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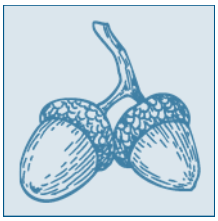
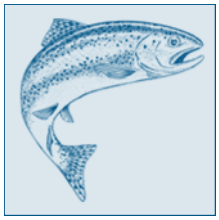
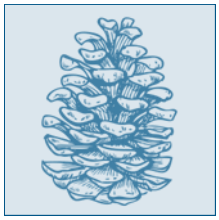
RESEARCH & MONITORING




Bioassessment

Quality Assurance Project Plan

Version 3.1 (Public)
September 14, 2023

Prepared by:
Cajun James, Ph.D., Program Director
Research and Monitoring Program
Sierra Pacific Industries
P.O. Box 496028, Redding, CA 96409

In Collaboration with:
Marine Pollution Studies Laboratory
Moss Landing Marine Laboratories
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NOTE

This Version 3.1 is a public copy of Sierra Pacific Industries' *Bioassessment Quality Assurance Project Plan* Version 3.0. Proprietary and confidential information has been removed.

Group A:
Project Management

A1: TITLE AND APPROVAL SHEET

DOCUMENT SUMMARY

Table 1: Document Summary

Lead Organization	Sierra Pacific Industries PO Box 496028 Redding, CA 96409 http://www.spi-ind.com
Primary Contact	Cajun James, Ph.D. Program Director; Quality Assurance Manager Research and Monitoring Program Sierra Pacific Industries PO Box 496028 Redding, CA 96049 (530) 378-8151 cjames@spi-ind.com
Effective Date	September 14, 2023

APPROVALS

Cajun James, Ph.D.; Program Director, Quality Assurance Manager
Research and Monitoring Program, Sierra Pacific Industries

Signature _____ Date 9/14/2023

Will Hagan; Quality Assurance Oversight Manager
Marine Pollution Studies Laboratory, Moss Landing Marine Laboratories

Signature _____ Date 09/14/23

RECOMMENDED CITATION

James, C. *Bioassessment Quality Assurance Project Plan*; Sierra Pacific Industries: Redding, CA, 2023.

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A3: DISTRIBUTION LIST

OFFICIAL DISTRIBUTION

This quality assurance (QA) project plan (QAPP) will be officially distributed to the Sierra Pacific Industries (SPI) staff and contractors identified in Table 2.

Table 2: Distribution List

Recipient	Mailing Address
Autumn Bonnema Laboratory Liaison (831) 771-4175 autumn.bonnema@sjsu.edu	Moss Landing Marine Laboratories Marine Pollution Studies Laboratory 7544 Sandholdt RD Moss Landing, CA 95039
Will Hagan Quality Assurance Oversight Manager (206) 527-3313 william.hagan@sjsu.edu	Moss Landing Marine Laboratories Marine Pollution Studies Laboratory 7544 Sandholdt RD Moss Landing, CA 95039
Cajun James, Ph.D. Program Director and Quality Assurance Manager (530) 378-8151 cjames@spi-ind.com	Sierra Pacific Industries Research and Monitoring PO Box 496028 Redding, CA 96409
Kalina Manoylov, Ph.D. Diatom Taxonomist (517) 974-4755 manoylov7@gmail.com	115 Waters Edge Dr. Milledgeville, GA 31061
Roxanne Moore Laboratory Liaison (707) 822-4649 #101 rgolich@northcoastlabs.com	North Coast Laboratories, Ltd. Management Division 5680 W End RD Arcata, CA 95521-9202
Daniel Pickard Benthic Macroinvertebrate Taxonomist (530) 898-4792 dpickard@csuchico.edu	California Department of Fish and Wildlife Aquatic Bioassessment Laboratory - Chico 400 W First ST Chico, CA 95929-0555
Marco Sigala Bioassessment Coordinator (831) 771-4173 marco.sigala@sjsu.edu	Moss Landing Marine Laboratories Marine Pollution Studies Laboratory 7544 Sandholdt RD Moss Landing, CA 95039

Recipient	Mailing Address
Rosalina Stancheva, Ph.D. Diatom Quality Control Taxonomist (858) 231-0506 rosalinastan@gmail.com	3220 Ridge View Court, apt. 201, Woodbridge, VA 22192
Stacey Swenson Data Manager (831) 771-4114 stacey.swenson@sjsu.edu	Moss Landing Marine Laboratories Marine Pollution Studies Laboratory 7544 Sandholdt RD Moss Landing, CA 95039
Jon Lee Benthic Macroinvertebrate Quality Control Taxonomist (707) 740-8647 jonleebugs@gmail.com	Jon Lee Consulting 2337 15th Street Eureka, CA 95501

ADDITIONAL DISTRIBUTION

At the discretion of the SPI Research and Monitoring Program Director, this QAPP may also be distributed to other interested parties (e.g., subcontractors, scientific advisors, the California Environmental Data Exchange Network (CEDEN)). The goal of this distribution is to:

- Increase the transparency of SPI's forest management activities
- Promote collaboration among SPI and its stakeholders
- Demonstrate SPI's commitment to sustainability and QA

A4: PROJECT/TASK ORGANIZATION

SPI's bioassessment studies include:

- Oversight by SPI and the Marine Pollution Studies Laboratory at Moss Landing Marine Laboratories (MLML-MPSL)
- Field sampling and physical habitat (PHAB) analysis by MLML-MPSL
- Benthic macroinvertebrate (BMI) taxonomy by the California Department of Fish and Wildlife's (CDFW's) Aquatic Bioassessment Laboratory (CDFW-ABL) and Jon Lee Consulting (JLC)
- Diatom taxonomy by Drs. Kalina Manoylov and Rosalina Stancheva
- Laboratory analyses by North Coast Laboratories, Ltd. (NCL) and the CDFW's Marine Pollution Studies Laboratory (CDFW-MPSL)

Scientific advisors provide additional input. Organizational details are provided below.

OVERSIGHT

Cajun James, Ph.D. – Sierra Pacific Industries

Program Director, Quality Assurance Manager

Since 2000, Dr. Cajun James has worked at SPI to establish the Research and Monitoring Program in California, Oregon, and Washington. She develops and directs several large monitoring networks, integrating water quality studies with the largest private weather station and repeater network in the United States. Dr. James' specialties include water quality, BMIs, land-use related erosion, instream wood recruitment, canopy cover estimation, near stream microclimate studies, watershed analysis, pre-and post-wildfire sedimentation, riparian responses to forest management and wildfire, rare plant surveys, road erosion inventories and modelling, and creating daily Project Activity Levels using the National Fire Danger Rating System.

As Program Director, Dr. James:

- Ensures that SPI's research and monitoring is implemented in a manner consistent with project QA documentation (including this QAPP)
- Ensures that SPI's research and monitoring is implemented in a manner consistent with utilized methods and standard operating procedures (SOPs)
- Ensures that SPI's research and monitoring is implemented in a manner consistent with the *Sustainable Forestry Initiative*
- Reviews and approves project QA documentation (including this QAPP)
- Maintains contact with the Bioassessment Coordinator
- Is responsible for the accuracy, completeness, and scientific defensibility of all data and publications produced
- Participates in applicable corrective actions
- Is responsible for obtaining all services and deliverables for the project
- Approves data for use

As QA Manager, Dr. James:

- Creates and maintains this QAPP and any relevant SOPs
- Reviews and approves project QA documentation (including this QAPP)
- Implements project QA documentation (including this QAPP)
- Is responsible for the accuracy, completeness, and scientific defensibility of all data produced under this project
- Maintains contact with the QA Oversight Manager
- Approves data for use

<u>Will Hagan – Marine Pollution Studies Laboratory</u>

Quality Assurance Oversight Manager

Will Hagan of MLML-MPSL provides objective, third-party QA oversight of SPI's Research and Monitoring Program. Since joining MLML-MPSL in 2005, Will has partnered with the National Oceanic and Atmospheric Administration (NOAA), SWRCB, several RWQCBs, the CALFED Bay-Delta Program, the Delta Regional Monitoring Program, and numerous other public, private, and non-profit

organizations. The scope of this work has included ambient monitoring, spill response, instream flow, habitat studies, and bioassessment. As QA Oversight Manager, Mr. Hagan:

- Creates, reviews, and approves project QA documentation (including this QAPP)
- Audits the SPI Research and Monitoring Program as requested by the Program Director
- Provides QA training as needed
- Assists the program director in developing QA systems and measurement quality objectives (MQOs) that meet SPI objectives
- Initiates and/or participates in applicable corrective actions

FIELD SAMPLING AND ANALYSIS

Marco Sigala - Marine Pollution Studies Laboratory

Bioassessment Coordinator

Since 2000, Mr. Sigala has participated in many state, regional, and federal (e.g., Environmental Protection Agency (EPA), NOAA) projects, performing and managing all duties such as sample collection, logistical support, coordination of field teams and laboratories, data management, and reporting. As Bioassessment Coordinator, Mr. Sigala:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director
- Oversees field sampling and PHAB analysis
- Oversees data reporting, including field data entry and laboratory reporting as well as overall data completeness and quality control checks
- Ensures laboratory adherence to all QC standards outlined in this QAPP
- Verifies laboratory compliance with SOPs and methods
- Follows a “no surprises” policy using real-time QC communication
- Prepares and reviews elements for this QAPP as needed
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Maintains contact with the Program Director, QA Oversight Manager, Laboratory Liaisons, and taxonomists

- Communicates with the Program Director and/or the QA Oversight Manager when QA requirements are not met or when systemic QA issues are identified

BENTHIC MACROINVERTEBRATE TAXONOMY

Daniel Pickard - California Department of Fish and Wildlife Aquatic Bioassessment Laboratory

Benthic Macroinvertebrate Taxonomist

Daniel Pickard has over 25 years of experience identifying aquatic invertebrates from all areas of the United States using standard taxonomic principles, dichotomous keys, extensive literature review, and colleague interaction. Mr. Pickard's background also includes research, teaching, BMI-related software applications, and curation of BMI museum specimens. As the BMI Project Lead , Mr. Pickard:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director and Bioassessment Coordinator
- Maintains contact with the Bioassessment Coordinator and BMI QC Taxonomist
- Oversees data reporting, including field data entry and laboratory reporting as well as overall data completeness and quality control checks
- Adheres to applicable SOPs and methods
- Follows a "no surprises" policy using real-time QC communication
- Prepares and reviews elements for this QAPP as needed
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Communicates with the Program Director, QA Oversight Manager and/or Bioassessment Coordinator when QA requirements are not met or when systemic QA issues are identified

Jon Lee – Jon Lee Consulting

Benthic Macroinvertebrate Quality Control Taxonomist

As the BMI QC Taxonomist, Mr. Lee:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director and Bioassessment Coordinator

- Adheres to the Surface Water Ambient Monitoring Program (SWAMP) document *Standard Operating Procedures for the External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015).
- Maintains contact with the Bioassessment Coordinator and BMI Taxonomist
- Follows a "no surprises" policy using real-time QC communication
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Communicates with the Program Director, QA Oversight Manager, Bioassessment Coordinator, and/or BMI Taxonomist when QA requirements are not met or when systemic QA issues are identified

DIATOM TAXONOMY

Kalina Manoylov, Ph.D.

Diatom Taxonomist

As Diatom Taxonomist, Dr. Manoylov:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director and Bioassessment Coordinator
- Maintains contact with the Bioassessment Coordinator and Diatom QC Taxonomist
- Ensures adherence to all QC standards as outlined in this QAPP
- Adheres to applicable SOPs and methods
- Follows a "no surprises" policy using real-time QC communication
- Prepares and reviews elements for this QAPP as needed
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Communicates with the Program Director, QA Oversight Manager, and/or Bioassessment Coordinator when QA requirements are not met or when systemic QA issues are identified

Rosalina Stancheva, Ph.D.

Diatom Quality Control Taxonomist

As Diatom Quality Control Taxonomist, Dr. Stancheva:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director and Bioassessment Coordinator
- Adheres to the SWAMP document *Standard Operating Procedures for Internal and External Quality Control of Laboratory Processing, Identification, and Enumeration of Stream Algae in California* (November 2019).
- Maintains contact with the Bioassessment Coordinator and Diatom Taxonomist
- Ensures adherence to all QC standards as outlined in this QAPP
- Follows a "no surprises" policy using real-time QC communication
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Communicates with the Program Director, QA Oversight Manager, and/or Bioassessment Coordinator when QA requirements are not met or when systemic QA issues are identified

LABORATORY ANALYSIS

Roxanne Moore - North Coast Laboratories, Ltd.

