-certified laboratory for water quality and BMI taxonomy. The SFFCRP grant guarantees that planned treatments will occur on the monitored sites during the project period, with landowner access agreements already in place. SSI's existing monitoring data, dating back two decades at many reaches, provides the pre-fire baseline for burn-scar comparisons. Letters of support from Nevada County OES, partner landowners, BLM, and academic collaborators will accompany the Full Proposal. The project is staffed across SSI's Forestry, Lab, Restoration, and Education programs.

Cost Share and Leveraged Funds

This proposal layers FPR-effectiveness analysis onto two active, independently funded SSI programs, producing substantial leverage of the EMC investment:

- **Wildlife Conservation Board - Sierra Foothill Forest Climate Resilience Project (Grant WC-2340KM):** \$2,396,000, active through March 2027. Funds the forest treatments at SFFCRP sites monitored under this proposal (hand thinning, mastication, prescribed fire, invasive removal, planting/seeding), baseline monitoring of those sites, and project management overhead. Treatments are the experimental manipulation that makes BACI inference possible.
- **Delta Stewardship Council - Integrated Sierra Stream Climate Resilience Modeling:** Funds ongoing BMI sampling, taxonomy, water-quality data collection, and continuous monitoring at SSI sites across the Sierra Nevada — including sites whose locations relative to the Dixie, Caldor, and Mosquito fire footprints form the natural-experiment design of this proposal. Provides the SWAMP-compatible QA/QC framework and the laboratory taxonomy capacity used here.
- **SSI institutional contributions:** Two decades of pre-existing baseline data at most monitoring reaches; permanent monitoring infrastructure (continuous temperature loggers, established gauging cross-sections); the long-running community science volunteer program; and SSI's permanent laboratory facilities.

Total leveraged investment conservatively exceeds \$2.5 million. EMC funds only the incremental staff time, WLPZ-specific sampling, and synthesis/policy-translation work for FPR-effectiveness. Detailed cost-share accounting will be provided in the Full Proposal using the EMC Budget template.

k. Critical Question Themes and Forest Practice Rules Addressed

The project addresses four of the six FY 2026/27 prioritized Critical Monitoring Questions, spanning four EMC Research Themes, plus a substantial set of non-priority CMQs in the same themes. The integrated aquatic-terrestrial design is the mechanism by which a single coordinated effort can produce evidence relevant to all four priority questions simultaneously.

Prioritized Critical Monitoring Questions

| CMQ | Question | How this project addresses it |
|-----|--|---|
| 1h | Are FPRs effective at managing WLPZs to reduce potential fire behavior and rate of spread? | Fuel data pre/post-treatment within WLPZ buffers across stream classes, paired with prescribed-fire participation through SFFCRP. Direct test of the fuel-reduction outcome of WLPZ prescriptions. |
| 2a | Are FPRs effective at minimizing management-related sediment delivery to channels at watershed and sub-watershed scale? | Continuous turbidity, storm-event grab samples, and substrate analysis above and below treatment units across multiple stream classes to isolate management-related sediment from background variability. |
| 6e | Are FPRs effective at achieving post-fire recovery and restoration? | Natural-experiment monitoring across Dixie, Caldor, and Mosquito footprints, sampling vegetative and BMI/aquatic recovery trajectories under contrasting management approaches (untreated, salvage, reforested) and severity classes. |
| 12a | Are FPRs effective at improving overall forest wildfire resilience and the ecosystem functional response to fuel reduction and forest health treatments? | Integrated aquatic-terrestrial indicators (BMI, water quality, riparian vegetation, soil moisture) provide the most comprehensive available test of ecosystem-level functional response to FPR-compliant treatments. |

Additional (Non-Priority) CMQs Addressed

By design, the integrated monitoring framework simultaneously informs the following non-priority CMQs, increasing the proposal's breadth per EMC Section VII.A.i:

- Theme 1a — canopy closure / shade on watercourses (densiometer + hemispherical photo data)
- Theme 1b — stream water temperature (continuous loggers)
- Theme 1c — retention of predominant conifers and large woody debris input (vegetation transects, LWD inventory)
- Theme 1d — conifer and deciduous species retention for shade, temperature, primary productivity
- Theme 1e — organic matter input as indexed by BMI assemblages and site characterization
- Theme 5a — distribution and quality of foraging, rearing, and spawning habitat for anadromous salmonids (where present and accessible in lower-elevation reaches)
- Theme 6c — managing fuel loads, vegetation patterns, and fuel breaks for fire hazard reduction
- Theme 6d — managing forest structure and stocking standards for wildfire resilience
- Theme 11a — retention of diverse forests with hardwood mixture (14 CCR § 897(b)(1))
- Theme 11b — retention of native oaks (14 CCR § 959.15)

Forest Practice Rules and Related Regulations Addressed

- 14 CCR §§ 916.2, 936.2, 956.2 — Protection of Beneficial Uses of Water and Riparian Functions
- 14 CCR §§ 916.4, 936.4, 956.4 — Watercourse and Lake Protection
- 14 CCR §§ 916.5, 936.5, 956.5 — Procedures for Determining WLPZ Widths and Protective Measures
- 14 CCR §§ 916.9, 936.9, 956.9 — WLPZ specifications by zone (Channel, Core, Inner, Outer, Special Operating)
- 14 CCR § 897(b)(1) — Diverse forests with hardwood mixture
- 14 CCR § 959.15 — Native oak retention
- Relevant post-fire emergency notice and CEQA exemption provisions used by SFFCRP partner treatments

I. Requested Funding

Total requested from EMC across three fiscal years: \$205,000. This request is sized to be one of multiple funded projects within the FY 2026/27 program pool, consistent with the EMC's stated preference (Section III) for funding multiple research projects each year, and reflects the substantial leveraged investment from existing WCB and Delta Stewardship Council funding described in Section vi above.

| Fiscal Year | Amount | Primary Activities |
|-------------|----------|---|
| FY 2026/27 | \$75,000 | Stratification and selection of monitoring reaches across SFFCRP units and existing Delta-program sites; installation of WLPZ-specific vegetation transects and supplemental HOBO loggers; initiation of Brown's fuel |

| Fiscal Year | Amount | Primary Activities |
|--------------------|------------------|--|
| | | transects at SFFCRP units; incremental BMI/water-quality sampling layered onto existing programs. |
| FY 2027/28 | \$85,000 | Peak field season: during- and post-treatment WLPZ vegetation and fuel transect re-measurement at SFFCRP units; targeted storm-event turbidity sampling above and below treatments; expanded post-fire vegetation sampling at burn-scar sites; BMI lab processing for FPR-relevant subset. |
| FY 2028/29 | \$45,000 | Final season of WLPZ vegetation and fuel re-measurement; longer-term post-treatment recovery sampling; statistical synthesis of integrated aquatic-terrestrial dataset; manuscript preparation, technical report, and final presentations to EMC, Board, and Forest Practice Committee. |
| TOTAL | \$205,000 | Leveraged investment from WCB SFFCRP, Delta Stewardship Council program, and SSI institutional contributions: >\$2.5M (see Section vi). |

Brief Justification of Costs (under 200 words)

Personnel costs are calculated at marginal/incremental rates. Most SSI staff time on this project is partially supported by the SFFCRP (WCB-2340KM, through March 2027) and SSI's Delta Stewardship Council-funded BMI/water-quality program; EMC funds only the additional staff hours required for FPR-effectiveness-specific tasks: installation and re-measurement of WLPZ vegetation and Brown's fuel transects, targeted storm-event turbidity sampling for treatment-effect detection, the additional BMI lab sample collection and processing required for the FPR-relevant site subset, and the statistical synthesis and policy-translation deliverables EMC reviewers expect. A modest equipment line in FY 2026/27 covers supplemental HOBO loggers at new WLPZ transect locations not already instrumented. Travel covers incremental field work across Nevada, Yuba, Sierra, and Plumas Counties. Indirect costs are held at 15% per Section VI.B.ii.d. The funding ramp reflects setup and baseline establishment in Year 1, peak field intensity coinciding with SFFCRP active-treatment year in Year 2, and synthesis and deliverables emphasis in Year 3. The Year 1 request of \$75,000 sits well below the FY 2026/27 program cap of \$261,459, allowing EMC to fund several concurrent projects.