Laboratory Liaison

Roxanne Moore has been employed at NCL since 1987. Roxanne has worked as a bench chemist, gas chromatograph and high-performance liquid chromatography analyst, organic laboratory supervisor, laboratory manager, and director of operations.

As the NCL Laboratory Liaison, Ms. Moore:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director and Bioassessment Coordinator
- Verifies laboratory compliance with SOPs and methods
- Follows a "no surprises" policy using real-time QC communication
- Prepares and reviews elements for this QAPP as needed
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Communicates with the Program Director and/or QA Oversight Manager when QA

requirements are not met or when systemic QA issues are identified

Autumn Bonnema – California Department of Fish and Wildlife Marine Pollution Studies Laboratory

Laboratory Liaison

As the CDFW-MPSL Laboratory Liaison, Ms. Bonnema:

- Ensures that the overall project is completed according to the proposed plan in consultation with the Program Director and Bioassessment Coordinator
- Ensures that laboratory work is conducted, and that data are reported accordingly
- Verifies laboratory compliance with SOPs and methods
- Follows a "no surprises" policy using real-time QC communication
- Prepares and reviews elements for this QAPP as needed
- Acknowledges necessary lead and turnaround times
- Participates in applicable corrective actions
- Communicates with the Program Director and/or QA Oversight Manager when QA requirements are not met or when systemic QA issues are identified

SCIENTIFIC ADVISORS

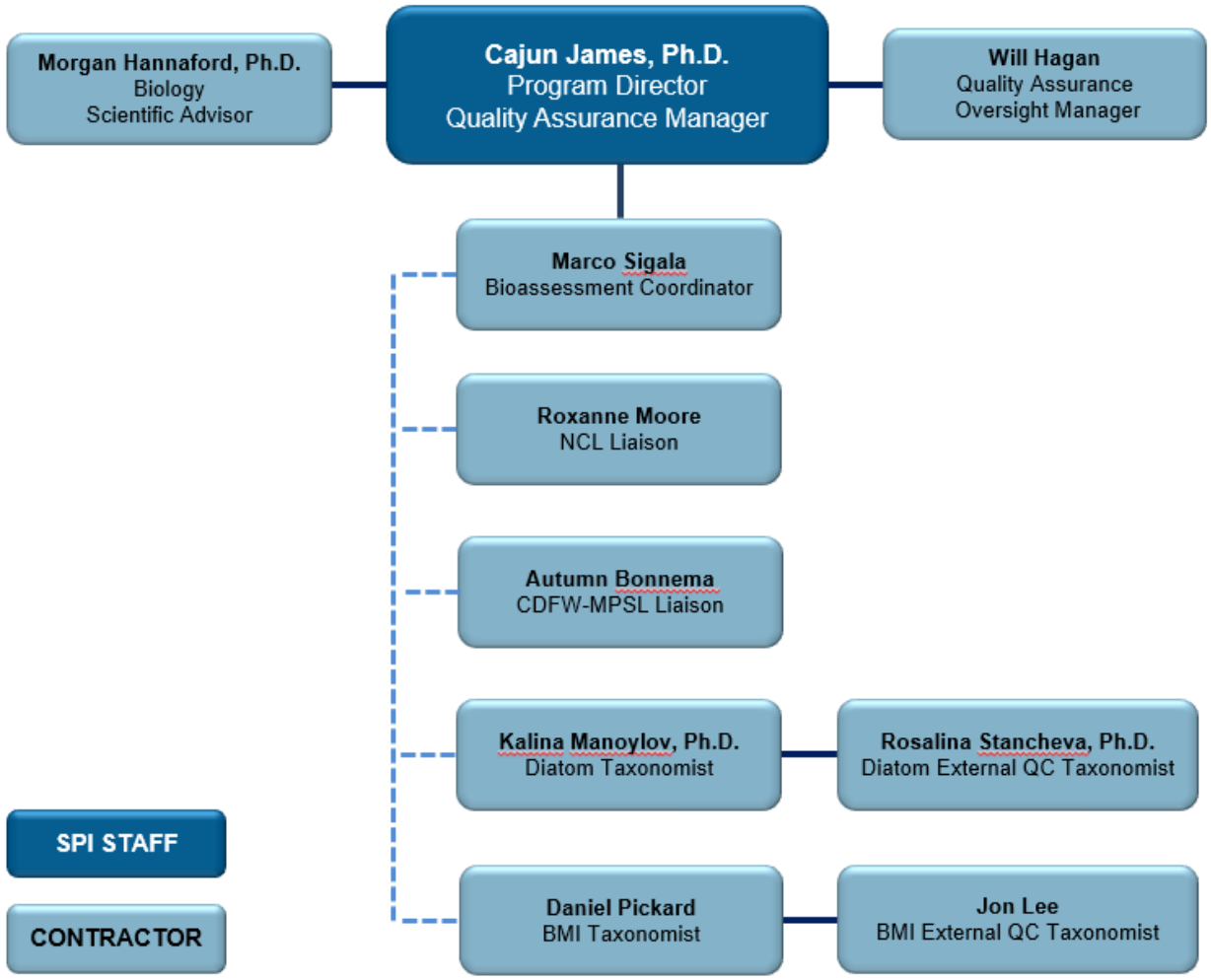
Morgan Hannaford, Ph.D. - Shasta College

Dr. Hannaford is a recognized expert in the use of biological indicators for evaluating water and habitat quality in streams. He is a Department Chair at Shasta College and a specialist in BMI biology, identification, sampling techniques, study design, and data analysis. Dr. Hannaford also conducts research on microhabitat streamflow, hyporheic exchange, and their combined influence on stream water temperature patterns. He is knowledgeable with current techniques for evaluating macroinvertebrate data, including rapid bioassessment metric analysis and multivariate statistical models of benthic community structure. With over 25 years of experience in academic research, industry and agency consulting, and college teaching, he is skilled at communicating results in written reports and presentations to a wide range of interested citizens, agency groups, and scientists.

ORGANIZATIONAL STRUCTURE

The project personnel specified above operate in an oversight role and are completely independent of data production. This relationship is shown in Figure 1.

Figure 1: Organizational Chart



A5: PROBLEM DEFINITION/BACKGROUND

BACKGROUND

SPI is committed to using scientifically defensible data of known and documented quality to inform the management of its forestlands. In 2000, SPI established its Research and Monitoring Program to study and reduce potential impacts of timber harvest operations on:

- Water quality
- Near-stream microclimate
- Stream temperature
- Sediment production
- Surface erosion
- Aquatic insects
- Fire weather
- Riparian vegetation
- Road erosion and delivery to stream networks

While the California Forest Practice Rules (CFPRs) provide for the protection of environmental resources in forested areas, their scientific basis is unknown. SPI's Research and Monitoring Program seeks to create a transparent, accountable, and defensible dataset that fosters both scientific understanding (e.g., monitoring, publications) and practical usage (e.g., weather forecasting, hillslope erosion control methods, best management practices to reduce sediment discharge to watercourses, and road management). The broad timeframe and scope now represented by programmatic data allows SPI to optimize its actions with regard to water quality, and to justify those actions to regulators and stakeholders.

The growing dataset will also aid SPI in its creation of meaningful timber harvest plans.
Currently, timber harvest plans are submitted by registered professional foresters and are reviewed by an interdisciplinary review team consisting of:

- CAL FIRE
- CDFW
- SWRCB
- RWQCBs
- CGS

CAL FIRE is the lead agency that approves timber harvest plans in California. Members of the public are allowed to participate in timber harvest plan review process, which is functionally equivalent to the California Environmental Quality Act.

PROBLEM STATEMENT

Very little quantitative information is available on the impacts of California's forest management operations on the three most dominant biological groups that typically form stream communities (i.e., fish, aquatic invertebrates, and attached algae/diatoms). To protect aquatic resources, current CFPRs limit or prohibit operations within watercourses and riparian zones. These regulations are founded on the potential of forest operations to change the condition and water quality of these habitats. Additionally, a lack of relevant data has led to unsubstantiated proposals put forth in public forums that would result in significant regulatory increases and possible takes of private forest land.

DECISIONS AND OUTCOMES

Resident biota indicate both the current and recent condition of a stream's habitat, water-quality, and hydrology. In general:

- Diatoms and algae reflect the conditions of the previous days to weeks
- Invertebrates reflect conditions during their lifespans of several months to a year
- Fish reflect previous conditions for as much as several years

Beginning in 2000, SPI began supporting research on the response of BMI to near-stream harvest operations. BMI were selected because fish are not sufficiently abundant within SPI's streams, and electrofishing regulatory requirements were becoming too cumbersome.

Initially, Dr. Morgan Hannaford performed rapid biological assessments for various riparian buffer

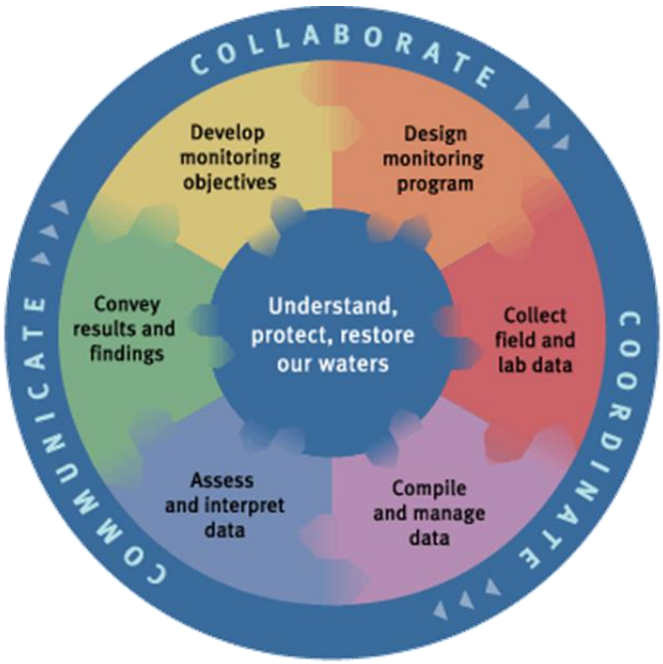
widths, comparing the presence of BMI before and after harvesting. He listed taxa and numbers of invertebrates collected at the study sites. In 2014, SPI expanded BMI sampling by contracting with the Chico Foundation to have SWAMP sampling performed in 5-20 locations each year. SWAMP sampling is performed on SPI forestlands by field crews approved in the SWAMP bioassessment protocols, and the data are available in CEDEN. SWAMP data collection includes BMI and diatom taxonomy, laboratory analyses, and PHAB analysis to characterize water quality. SWAMP sampling has been performed near all of SPI's continuous water quality stations to compare the long-term continuous water quality results from the stations with SWAMP sampling.

Results from this research are critical to gain a better understanding of what the stream biota indicates about both the current and recent conditions of the habitat, water-quality, and hydrologic factors within SPI's forestlands. Additionally, SWAMP sampling has been performed in six fire areas to understand how perennial running streams recover from wildfires. Sample points in the Ponderosa Fire (2012), Rim Fire (2013), King Fire (2014), Carr Fire (2018), Delta/Hirz Fire (2018), and Camp Fire (2018) have been collected for at least three years post-fire to better understand how biological stream communities recover over time.

NATIONAL WATER QUALITY MONITORING COUNCIL

The SPI Research and Monitoring Program has developed its bioassessment studies to be consistent with the tennants put forth by the National Water Quality Monitoring Council (NWQMC) "Monitoring Framework" (Figure 2).

Figure 2: National Water Quality Monitoring Council Monitoring Framework



The center of the NWQMC framework states that the goal of water quality monitoring is to "understand, protect, and restore our waters". SPI strives to meet these goals through various components of its work by using best management practices and scientific research to inform timber harvest plans and land management. The NWQMC framework is meant to be used in an iterative process and therefore new results and findings may inform evolving monitoring objectives from year to year. SPI uses the NWQMC's guidance to ensure that "all components are included, balanced, connected, and collectively focused on producing quality information". Table 3 itemizes SPI's efforts in utilizing the framework as the overarching guidance to successful design, implementation, and outreach of its bioassessment studies.

Table 3: Adherence to the National Water Quality Monitoring Council Framework

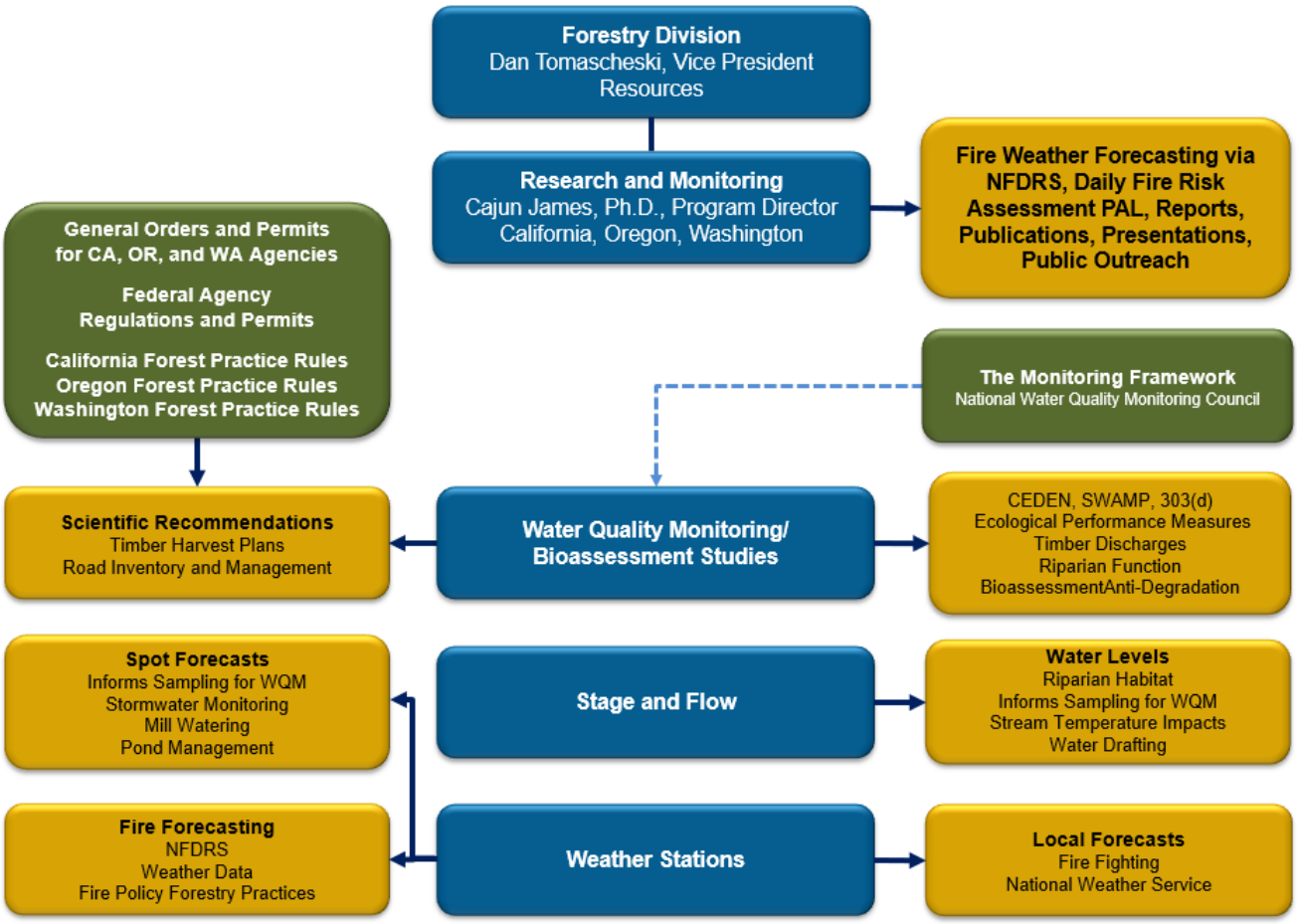
NWQMC Guideline	SPI Research and Monitoring Project
Develop monitoring objectives	• Evaluate water quality over time and space to investigate the potential effects of forestry operations and wildfire on surrounding streams and watersheds
Design monitoring program	• SWAMP-comparable laboratory, taxonomic, and physical habitat analyses • Sampling/analysis sites with historical SPI data • EPA 24-element QA project plan

NWQMC Guideline	SPI Research and Monitoring Project
Collect field and laboratory data	• Laboratory data • BMI taxonomy • Diatom taxonomy • Physical habitat analysis
Compile and manage data	• Research data resides on secure SPI cloud-based storage • Capture of essential metadata • Use of SWAMP and CEDEN conventions
Assess and interpret data	• In-house, Ph.D. research scientist interprets data • Consultants in geology, hydrology, meterology, statistical anlysis, custom sofware design, and statistical modelling • Third-party QA consulting/oversight
Convey results and findings	• CEDEN • SWRCB Integrated Report solicitation • Peer-reviewed publications and journal articles • SPI Research and Monitoring website postings • Conference presentations • Sustainable Forestry Initiative
Collaborate	• SWAMP • CDFW • MPSL
Coordinate	• SWRCB • Redding RWQCB
Communicate	• CEDEN • SWRCB Integrated Report solicitation • Peer-reviewed publications • SPI website • Conference presentations • Presentations at California universities and colleges • QAPP distribution

PRODUCTS AND TOOLS

Product and tool development is a core component and necessary outcome from SPI's water quality monitoring program. The Program Director reviews the program's product and tool inventory on an annual basis. Through discussions with program staff and SPI managers, the Program Director determines the focus of product and tool development for the coming year. The program's products and tools are used internally by SPI, and externally by government agencies, the scientific community, the timber industry, and the public. Figure 3 depicts how SPI's bioassessment studies contribute to the Research and Monitoring Program's products and tools.

Figure 3: Highlighted Products and Tools



A6: PROJECT/TASK DESCRIPTION

This element details the logistics associated with SPI's bioassessment studies. Element B1: *Sampling Process Design* details the experimental design behind these logistics.

WORK SUMMARY

The Research and Monitoring Program at SPI performs ongoing bioassessment studies. This results in the collection of biotic and abiotic samples from watercourses to determine the effects of timber harvesting operations and wildfire on watercourse zones and riparian buffers.

CONSTITUENTS TO BE MONITORED

SPI's ongoing bioassessment studies are performed by:

- CDFW-ABL
- Dr. Rosalina Hristova
- Dr. Kalina Manoylov
- JLC
- CDFW-MPSL
- MLML-MPSL
- NCL

Their scope includes taxonomic, laboratory, and PHAB analyses. Details are presented in Tables 4-10.

Table 4: Benthic Chlorophyll

Analyte	Sample Count	Sampling Frequency	Collection Organization	Analyst
Benthic chlorophyll	4-8	Once annually	MLML-MPSL	CDFW-MPSL

Table 5: Benthic Macroinvertebrate Taxonomy

Analyte	Sample	Sampling	Collection	Taxonomist

	Count	Frequency	Organization	
BMI	16-20	Once annually	MLML-MPSL	ABL
BMI (external QC)	2	Once annually	MLML-MPSL	JLC

Table 6: Conventional Analytes in Water

Analyte	Sample Count	Sampling Frequency	Collection Organization	Analyst
Chloride	16-19	Once annually	MLML-MPSL	NCL
Organic carbon (dissolved)	16-19	Once annually	MLML-MPSL	NCL
Hardness (as CaCO3)	16-19	Once annually	MLML-MPSL	NCL
Sulfate	16-19	Once annually	MLML-MPSL	NCL

Table 7: Diatom Taxonomy

Analyte	Sample Count	Sampling Frequency	Collection Organization	Taxonomist
Diatoms	4-8	Once annually	MLML-MPSL	Dr. Kalina Manoylov
Diatoms (external QC)	1	Once annually	MLML-MPSL	Dr. Rosalina Hristova

Table 8: Nutrients in Water

Analyte	Sample Count	Sampling Frequency	Collection Organization	Analyst
Ammonia (as N)	16-19	Once annually	MLML-MPSL	NCL
Kjeldahl nitrogen (total)	16-19	Once annually	MLML-MPSL	NCL
Nitrate + nitrite (calculated)	16-19	Once annually	MLML-MPSL	NCL
Phosphorus (total, as P)	16-19	Once annually	MLML-MPSL	NCL

Table 9: Physical Habitat Analysis

Analyte	Sample Count	Analytical Frequency	Collection Organization	Analyst
Physical Habitat	n/a	Once annually	n/a	MLML-MPSL

Table 10: Solid Parameters in Water

Analyte	Sample Count	Sampling Frequency	Collection Organization	Analyst
Ash-free dry mass	4-8	Once annually	MLML-MPSL	CDFW-MPSL
Suspended sediment concentration	16-19	Once annually	MLML-MPSL	CDFW-MPSL
Suspended solids (total)	16-19	Once annually	MLML-MPSL	CDFW-MPSL

SCHEDULE

Table 11 identifies key events related to data production and supporting activities.

Table 11: Schedule of Key Project Events

Task	Frequency	Product	Responsible Party
Internal QC Audit (field/laboratory)	Quarterly	Audit checklist	QA Manager; Research Forester Lead
QAPP revision	Annually July-August	Current QAPP	QA Oversight Manager; Program Director
SOP review	Annually	Current SOPs	QA Oversight Manager; Program Director
PHAB analysis	Annually August - October	PHAB metrics; Sample results in CEDEN	Bioassessment Coordinator; Data Manager
BMI sampling	Annually August - October	California Stream Condition Index scores and BMI metrics; Sample results in CEDEN	Bioassessment Coordinator; BMI Taxonomist; Data Manager
Laboratory analysis grab sampling	Annually August - October	Sample results in CEDEN	Bioassessment Coordinator; Laboratory Liaisons; Data Manager
Diatom sampling	Annually August - October	Diatom ASCI scores and metrics; Sample results in CEDEN	Bioassessment Coordinator; Diatom Taxonomist; Data Manager

GEOGRAPHICAL SETTING

To date, SPI's bioassessment studies have been carried out at the sampling locations identified in Table 12. Based on the considerations detailed in B1: *Sampling Processing Design*, a subset of these sites (and new sites, if appropriate) will be selected for each sampling year.

Table 12: Sampling Locations

Site	Station Code	Target Latitude	Target Longitude	Datum
[redacted]				

Site	Station Code	Target Latitude	Target Longitude	Datum

Site	Station Code	Target Latitude	Target Longitude	Datum

CONSTRAINTS

EPA defines "completeness" as *the amount of valid data obtained compared to the planned amount - usually expressed as a percentage*. While matrix interference, container breakage, and/or sample transport delay may impact the number of valid sample results, SPI maintains a completeness goal of 90%.

A7: QUALITY OBJECTIVES AND CRITERIA

A project's strategic planning process must consider each of the data quality indicators (DQIs). EPA defines DQIs as *the quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user*. The principal DQIs are:

- Precision
- Accuracy
- Bias
- Comparability
- Completeness
- Representativeness
- Sensitivity

EPA definitions associated with each DQI are provided in Table 13.

Table 13: Data Quality Indicator Definitions

Indicator	Definition
Precision	The measure of agreement among repeated measurements of the same property under identical or substantially similar conditions; calculated as either the range or as the standard deviation.
Accuracy	A measure of the overall agreement of a measurement to a known value; includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations.
Bias	The systematic or persistent distortion of a measurement process that causes errors in one direction.
Representativeness	A qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.
Comparability	A qualitative term that expresses the measure of confidence that one dataset can be compared to another and can be combined for the decision(s) to be made.
Completeness	A measure of the amount of valid data needed to be obtained from a measurement system.
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.

For SPI's bioassessment studies, these DQIs are assessed by category-specific objectives applied to:

- BMI taxonomy
- Diatom taxonomy
- Laboratory analysis

- PHAB analysis

Benthic Macroinvertebrate Taxonomy

SPI's BMI analyses are performed by ABL, and as feasible, are subject to the SWAMP-comparability guidelines of SWAMP's *Bioassessment Program Quality Assurance Project Plan* (September 2019). To promote data comparability with SWAMP, SPI requires use of the BMI-related SWAMP procedures specified in B2: *Sampling Methods* and B4: *Analytical Methods*.

External QC for BMI taxonomy is performed by Mr. Jon Lee (Jon Lee Consulting) according to the SWAMP document *Standard Operating Procedures for the External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015).

Diatom Taxonomy

SPI's diatom taxonomy is performed by Dr. Kalina Manoylov, and as feasible, is subject to the SWAMP-comparability guidelines of SWAMP's *Bioassessment Program Quality Assurance Project Plan* (September 2019). To promote data comparability with SWAMP, SPI requires use of the diatom-related SWAMP procedures specified in B2: *Sampling Methods* and B4: *Analytical Methods*.

External QC for diatom taxonomy is performed by Dr. Rosalina Stancheva according to the SWAMP document *Standard Operating Procedures for Internal and External Quality Control of Laboratory Processing, Identification, and Enumeration of Stream Algae in California* (November 2019).

Laboratory Analysis

Project laboratory analyses include a variety of field and laboratory QC samples (defined in B5: *Quality Control*). Required QC samples, along with associated frequencies and MQOs, appear in Tables 14-17.

Table 14: Quality Control - Chloride, Hardness (as CaCO3), Organic Carbon (Dissolved), and Sulfate in Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	80-120% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery; RPD<25% for duplicates
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)

Table 15: Quality Control - Ammonia (as N), Kjeldahl Nitrogen (Total), Nitrate + Nitrite (Calculated), and Phosphorus (Total, as P) in Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Per 10 analytical runs	90-110% recovery
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Reference Material	Per 20 samples or per analytical batch, whichever is more frequent	90-110% recovery
Matrix Spike	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery
Matrix Spike Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	80-120% recovery RPD<25% for duplicates
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Blank, Travel Blank, Equipment Blank	Per method	<RL for target analyte
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)

Table 16: Quality Control - Ash-Free Dry Mass, Suspended Sediment Concentration, Suspended Solids (Total) in Water

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Laboratory Blank	Per 20 samples or per analytical batch, whichever is more frequent	<RL for target analyte
Laboratory Duplicate[1]	Per 20 samples or per analytical batch, whichever is more frequent	RPD<25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Blank,	Per method	<RL for target analyte

Equipment Blank		
Field Duplicate	5% of total project sample count	RPD<25% (n/a if native concentration of either sample<RL)

[1] Applicable only to total suspended solids

Table 17: Quality Control - Benthic Chlorophyll

Laboratory Quality Control	Frequency of Analysis	Measurement Quality Objective
Calibration Standard	Per analytical method or manufacturer's specifications	Per analytical method or manufacturer's specifications
Calibration Verification	Prior to analysis, after every 10 samples, and at the end of the analytical day	80-120% recovery
Laboratory Blank	3 per 20 samples or per analytical batch, whichever is more frequent	<MDL for target analyte
Laboratory Control Sample	Per 20 samples or per analytical batch, whichever is more frequent	75-125% recovery
Laboratory Duplicate	Per 20 samples or per analytical batch, whichever is more frequent	RPD≤25% (n/a if native concentration of either sample<RL)
Field Quality Control	**Frequency of Analysis**	**Measurement Quality Objective**
Field Duplicate	Per 20 samples	RPD≤25% (n/a if native concentration of either sample<RL)

Regardless of analyte/parameter, QC sample failures should prompt the corrective actions specified in Table 18.

Table 18: Recommended Corrective Action for Laboratory Analyses

Laboratory Quality Control Failure	Recommended Corrective Action
Calibration Standard	Recalibrate the instrument. Affected samples and associated quality control must be reanalyzed following successful instrument recalibration.
Calibration Verification	Reanalyze the calibration verification to confirm the result. If the problem continues, halt analysis and investigate the source of the instrument drift. The analyst should determine if the instrument must be recalibrated before the analysis can continue. All of the samples not bracketed by acceptable calibration verification must be reanalyzed.
Laboratory Blank	Reanalyze the blank to confirm the result. Investigate the source of contamination. If the source of the contamination is isolated to the sample preparation, the entire batch of samples, along with the new laboratory blanks and associated QC samples, should be prepared and/or re-extracted and analyzed. If the source of contamination is isolated to the analysis procedures, reanalyze the entire batch of samples. If reanalysis is not possible, the associated sample results must be flagged to indicate the potential presence of contamination.
Laboratory Control Standard	Reanalyze the laboratory control standard to confirm the result. Compare this to reference material and/or matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.

Laboratory Quality Control Failure	Recommended Corrective Action
Laboratory Duplicate	Reanalyze the duplicate samples to confirm the results. Visually inspect the samples to determine if a high RPD between the results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity.
Reference Material	Reanalyze the reference material to confirm the result. Compare this to the matrix spike/matrix spike duplicate recovery data. If adverse trends are noted, reprocess all of the samples associated with the batch.
Matrix Spike	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike to confirm the result. Review the recovery obtained for the matrix spike duplicate. Review the results of the other QC samples (e.g., laboratory control samples, reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Matrix Spike Duplicate	The spiking level should be near the midrange of the calibration curve or at a level that does not require sample dilution. Reanalyze the matrix spike duplicate to confirm the result. Review the recovery obtained for the matrix spike. Review the results of the other QC samples (e.g., laboratory control samples, reference materials) to determine if other analytical problems are a potential source of the poor spike recovery.
Field Quality Control Failure	**Recommended Corrective Action**
Field Blank, Travel Blank, Equipment Blank	Investigate the source of contamination. Potential sources of contamination include sampling equipment, protocols, and handling. The laboratory should report evidence of field contamination as soon as possible so corrective actions can be implemented. Samples collected in the presence of field contamination should be flagged.
Field Duplicate	Visually inspect the samples to determine if a high RPD between results could be attributed to sample heterogeneity. For duplicate results due to matrix heterogeneity, or where ambient concentrations are below the reporting limit, qualify the results and document the heterogeneity. All failures should be communicated to the project coordinator, who in turn will follow the process detailed in the method.

Physical Habitat Analysis

As feasible, SPI's PHAB analyses are subject to the SWAMP comparability guidelines of SWAMP's *Bioassessment Program Quality Assurance Project Plan* (September 2019), as well as the performance requirements specified in the SWAMP document *Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016).

A8: SPECIAL TRAINING NEEDS/CERTIFICATION

This element identifies recommended and required qualifications associated with the following project personnel:

- BMI taxonomy staff
- Bioassessment Coordinator
- Diatom taxonomy staff
- Laboratory staff

BENTHIC MACROINVERTEBRATE TAXONOMY STAFF

Taxonomists responsible for BMI specimen identifications are subject to the following recommendations and requirements.

Requirements

- Have a minimum of two consecutive years of experience identifying BMIs
- Hold a bachelor's or master's degree in entomology, ecology, evolution, or a related field
- Complete coursework related to entomology, insect morphology, insect taxonomy, aquatic ecology, limnology, or insect ecology
- Complete a graduate thesis or undergraduate research in taxonomy, phylogenetics, or ecology of benthic aquatic organisms
- Be an active member of the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT)
- Be able to identify BMIs to all levels of SAFIT-recommended taxonomy (i.e., Level 1, Level 2, Level 2a)
- Regularly attend taxonomy training workshops offered by SAFIT
- Participate in at least one BMI taxonomic workshop per year
- Know how to access and use BMI taxonomic literature (contact SAFIT for assistance with identifying relevant taxonomic literature, if necessary)

- Be proficient at using dichotomous keys to identify BMIs
- Have experience in the use of light microscopy and standard specimen preparation techniques, including slide preparation, clearing, and dissection

BIOASSESSMENT COORDINATOR

The Bioassessment Coordinator performing field sample collection and/or related PHAB analyses must adhere to the requirements below and is encouraged to consider the recommendations that follow.

Requirements

Please note that the Bioassessment Coordinator is required to be present on all field days. If they are unable to attend a field day, an alternate staff member may be designated if they meet these requirements:

- Have a *minimum of three consecutive years of experience* in this work
- Participate in intercomparison exercises provided by CDFW
- Train on and be aware of all SWAMP SOPs, QC, and reporting requirements

Recommendations

- Complete training through the CDFW College of Bioassessment
- Participate in courses hosted by the SWRCB Training Academy
- Participate in regular (e.g., yearly) field audits of sampling crews, with additional training and follow-up auditing as necessary
- Participate in annual intercalibration events involving multiple crews with experience in different regions of California

DIATOM TAXONOMY STAFF

Taxonomists responsible for diatom specimen identifications are subject to the following recommendations and requirements.

Requirements

- Have a minimum of two years of experience identifying freshwater algae (i.e., diatoms and/or

cyanobacteria, green algae, xanthophytes, chrysophytes, and red algae), preferably from stream benthos

- Hold a bachelor's or master's degree in botany, ecology, biology, or a related field
- Possess strong academic preparation in diatom taxonomy demonstrated by one or more of the following:
    - Coursework related to plant taxonomy, aquatic ecology, or limnology
    - Graduate thesis or undergraduate research projects in algal taxonomy or ecology of benthic freshwater algae
    - University-level phycology class, or soft-bodied algae and/or diatom taxonomy class
- Be able to identify diatoms to the SOP-recommended taxonomy levels
- Regularly attend taxonomy training and QC reconciliation workshops offered by SWAMP
- Know how to access and use SOP-recommended diatom taxonomic literature
- Be proficient at using dichotomous keys to identify diatoms
- Have experience in the use of light microscopy and digital microphotography for taking high-quality diatom light photomicrographs
- Have experience with standard specimen preparation techniques, including slide preparation
- Have good record-keeping and computer skills

Recommendations

- Have a knowledge and experience identifying benthic diatoms and/or soft-bodied algae from streams and rivers in California
- Have experience in culturing diatoms or other microorganisms
- Have experience in molecular sequencing techniques
- Have experience in diatom specimen preparation techniques for electron microscopy

LABORATORY STAFF

NCL staff are expected to comply with the laboratory's *Quality Manual* (2022 v.2) and all applicable methods and SOPs. NCL holds certificate #1247 with California's Environmental Laboratory Accreditation Program (ELAP). The certificate includes all available analytes and parameters analyzed on behalf of SPI and requires biennial renewal. As part of its accreditation, NCL participates in routine proficiency tests through multiple vendors, and is subject to ELAP audits.

CDFW-MPSL staff are expected to comply with the *Quality Manual* (June 2023) and all applicable methods and SOPs.

A9: DOCUMENTATION AND RECORDS

CRITICAL RECORDS

SPI will collect and compile project laboratory and field records. A portion of project data produced will be uploaded to CEDEN and accompanied by a reference to this QAPP. The critical records required for this project include the following:

- This QAPP
- Field and laboratory records
- Internal databases and CEDEN
- Technical reports
- Corrective action files
- Audit reports

PLANNING DOCUMENT DISTRIBUTION

Copies of this QAPP will be sent via electronic mail by the Program Director to all parties identified in Element A3: *Distribution List*. Revised or amended QAPPs will be distributed in the same fashion. Master copies of each QAPP will be held at the SPI Redding offices under the direction and supervision of the Program Director.

DOCUMENT CONTROL REQUIREMENTS

The Program Director will ensure that this QAPP is subject to strict document control standards. Revised or amended versions will be noted through the version number system. Specifically, the number preceding the decimal point denotes each revision of the document while the number following the decimal point denotes amendments. All project participants must ensure use of the most recent copy of this QAPP and all relevant methods and/or SOPs.

REPORTING REQUIREMENTS

Project participants (including SPI staff, contractors, and their subcontractors) producing data for

this project will follow all reporting requirements outlined in the procedures specified in Element B2: *Sampling Methods* and Element B4: *Analytical Methods*. Reporting requirements noted in pertinent laboratory QA manuals or other QA documents will also be followed. Collected data will adhere to all applicable SWAMP reporting requirements, including the capture of all required metadata.

Analytical results produced by contractors (and their subcontractors) will be organized in a data report package. In addition to the reported data, the data report package will include sufficient QC information to determine that the method was within control limits at the time that the samples were analyzed. A typical report package includes:

- A copy of the chain of custody (COC)
- Specific sample identifiers, including but not limited to laboratory sample ID, coded field sample ID, matrix, and dilution factors
- Holding time verification
- QA/QC results
- All relevant metadata
- For laboratory analyses: final analyte concentration including reporting limit, laboratory qualifiers, and reanalysis
- For taxonomic analyses: final identification, laboratory qualifiers, and re-identification

RECORD MAINTENANCE

All records generated by SPI staff will be maintained by the Program Director in an electronic or hardcopy format and will be archived for a minimum of five years from the date of record. Records generated by contractors and their subcontractors are to be maintained by the contractor and archived for a minimum of five years from the date of record. It is acceptable to scan documents and keep electronic copies if the contractor has a backup system for its electronic files. In addition, any relevant requirements regarding record maintenance outlined in laboratory QA manuals shall be followed unless those requirements stipulate records retention beyond five years.

Group B:
Data Generation and Acquisition

B1: SAMPLING PROCESS DESIGN

This element describes the experimental design behind SPI's bioassessment studies. Element A6: *Project/Task Description* details the resulting logistics (i.e., constituents to be monitored, measurements, schedule, geographic setting, and constraints).

Original bioassessment sampling locations were selected in 2016 by James Harrington, then of the California Department of Fish and Wildlife and a scientific advisor to SWRCB's SWAMP. Based on field visitation and timber harvest plan review, he recommended bioassessment sampling in locations for which baseline water quality data were available (e.g., near SPI water quality stations).

Additional sampling sites continue to be added - usually within fire boundaries and/or timber harvest plans. Each year, the Program Director re-evaluates these sites with input from the Bioassessment Coordinator, BMI taxonomist, diatom taxonomist, and/or SPI forest managers. Consequently, new sites are added on an as-needed basis.

These sites may be subject to repeat analyses in order to:

- Confirm improving or deteriorating biological index scores or laboratory results
- Investigate anomalous biological index scores or laboratory results
- Examine the effects of recent, local fire
- Examine the effects of recent, local timber harvest

Past sampling sites may be discontinued if:

- Past biological index scores or laboratory results are unremarkable
- There has been no recent, local fire activity
- There has been no recent, local timber harvest activity
- Sites are dry
- Sites are inaccessible and/or unsafe

Based on real-time field communication with the Bioassessment Coordinator, the Program Director may finalize site selection once sampling is already in progress.

B2: SAMPLING METHODS

Sampling methods associated with SPI's bioassessment studies are described below. Sample processing is further addressed in Element B3: *Sample Handling and Custody.*

SPI's ongoing bioassessment studies include sampling for BMI taxonomy, diatom taxonomy, and laboratory analysis. Sampling will follow the SWAMP document *Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016), recognized by EPA as California's standard in the assessment of wadeable streams and rivers. Sampling will be conducted by staff from MLML-MPSL. Category-specific sampling techniques are summarized below.

Benthic Macroinvertebrate Sampling

BMI samples are collected along the sampling reach at each of the 11 main transects and then composited into one sample. A D-frame kick net is used to capture BMIs that flow into the net with the water current as the sampler disturbs 1 ft^2 upstream of the net. The sample is fixed in ethanol and then sent to the taxonomy laboratory for identification.

Diatom Sampling

Diatom samples are collected along the same main transect locations where BMI samples are collected but offset upstream by 0.5 m to avoid disturbed substrate. One of three types of collection devices (i.e., rubber delimiter, PVC delimiter, or syringe scrubber) will be used at each transect to collect diatoms and then composite them in one jar. The composite jar will be processed to produce one diatom sample for taxonomic identification.

The composite jar collected for benthic diatom taxonomy will also be used to create benthic chlorophyll and ash-free dry mass filters for analysis. These data will provide an indicator of the amount of benthic biomass available in the stream reach.

Laboratory Analysis Sampling

Water samples will be collected prior to (preferred) or after PHAB analysis and taxonomy collections

depending on the time of day and applicable holding time restrictions. The sampler will stand in an undisturbed portion of the stream facing upstream. The sampler will dunk the capped bottle ~0.1 m under the water surface, uncap the bottle, fill it with a small amount of water, cap it, and then bring it out of the water. The first two times this process occurs for a bottle, it will be shaken and then the contents discarded. This serves to rinse the inside of the sample bottle. The bottle will be filled the third time it is dunked. If a sample bottle has preservative in it, it will not be rinsed in this manner but rather filled directly from a bottle that has been rinsed. After all sample bottles are filled and returned to the vehicle, they will be placed into a cooler with ice.

B3: SAMPLE HANDLING AND CUSTODY

SPI's bioassessment studies require the use of contracted taxonomic and laboratory facilities. For each facility, a COC form (see Appendix D) must be filled out and delivered with the samples to the designated location. An electronic version of the COC will also be emailed to the analyst or taxonomist prior to or on the day of sample arrival. Facility-specific custody, transport, and holding times are detailed below.

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE AQUATIC BIOASSESSMENT LABORATORY

BMI samples are preserved and either hand-delivered by MLML-MPSL to CDFW-ABL or shipped in a cooler or box via commercial courier. BMI samples will be received and processed according to Section 2 of the SWAMP document *Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California* (October 2012), including a sample integrity check and a hydrometer check to ensure that each sample contains a minimum of 70% ethanol. Samples for BMI taxonomy have their labels checked against COC forms to confirm the presence of all samples and required ancillary information. Unique *LabSampleIDs* are assigned to each sample upon login to the database. The laboratory's COC form appears in Appendix D of this QAPP.

BMI specimens for external QC will be commercially shipped from CDFW-ABL to JLC for processing according to the SWAMP document *Standard Operating Procedures for the External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015).

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE MARINE POLLUTION STUDIES LABORATORY

Laboratory personnel logging in samples carefully inspect each sample for COC documentation, sample labeling, packing lists, and the condition of the sample packing materials and containers. Any discrepancies or problems associated with sample shipment are documented on the COC form and in the sample receiving logbook. The original COC and a copy of the logbook are retained together in a binder in the laboratory office. The laboratory's COC form appears in Appendix D of this QAPP.

MLML-MPSL delivers frozen samples directly to CDFW-MPSL's freezer and the associated COC is given to the appropriate staff. Samples are stored for the required holding time. Thereafter, the laboratory supervisor or project leader will determine if the sample will be archived. When the holding time interval has passed and the samples are approved for disposal, samples and sample containers will be disposed of according to applicable regulations.

Table 19 specifies the sample handling guidelines associated with CDFW-MPSL's analyses.

Table 19: Sample Handling - California Department of Fish and Wildlife Marine Pollution Studies Laboratory

Constituent	Required Holding Time
Benthic chlorophyll	Filter, wrap in foil, store on wet ice in the field, but freeze (preferably to -80 ºC) within four hours of collection; analyze within 28 days
Ash-free dry mass	28 days
Suspended sediment concentration	7 days
Suspended solids (total)	7 days

DR. KALINA MANOYLOV

Diatom specimens are sampled and preserved by MLML-MPSL and shipped to Dr. Kalina Manoylov via commercial courier. Specimens are received and processed according to the SWAMP document *Standard Operating Procedures for Laboratory Processing, Identification, and Enumeration of Stream Algae* (November 2015). Immediately after collection, diatom samples are preserved with 2 mL of 37% formaldehyde to 40 mL of sample. If kept dark and away from heat, samples may be stored for two years. If the total volume in a sample tube is less than 50 mL, it may indicate that a sample leaked during transport or was not preserved. Follow-up with the field crew may be required.

Specimens for diatom taxonomy have their labels checked against COC forms to confirm the presence of all specimens and required ancillary information. Unique *LabSampleIDs* are assigned to each specimen upon login to the database. The taxonomist's COC form appears in Appendix D of this QAPP.

Diatom specimens for external QC will be shipped via commercial courier from Dr. Manoylov to Dr. Rosalina Stancheva for processing according to the SWAMP document *Standard Operating Procedures for the External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015).

NORTH COAST LABORATORIES, LTD.

Coolers are shipped via overnight FedEx to NCL or SPI staff may drive coolers to NCL on a given sampling day to ensure receipt by NCL. Prior to any sampling effort, the laboratory is contacted to order the appropriate containers and coolers. The containers and coolers ordered are reviewed with laboratory staff to confirm that appropriate supplies are ordered and shipped correctly.

At the time of delivery, the time, date, and temperature of the cooler blank bottle or one sample bottle will be recorded by NCL. The laboratory receives the samples and stores them in a walk-in refrigerator or freezer as appropriate. Each sample is properly identified and stored. The date, time, and temperature of any acidified or preserved samples is recorded by the laboratory. Samples are stored at NCL until results are confirmed and outstanding questions are resolved. The laboratory's COC form appears in Appendix D of this QAPP.

Table 20 specifies the sample handling guidelines associated with NCL's analyses.

Table 20: Sample Handling - North Coast Laboratories, Ltd.

Analyte	Required Holding Time
Ammonia (as N)	48 hours; 28 days if acidified
Chloride	28 days
Hardness (as $CaCO_3$)	6 months
Kjeldahl nitrogen (total)	7 days; 28 days if acidified
Nitrate + nitrite (calculated)	28 days
Organic carbon (dissolved)	Filter within 48 hours; 28 days
Phosphorus (total, as P)	28 days
Sulfate	28 days

B4: ANALYTICAL METHODS

SPI's bioassessment studies include multiple analytical categories:

- BMI taxonomy
- Diatom taxonomy
- Laboratory analysis
- PHAB analysis

Analytical methods associated with these categories are given section-specific coverage below.

BENTHIC MACROINVERTEBRATE TAXONOMY

CDFW-ABL performs taxonomy of all BMIs collected for SPI. In the interest of comparability with SWAMP, identifications are performed according to the SWAMP document *Standard Operating Procedures for the Laboratory Processing and Identification of Benthic Macroinvertebrates in California* (October 2012). External QC taxonomy is performed by JLC according to the SWAMP document *Standard Operating Procedures for the External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015). These documents detail:

- Laboratory infrastructure
- Staff qualifications
- Sample receipt
- Sample preparation and processing
- BMI identification and enumeration
- QC

DIATOM TAXONOMY

Dr. Kalina Manoylov performs laboratory taxonomy of all diatom samples collected for SPI. In the interest of SWAMP comparability, identifications are performed according to the SWAMP document

Standard Operating Procedures for the Laboratory Processing, Identification, and Enumeration of Stream Algae (November 2015). External QC taxonomy is performed by Dr. Rosalina Stancheva according to the SWAMP document *Standard Operating Procedures for Internal and External Quality Control of Laboratory Processing, Identification, and Enumeration of Stream Algae in California* (November 2019). These documents detail:

- Laboratory infrastructure
- Staff qualifications
- Sample receipt
- Sample preparation and processing
- Diatom identification and enumeration
- QC
- Results reporting

LABORATORY ANALYSIS

California Department of Fish and Wildlife Marine Pollution Studies Laboratory

Details associated with CDFW-MPSL laboratory analyses appear in Table 21.

Table 21: Analytical Methods - California Department of Fish and Wildlife Marine Pollution Studies Laboratory

Constituent	Analytical Method	Detector Type	Method Detection Limit	Reporting Limit
Ash-free dry mass	MPSL-114	Balance	n/a	1 mg/L
Benthic chlorophyll	MPSL-115	Fluorescence	0.141 mg/m^2	0.340 mg/m^2
Suspended sediment concentration	ASTM D 3977-97	Balance	n/a	1 mg/L
Suspended solids (total)	SM 2540 D	Balance	n/a	1 mg/L

North Coast Laboratories, Ltd.

Details associated with NCL laboratory analyses appear in Table 22.

Table 22: Analytical Methods - North Coast Laboratories, Ltd.

Constituent	Analytical Method	Detector Type	Method Detection Limit (mg/L)	Reporting Limit (mg/L)
Ammonia (as N)	SM 4500 - NH_3 B, D	Ion Selective Electrode	0.064	0.1
Kjeldahl nitrogen (total)	SM 4500 - NH_3 B, D	Ion Selective Electrode	0.74	1
Nitrate + nitrite (calculated)	EPA 300.0	Conductivity	0.072	0.1
Phosphorous (total, as P)	SM 4500 - P E	Colorimetric	0.0074	0.02
Chloride	EPA 300.0	Conductivity	0.051	0.5
Hardness (as $CaCO_3$)	EPA 200.7	ICP-OES[1]	n/a	1
Organic carbon (dissolved)	SM 5310 C	Infrared	0.18	0.3
Sulfate	EPA 300.0	Conductivity	0.22	1

[1] Inductively coupled plasma-optical emission spectrometry

PHYSICAL HABITAT ANALYSIS

PHAB analysis is performed by MLML-MPSL according to the SWAMP document *Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016). Summarily, PHAB measurements are recorded at the reach scale (typically 150 meters) and along 21 transects and inter-transects evenly spaced within the reach to characterize instream channel and bank substrates and morphology, riparian vegetation cover, flow habitats, and human influence. Standard measurements and observations are performed along the reach in a consistent manner producing more than 1,700 data points for a given sampling event.

B5: QUALITY CONTROL

This element describes SPI's bioassessment QC systems as they relate to each of the DQIs identified in Element A7: *Quality Objectives and Criteria*. SPI's Research and Monitoring Program conducts studies that include the following analytical categories:

- BMI taxonomy
- Diatom taxonomy
- Laboratory analysis
- PHAB analysis

Category-specific DQIs and their associated QC are identified in Tables 23-25.

BENTHIC MACROINVERTEBRATE TAXONOMY

For BMI sampling and taxonomy, applicable DQIs are evaluated and optimized according to Table 23.

Table 23: Benthic Macroinvertebrate Taxonomy - Data Quality Indicators

Indicator	Quality Control
Accuracy	• Adherence to QAPP Element A8: *Special Training and Certification* • External laboratory confirmations • Intercomparison study participation
Representativeness	• Adherence to QAPP Element A5: *Problem Definition/Background* • Adherence to QAPP Element A6: *Project/Task Description*
Comparability	• Use of consistent methods/SOPs • External laboratory confirmations • Intercomparison study participation • As feasible, comparability with SWAMP quality control
Completeness	• Adherence to a 90% completeness requirement

DIATOM TAXONOMY

For diatom sampling and taxonomy, applicable DQIs are evaluated and optimized according to Table 24.

Table 24: Diatom Taxonomy - Data Quality Indicators

Indicator	Quality Control
Accuracy	• Adherence to QAPP Element A8: *Special Training and Certification* • External laboratory confirmations • Intercomparison study participation
Representativeness	• Adherence to QAPP Element A5: *Problem Definition/Background* • Adherence to QAPP Element A6: *Project/Task Description*
Comparability	• Use of consistent methods/SOPs • Intercomparison study participation • As feasible, comparability with SWAMP quality control • External laboratory confirmations
Completeness	• Adherence to a 90% completeness requirement

LABORATORY ANALYSIS

For laboratory analyses (and associated sampling), DQIs are evaluated and optimized according to Table 25.

Table 25: Laboratory Analysis - Data Quality Indicators

Indicator	Quality Control
Precision	• Use of laboratory, field, and matrix spike duplicates
Bias	• Contamination-based bias: use of laboratory, field, travel, and equipment blanks • Matrix-based bias: use of matrix spikes and surrogates
Accuracy	• Use of calibration verification samples • Use of laboratory control samples • Use of reference materials
Representativeness	• Adherence to QAPP Element A5: *Problem Definition/Background* • Adherence to QAPP Element A6: *Project/Task Description*
Comparability	• Use of consistent methods/SOPs • Adoption of SWAMP MQOs and holding times
Completeness	• Adherence to a 90% completeness requirement
Sensitivity	• Instrument calibration • MDLs/RLs

Field and laboratory QC samples referenced in Table 25 are defined below. To promote SWAMP comparability, QC sample definitions (except where noted) are taken from the *Surface Water Ambient Monitoring Program Quality Assurance Program Plan* (January 2022).

Field Quality Control Samples

Equipment Blank

An equipment blank is a sample of analyte-free media that has been used to rinse the sampling equipment. It is collected after completion of decontamination and prior to sampling through clean equipment. This blank is useful in documenting adequate decontamination of sampling equipment. This blank is used to provide information about contaminants/bias that may be introduced during sample collection when using filtration equipment or equipment that must be decontaminated between use.

Field Blank

A field blank is a sample of analyte-free media that is carried to the sampling site, exposed to the sampling conditions, returned to the laboratory, and treated as a routine environmental sample. Preservatives, if any, are added to the sample container in the same manner as the environmental sample. The field blank matrix should be comparable to the sample of interest. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.

Field Duplicate

A field duplicate is an independent sample sharing the same collection methodology, location, and time as the associated field samples.

Travel Blank

According to EPA, a travel blank is a clean sample of matrix that is carried to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

Laboratory Quality Control Samples

Calibration Standard

A calibration standard is a solution prepared from the dilution of stock standard solutions that includes the internal standards and surrogate analytes, when applicable. The calibration solutions are used to calibrate the instrument response with respect to analyte concentration.

Calibration Verification

Calibration verification is when calibration check samples are analyzed prior to (i.e., initial), during (i.e., continuing or ongoing), and/or after (i.e., final) analysis of samples. The initial calibration verification, continuing calibration verification, and final calibration verification are used to verify the continued accuracy of an instrument calibration.

Laboratory Blank

A laboratory blank (often reagent water) is free from the target analyte(s) and is used to represent the environmental sample matrix as closely as possible. The method blank is processed simultaneously with and under the same conditions and steps of the analytical procedures (e.g., including exposure to all glassware, equipment, solvents, reagents, labeled compounds, internal standards, and surrogates that are used with samples) as all samples in the analytical batch (including other QC samples). The method blank is used to determine if target analytes or interferences are present in the laboratory environment, reagents, or instruments. Results of method blanks provide a measurement of bias introduced by the analytical procedure.

Laboratory Control Sample

A laboratory control sample (LCS) is a sample matrix representative of the environmental sample (e.g., water, sand) that is prepared in the laboratory and is free from the analytes of interest. The LCS is spiked with verified amounts of analytes or a material containing known and verified amounts of analytes. It is either used to establish intra-laboratory or analyst-specific precision and bias, or to assess the performance of a portion of the measurement system.

Laboratory Duplicate

A laboratory duplicate is an analysis or measurement of the target analyte(s) performed identically on two subsamples of the same sample, usually taken from the same container. The results from laboratory duplicate analyses are used to evaluate analytical or measurement precision, and include variability associated with subsampling and the matrix (not the precision of field sampling, preservation, or storage internal to the laboratory).

Matrix Spike/Matrix Spike Duplicate

A matrix spike (MS) is prepared by adding a known concentration of the target analyte to a field sample, which is then subjected to the entire analytical procedure. Matrix spikes are analyzed in

order to assess the magnitude of matrix interference and bias present. Because matrix spikes are analyzed in pairs, the second spike is called the matrix spike duplicate (MSD). The MSD provides information regarding the precision of the matrix effects.

Reference Material

A reference material or substance has one or more properties that are characterized by a metrologically valid procedure, accompanied by a certificate that provides the value of the specified property, its associated uncertainty, and a statement of metrological traceability (typically from EPA or the National Institute of Science and Technology). Reference materials are used for calibrating an apparatus, assessing a measurement method, or assigning values to materials. They are used to measure the accuracy of analytical processes, either quantitatively to calibrate or determine concentration accuracy, or qualitatively to identify a substance or species.

PHYSICAL HABITAT ANALYSIS

For PHAB analysis, applicable DQIs are evaluated and optimized according to Table 26.

Table 26: Physical Habitat Analysis - Data Quality Indicators

Indicator	Quality Control
Accuracy	• Adherence to QAPP Element A8: *Special Training and Certification*
Representativeness	• Adherence to QAPP Element A5: *Problem Definition/Background* • Adherence to QAPP Element A6: *Project/Task Description*
Comparability	• Use of consistent methods/SOPs • Intercomparison study participation • As feasible, comparability with SWAMP quality control
Completeness	• Adherence to 90% completeness requirement

B6: INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

SPI's bioassessment studies utilize instruments and equipment associated with BMI and diatom taxonomy, laboratory analysis, and PHAB analysis. Testing, inspection, maintenance, and corrective action procedures for these devices are detailed in the planning and procedural documents identified in Table 27.

Table 27: Device Management

Item	Document Reference(s)	Responsible Party
CDFW-ABL devices	*Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016) *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	CDFW-ABL
CDFW-MPSL devices	*Quality Manual* (June 2023)	CDFW-MPSL
Diatom taxonomy devices	*Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016) *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	Dr. Kalina Manoylov
MLML-MPSL devices	*Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	MLML-MPSL
NCL devices	*Quality Manual* (2022 v.2)	NCL

Instruments and equipment in need of calibration are further addressed in Element B7: *Instrument/Equipment Calibration and Frequency.*

B7: INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

SPI's bioassessment studies utilize instruments and equipment associated with BMI and diatom taxonomy, laboratory analysis, and PHAB analysis. Calibration of these devices is detailed in the planning and procedural documents identified in Table 28.

Table 28: Device Calibration

Item	Document Reference(s)	Responsible Party
CDFW-ABL devices	*Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016) *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	CDFW-ABL
CDFW-MPSL devices	*Quality Manual* (June 2023)	CDFW-MPSL
Diatom taxonomy devices[1]	*Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016) *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	Dr. Kalina Manoylov
MLML-MPSL devices	*Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	MLML-MPSL
NCL devices	*Quality Manual* (March 2022 v.2)	NCL

Non-calibration instrument and equipment management is further addressed in Element B6: *Instrument/Equipment Testing, Inspection, and Maintenance.*

B8: INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES

SPI-based supplies and consumables will be inspected by Program-Director-assigned Research Foresters to make sure that they are intact, meet specifications, are available in adequate supply, and are stored properly. Specifications are detailed in applicable SOPs. If specifications are not met, the Program Director will be notified, and documentation may be initiated according to the SPI SOP *Corrective Action*.

Supplies and consumables used by contractors are managed according to the planning and procedural documents identified in Table 29.

Table 29: Management of Supplies and Consumables

Item	Document Reference(s)	Responsible Party
CDFW-ABL supplies and consumables	*Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016) *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	CDFW-ABL
CDFW-MPSL supplies and consumables	*Quality Manual* (June 2023)	CDFW-MPSL
Diatom taxonomy supplies and consumables[1]	*Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016) *Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	Dr. Kalina Manoylov
MLML-MPSL supplies and consumables	*Collections of Water and Bed Sediment Samples with Associated Field Measurements and Physical Habitat in California* (March 2014)	MLML-MPSL
NCL supplies and consumables	*Quality Manual* (2022 v.2)	NCL

B9: NON-DIRECT MEASUREMENTS

The SPI Program Director utilizes measurements obtained from outside sources to supplement bioassessment data and, occasionally, to verify potential outliers. These non-direct measurements are itemized in Table 30.

Table 30: Non-Direct Measurements

Source	Use
California Environmental Data Exchange Network (State Water Resources Control Board) http://ceden.waterboards.ca.gov/AdvancedQueryTool	Fill information gaps and confirm results
Fire Weather - National Weather Service (National Oceanic and Atmospheric Administration) https://www.wrh.noaa.gov/fire2/cafw/index.php	Fill information gaps and comply with warnings (Red Flag Zones)
Sacramento Forecast - National Weather Service (National Oceanic and Atmospheric Administration) https://www.weather.gov/sto/	Fill information gaps and comply with warnings (Red Flag Zones)
Northern California Geographic Area Coordination Center: Operations Northern California (Multi-Agency) https://gacc.nifc.gov/oncc/predictive/fuels_fire-danger/	Confirm results (fuel and fire data)
MesoWest (University of Utah, Department of Atmospheric Sciences) http://mesowest.utah.edu/cgi-bin/droman/mesomap.cgi?state=CA&rawsflag=3	Fill information gaps and confirm results (weather station data)

Since data are mined from state and federal agencies that have internal QA systems, no further verification or validation is performed by SPI. Further, mined data are not subject to the requirements or stipulations contained in this QAPP or any relevant procedural documents.

B10: DATA MANAGEMENT

SPI's Research and Monitoring Program uses field and laboratory forms, proprietary data processing software, and multiple databases to optimize data management for its bioassessment studies. Data collected will be managed in a Microsoft SQL Server database maintained at the MLML-MPSL Regional Data Center, which allows the user data access through secure online forms.

The field crew uses the most current SWAMP bioassessment wadeable stream field data sheets during collection. Hard copy forms will be used in the field to record data. Within a month of collection, the data will be transferred by the field crew or MLML-MPSL staff from hard copy into soft copy using Microsoft Access SWAMP bioassessment data entry forms provided by MLML-MPSL. At least 10% of the electronic data will be compared against hard copy reports for accuracy. Any errors will be fixed and an additional 10% of electronic data will be checked. This process will continue until no errors are found within a 10% batch or 100% of the field forms are checked. Hard copy data sheets will be retained by the field crew and provided to the Program Director and/or QA Oversight Manager in either hard or soft copy if requested.

After PHAB analysis data are entered into the MLML-MPSL SQL server database, a Microsoft Excel reporting template will be created by MLML-MPSL staff for taxonomy and laboratory data. Each template will provide the necessary sample collection information upon which the taxonomist/laboratory will add their results. When the template is complete, taxonomy/laboratory staff will use the appropriate MLML-MPSL online checker to check for errors and submit their file.

Category-specifc data management processes are detailed below.

BENTHIC MACROINVERTEBRATE TAXONOMY DATA

BMI data are entered by CDFW-ABL staff into the SWAMP database. Once finalized in the SWAMP database, SPI data are queried and loaded into the MLML-MPSL SQL server database before being sent to CEDEN. Samples will be logged in by laboratory staff to assign *LabSampleIDs* prior to entering taxonomic data. When the BMI data have undergone internal and external QC review, the laboratory liaison will notify MLML-MPSL staff that the data are final.

DIATOM TAXONOMY DATA

Diatom results will be entered into the Microsoft Excel template provided by MLML-MPSL, checked for errors, and submitted using the online MLML-MPSL SWAMP checker.

LABORATORY DATA

NCL and CDFW-MPSL results will be reported in the Microsoft Excel template provided by MLML-MPSL, checked for errors, and submitted using the online MLML-MPSL CEDEN checker.

PHYSICAL HABITAT ANALYSIS DATA

When PHAB analysis data entry is complete, MLML-MPSL staff will export the data from Microsoft Access into Microsoft Excel in the SWAMP template format. This template will be run through the MLML-MPSL SWAMP online checker to look for basic errors in the data. All errors will be fixed or addressed prior to submittal through the checker. MLML-MPSL staff will then load the data into the MLML-MPSL SQL server database. The MLML-MPSL SQL server database is backed up daily.

Group C:
Assessment and Oversight

C1: ASSESSMENTS AND RESPONSE ACTIONS

SPI's Research and Monitoring Program implements various internal and external assessments to ensure that:

- Elements of this QAPP have been correctly implemented as prescribed;
- The quality of generated data meets project objectives;
- Data is produced in a manner consistent with "known and documented" quality; and
- Corrective actions, when needed, are implemented in a timely manner and their effectiveness is confirmed.

Corrective actions are implemented and documented according to the SPI SOP *Corrective Action*.

EXTERNAL QUALITY CONTROL

BMI and diatom taxonomy are subject to the SWAMP-comparable external QC processes described in B5: *Quality Control*.

THIRD-PARTY AUDITS

In December 2016, April 2018, and April 2019, SPI's Research and Monitoring Program hosted external, third-party audits by MPSL. Similar MPSL audits will recur as requested by the Program Director.

INTERNAL AUDITS

SPI Research Foresters perform internal audits on a quarterly basis and as requested by the Program Director. These audits are performed according to the SPI SOP *Internal Audits*. At a minimum, audit scope includes:

- Water quality/weather station field notes
- Sonde deployment records
- Flow field sheets

- Tidbit field notes
- Terrestrial field notes
- Office notes
- Solution logbooks
- Calibration logbook
- Post calibration/post deployment book
- Sensor change book

The Research and Monitoring Program also holds weekly internal QA meetings to address issues not associated with audit events.

DATA VERIFICATION

SPI data are reviewed according to D1: *Data Review, Verification, and Validation* and D2: *Verification and Validation Methods*.

C2: REPORTS TO MANAGEMENT

The SPI Research and Monitoring Program Director is responsible for all project reports to management. A variety of reports, including presentations, are provided within and beyond SPI to inform management decisions including, but not limited to, best management practices, fire prevention, road maintenance, watering, water monitoring, and timber harvest plans (Table 31).

Table 31: Reports to Management

Type of Report	Date/ Frequency	Responsible Party	Report Recipients
Timber harvest plan review	As requested,	Program Director	Contractors; Foresters; Management
Monitoring report (per RWQCB general orders)	Annually	Program Director	RWQCBs
Presentation	Monthly or bimonthly	Program Director	Foresters; District Managers
Content for sustainable yield plans	Annually	Program Director	Forestry Managers
Presentation for Sustainable Forestry Initiative	Annually	Program Director	Third-party auditors

Group D:
Data Validation and Usability

D1: DATA REVIEW, VERIFICATION, AND VALIDATION

According to EPA, data verification is the process for evaluating the completeness, correctness, and conformance/compliance of a specific dataset against the method, procedural, or contractual specifications. Data validation extends the evaluation of data beyond verification to determine the quality of a specific dataset relative to the end use.

Data associated with SPI's bioassessment studies are evaluated against the requirements specified in the following elements of this QAPP:

- A7: *Quality Objectives and Criteria*
- B2: *Sample Handling and Custody*
- B5: *Quality Control*
- B7: *Instrument/Equipment Calibration and Frequency*

Data review, verification, and validation are performed using the procedures specified in Element D2: *Verification and Validation Methods.*

D2: VERIFICATION AND VALIDATION METHODS

SPI bioassessment data review criteria specified in Element D1: *Data Review, Verification, and Validation* are the basis for the laboratory- and taxonomist-specific data review processes identified in the following sections.

INITIAL DATA REVIEW

California Department of Fish and Wildlife Aquatic Bioassessment Laboratory

CDFW-ABL's data review is performed against the requirements of this QAPP and the SWAMP document *Standard Operating Procedures for the Laboratory Processing and Identification of Benthic Macroinvertebrates in California* (October 2012). Because CDFW-ABL is a SWAMP master-contract laboratory, data produced for SPI will ultimately be uploaded to CEDEN (see below).

California Department of Fish and Wildlife Marine Pollution Studies Laboratory

CDFW-MPSL's data review is performed against the requirements of this QAPP and the laboratory's *Quality Manual* (June 2023). Because CDFW-MPSL is a SWAMP master-contract laboratory, data produced for SPI will ultimately be uploaded to CEDEN.

Dr. Kalina Manoylov

Dr. Manoylov's data review is performed against the requirements of this QAPP and the SWAMP documents *Standard Operating Procedures for the Laboratory Processing, Identification, and Enumeration of Stream Algae* (November 2015) and *Standard Operating Procedures for Internal and External Quality Control of Laboratory Processing, Identification and Enumeration of Stream Algae in California* (November 2019) .

Dr. Rosalina Stancheva

Dr. Stancheva's data review is performed against the requirements of this QAPP and the SWAMP

document *Standard Operating Procedures for Internal and External Quality Control of Laboratory Processing, Identification and Enumeration of Stream Algae in California* (November 2019).

Jon Lee Consulting

JLC's data review is performed against the requirements of this QAPP and the SWAMP document *Standard Operating Procedures for the External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015).

Moss Landing Marine Laboratories Marine Pollution Studies Laboratory

MLML-MPSL's data review is performed against the requirements of this QAPP and the SWAMP document *Standard Operating Procedures for the Collection of Field Data for Bioassessments of California Wadeable Streams: Benthic Macroinvertebrates, Algae, and Physical Habitat* (May 2016),

North Coast Laboratories, Ltd.

NCL's data review is performed against the requirements of the laboratory's *Quality Manual* (2022 v.2).

SPI DATA REVIEW

Following the above laboratory/taxonomist data review processes, the Program Director assesses data completeness by examining the:

- Number of samples collected compared to the sampling plan
- Number of samples shipped and received at the laboratory in good condition
- Laboratory's ability to produce usable results for each sample

When all data components exist in the MLML-MPSL RDC database, MLML-MPSL staff will conduct checks across all data types for typographical errors, suspect values, and conformity to SWAMP business rules. MLML-MPSL staff will also verify non-taxonomic laboratory data following MLML-MPSL protocols. BMI taxonomy external QC results will be compared against the MQOs specified in the SWAMP SOP *External Quality Control of Benthic Macroinvertebrate Taxonomy Data Collected for Stream Bioassessment in California* (July 2015). Diatom taxonomy external QC results will be compared against the SWAMP document *Standard Operating Procedures for Internal and External*

Quality Control of Laboratory Processing, Identification and Enumeration of Stream Algae in California (November 2019). MPSL staff will report the findings to the QA Oversight Manager, Program Director, and Bioassessment Coordinator.

CALIFORNIA ENVIRONMENTAL DATA EXCHANGE NETWORK DATA

Bioassessment data intended for CEDEN upload are first reviewed by the MLML-MPSL Regional Data Center (RDC) Manager against the SWAMP SOP *Verification of the Surface Water Ambient Monitoring Program Chemistry Template* (March 2021). Data review issues are resolved by the Program Director, QA Oversight Manager, and MLML-MPSL RDC Manager, and when applicable, documented according to the SPI SOP *Corrective Action*.

D3: RECONCILIATION WITH USER REQUIREMENTS

PROJECT DATA

The data management processes described in D1: *Data Review, Verification, and Validation* and D2: *Verification and Validation Methods* may result in laboratory- or taxonomist-assigned data qualifiers (i.e., "flags"). Qualifiers inform data users of potential limitations to project results, and are assigned in response to QC failures (e.g., QC sample omission, insufficient QC sample frequency, MQO failure) or sample handling failures (e.g., holding time exceedances).

CALIFORNIA ENVIRONMENTAL DATA EXCHANGE NETWORK DATA

To further inform data usability, project results uploaded to CEDEN are assigned the following compliance codes by the MLML-MPSL RDC Manager:

- *Compliant*: Data classified as "Compliant" meet all requirements specified in this QAPP. These data are considered usable for their intended purpose without additional assessment.
- *Qualified*: Data classified as "Qualified" do not meet one or more of the requirements specified in this QAPP. These data are considered usable for their intended purpose following an additional assessment to determine the scope and impact of the deficiency.
- *Estimated*: Data classified as "Estimated" (i.e., EPA "J" flag) are assigned to data batches and sample results that are not considered quantifiable.
- *Screening*: Data classified as "Screening" are considered non-quantitative and may or may not meet the minimum requirements specified in this QAPP. These data may not be usable for their intended purpose and require additional assessment.
- *Rejected*: Data classified as "Rejected" do not meet the minimum requirements specified in this QAPP. These data are not considered usable for their intended purpose.

Appendix A: Abbreviations and Acronyms

ABL	Aquatic Bioassessment Laboratory
BMI	Benthic Macroinvertebrate
CAL FIRE	California Department of Forestry and Fire Protection
CDFW	California Department of Fish and Wildlife
CEDEN	California Environmental Data Exchange Network
CFPR	California Forest Practice Rules
CGS	California Geological Survey
COC	Chain of Custody
DFW	California Department of Fish and Wildlife
DQI	Data Quality Indicator
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MLML	Moss Landing Marine Laboratories
MPSL	Marine Pollution Studies Laboratory
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NCL	North Coast Laboratories, Ltd.
NOAA	National Oceanic and Atmospheric Administration
NWQMC	National Water Quality Monitoring Council
PHAB	Physical Habitat
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
RWQCB	Regional Water Quality Control Board
SAFIT	Southwest Association of Freshwater Invertebrate Taxonomists
SOP	Standard Operating Procedure
SPI	Sierra Pacific Industries, Inc.
SWAMP	Surface Water Ambient Monitoring Program

SWRCB State Water Resources Control Board

Appendix B: Glossary

Accuracy	The closeness or agreement of the observed value or test response to the true or acceptable reference value or the test response from a reference method. It is influenced by both random error (precision) and systematic error (bias). The terms "bias" and "precision" are often used in lieu of "accuracy".
Analytical Batch	A group of 20 or fewer samples and associated quality control that is processed by the same instrument within a 24-hour period (unless otherwise specified by method). An analytical batch may comprise multiple sample batches.
Assessment	A general evaluation process used to evaluate the performance, effectiveness, and processes of a management and/or technical system.
Batch	The collection of samples of the same group which is to be analyzed in one test run or inspected together within a specific time limit and traceable as a unit.
Bias	The constant or systematic distortion of a measurement process that manifests itself as a persistent positive or negative deviation from the known or true value. This can result from improper data collection, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.
Blank	A specimen that is intended to contain none of the analytes of interest and which is subjected to the usual analytical or measurement process to establish a zero baseline or background value.
Calibration	A comparison of a measurement standard, instrument, or item with one having higher accuracy to detect, quantify, and record any inaccuracy or variation; the process by which an instrument setting is adjusted based on response to a standard to eliminate the inaccuracy.
Calibration Standard	Reference solution of known value used to correct an instrument reading.
Calibration Verification	A periodic standard used to assess instrument drift between calibrations.
Comparability	A measure of the confidence with which one dataset, element, or method can be considered as similar to another.
Completeness	A measure of the amount of valid data obtained from a measurement system.
Control Limit	The variation in a process dataset expressed as plus/minus standard deviations from the mean, generally placed on a chart to indicate the upper and lower acceptable ranges of process data and to judge whether the process is in or out of statistical limitations.
Corrective Action	Any measures taken to rectify conditions adverse to quality and/or to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent reoccurrence.

Data Validation	An analyte- and sample-specific process that evaluates the information after the verification process (i.e., determination of method, procedural, or contractual compliance) to determine analytical quality and any limitations.
Data Verification	The process of evaluating the completeness, correctness, and conformance/compliance of a specific information set against the method, procedural, or contractual specifications for that activity.
Equipment Blank	An aliquot of reagent water that is subjected in the laboratory to all aspects of sample collection and analysis, including contact with all sampling devices and apparatus. The purpose of the equipment blank is to determine if the sampling devices and apparatus for sample collection have been adequately cleaned before they are shipped to the field site. An acceptable equipment blank must be achieved before the sampling devices and apparatus are used for sample collection.
Field Blank	A clean analyte-free sample which is carried to the sampling site and then exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample. This blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport.
Field Duplicate	An independent specimen collected from the same point in time and space as the previous specimen.
Field Measurements	Those activities associated with performing analyses or measurements in the habitat being examined.
Holding Time	The period of time a sample may be stored following collection, preservation, extraction, or analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualification of any data not meeting all of the specified acceptance criteria.
Intercomparison	An exercise in which samples are prepared and split by a reference laboratory, then analyzed by one or more testing laboratories and the reference laboratory. The intercomparison, with a reputable laboratory as the reference laboratory, serves as the best test of the precision and accuracy of the analyses at natural environmental levels.
Interference	An element, compound, or other matrix effect present in a sample which disturbs the detection of a target analyte leading to inaccurate concentration results for the target analyte.
Laboratory Blank	An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, and reagents that are used with samples. The laboratory blank is used to determine if method analytes or interferences are present in the laboratory environment, the reagents, or the apparatus.
Laboratory Duplicate	Two or more representative portions taken from one homogeneous sample by the analyst and analyzed in the same

	testing facility.
Laboratory Control Sample	A specimen of known composition prepared using contaminant-free reagent water, or an inert solid, that is spiked with the analyte of interest at the midpoint of the calibration curve or at the level of concern; and then analyzed using the same preparation, reagents, and analytical methods employed for regular specimens and at the intervals set in the Quality Assurance Project Plan.
Matrix	The material of which the sample is composed or the substrate containing the analyte of interest, such as drinking water, wastewater, air, soil/sediment, biological material, etc. Also called medium or media.
Matrix Spike	A test specimen prepared by adding a known concentration of the target analyte to a specified amount of a specific homogenized specimen where an estimate of the target concentration is available and subjected to the entire analytical protocol.
Matrix Spike Duplicate	A sample prepared simultaneously as a split with the matrix spike sample with each specimen being spiked with identical, known concentrations of targeted analyte.
Measurement Quality Objectives	The individual performance or acceptance goals for the individual Data Quality Indicators such as precision or bias.
Method	A procedure, technique, or tool for performing a scientific activity.
Method Blank	A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.
Method Detection Limit	The minimum concentration of an analyte that undergoes the entire measurement process and can be reported with a stated level of confidence that the analyte concentration is greater than zero.
Non-Direct Measurements	Data obtained from existing sources rather than measured or generated directly.
Parameter	A statistical quantity, usually unknown, such as a mean or a standard deviation, which characterizes a population or defines a system.
Precision	A measure of mutual agreement between two or more individual measurements of the same property, obtained under similar conditions.
Quality Assurance	An integrated system of management activities (planning, implementation, assessment, reporting, and quality improvement) that focuses on providing confidence in the data or product by ensuring that it is of the type and worth needed

	and expected by the client.
Quality Assurance Project Plan	A document that describes the intended technical activities and project procedures that will be implemented to ensure that the results of the work to be performed will satisfy the stated performance or acceptance criteria. The amount of information presented and the planned activities to ensure the value of the work will vary according to the type of study and the intended use of the data.
Quality Assurance Program Plan	A document describing in comprehensive detail the necessary decisions and decision criteria to be used by an overall regulatory program.
Reference Material	A substance whose properties are sufficiently homogeneous and established to be used for calibration and measurement.
Reporting Limit	The minimum value below which data are documented as non-detected.
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.
Spike	A known quantity of an analyte added to a sample for the purpose of determining recovery or efficiency (analyst spikes), or for quality control (blind spikes).
Standard Deviation	The measure of the dispersion or imprecision of a series of accepted results around the average, equal to the square root of the variance.
Standard Operating Procedure	A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Appendix C: References

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Appendix D:
Example Chain-of-Custody Forms

Figure 4: Example CDFW-ABL Chain-of-Custody Form

MPSL-MLML REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY (COC) RECORD

ProjectCode: SPI_Research_2023
AgencyCode: MPSL-MLML
Funding: Sierra Pacific Industries (SPI)
Date:
Field Crew: Marco Sigala, Billy Jakl

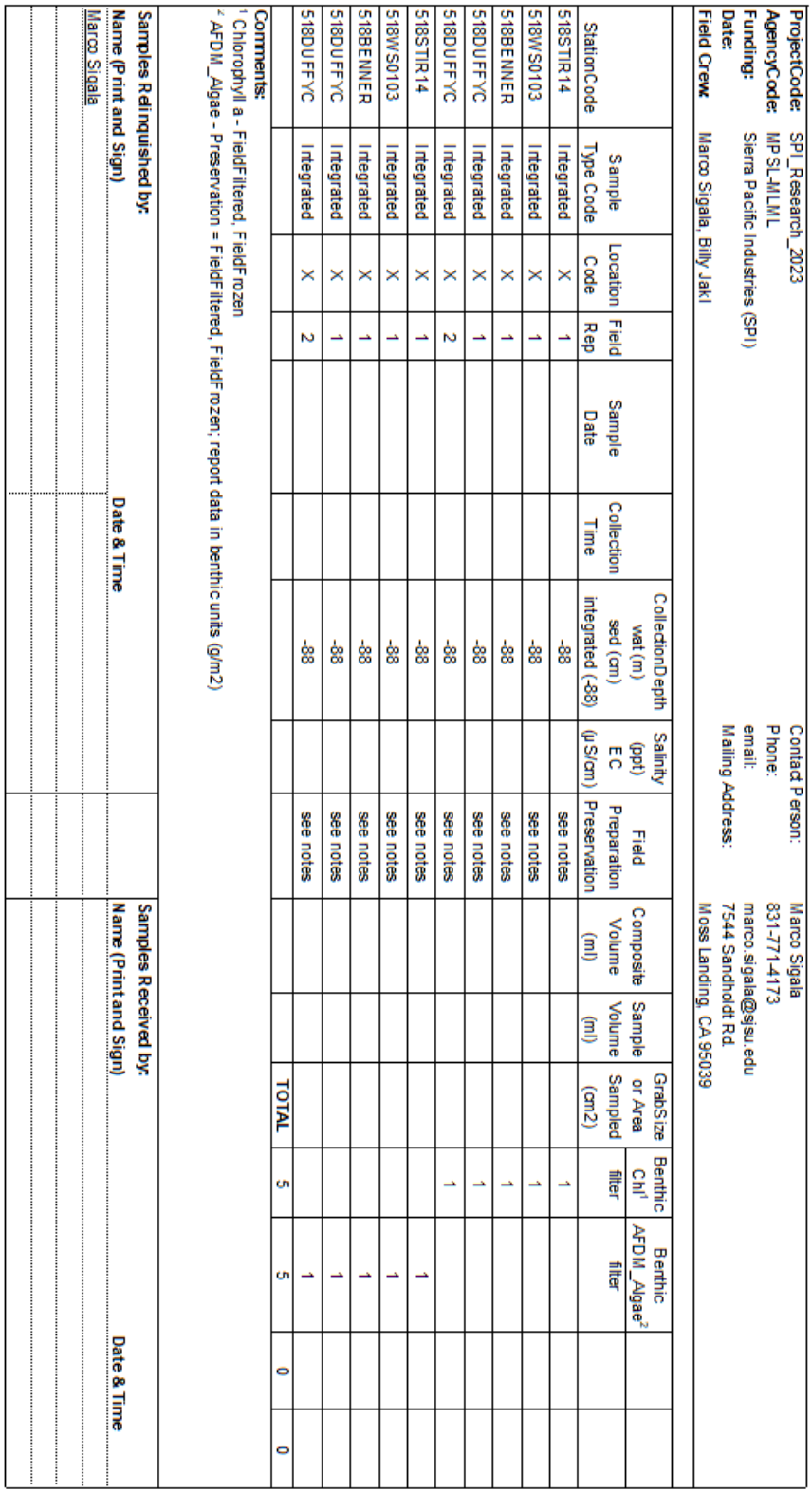
Contact Person: Marco Sigala
Phone: 831-771-4173
email: marco.sigala@sjsu.edu
Mailing Address: 7544 Sandholdt Rd.
Moss Landing, CA 95039

StationCode	Sample Type Code	Location Code	Field Replicate	Sample Date	Collection Time	CollectionDepth wat (m) sed (cm) integrated (-88)	Salinity (ppt) EC (µS/cm)	Field Preparation Preservation	Bioassessment TRC[1] SAFIT STE Level II Taxonomy	Bioassessment RWB[2] SAFIT STE Level II Taxonomy	Bioassessment MCM[3] SAFIT STE Level II Taxonomy
518STIR00	Integrated	X	1			-88		Ethanol		1	
518STIR05	Integrated	X	1			-88		Ethanol		1	
518STIR09	Integrated	X	1			-88		Ethanol		1	
518STIR12	Integrated	X	1			-88		Ethanol		1	
518STIR14	Integrated	X	1			-88		Ethanol		1	
518WS0103	Integrated	X	1			-88		Ethanol		1	
507RCABRS	Integrated	X	1			-88		Ethanol		1	
524NFCTN1	Integrated	X	1			-88		Ethanol		1	
507DCABSF	Integrated	X	1			-88		Ethanol		1	
507DCBLLB	Integrated	X	1			-88		Ethanol		1	
507SPION1	Integrated	X	1			-88		Ethanol		1	
507SPISFD	Integrated	X	1			-88		Ethanol		1	
525BLDR01	Integrated	X	1			-88		Ethanol		1	
525NSLT01	Integrated	X	1			-88		Ethanol		1	
518LSTCHC	Integrated	X	1			-88		Ethanol		1	
518BENNER	Integrated	X	1			-88		Ethanol		1	
518COTNWD	Integrated	X	1			-88		Ethanol		1	
518DUFFYC	Integrated	X	1			-88		Ethanol		1	
518STIR00	Integrated	X	2			-88		Ethanol		1	
507DCABSF	Integrated	X	2			-88		Ethanol		1	
								TOTAL	0	20	0

Comments:
[1] Targeted Riffle Composite (TRC) sample
[2] Reachwide Benthos (RWB; aka Multihabitat) sample
[3] Margin-Center-Margin (MCM) sample
Run External QC samples on StationCodes 518BENNER and 507SPISFD

Samples Relinquished by: Name (Print and Sign)	Date & Time	**Samples Received by:** Name (Print and Sign)	Date & Time
Marco Sigala			

Figure 5: Example CDFW-MPSL Chain-of-Custody Form (1 of 2)



MPSL-MLML REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY (COC) RECORD

ProjectCode: SPI_Research_2023 — Contact Person: Marco Sigala
AgencyCode: MPSL-MLML — Phone: 831-771-4173
Funding: Sierra Pacific Industries (SPI) — email: marco.sigala@sjsu.edu
Date: — Mailing Address: 7544 Sandholdt Rd. Moss Landing, CA 95039
Field Crew: Marco Sigala, Billy Jakl

StationCode	Sample Type Code	Location Code	Field Rep	Sample Date	Collection Time	CollectionDepth wat (m) sed (cm) integrated (-88)	Salinity (ppt) EC (µS/cm)	Field Preparation Preservation	Composite Volume (ml)	Sample Volume (ml)	GrabSize or Area Sampled (cm2)	Benthic Chl[1] filter	Benthic AFDM_Algae[2] filter	
518STIR14	Integrated	X	1			-88		see notes				1		
518WS0103	Integrated	X	1			-88		see notes				1		
518BENNER	Integrated	X	1			-88		see notes				1		
518DUFFYC	Integrated	X	1			-88		see notes				1		
518DUFFYC	Integrated	X	2			-88		see notes				1		
518STIR14	Integrated	X	1			-88		see notes					1	
518WS0103	Integrated	X	1			-88		see notes					1	
518BENNER	Integrated	X	1			-88		see notes					1	
518DUFFYC	Integrated	X	1			-88		see notes					1	
518DUFFYC	Integrated	X	2			-88		see notes					1	
											TOTAL	5	5	0
														0

Comments:
[1] Chlorophyll a - FieldFiltered, FieldFrozen
[2] AFDM_Algae - Preservation = FieldFiltered, FieldFrozen; report data in benthic units (g/m2)

Samples Relinquished by:
Name (Print and Sign) — **Date & Time**
Marco Sigala

Samples Received by:
Name (Print and Sign) — **Date & Time**

Figure 6: Example CDFW-MPSL Chain-of-Custody Form (2 of 2)

MPSL-MLML REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY (COC) RECORD

ProjectCode:	SPI_Research_2023	Contact Person:	Marco Sigala
AgencyCode:	MPSL-MLML	Phone:	831-771-4173
Funding:	Sierra Pacific Industries (SPI)	email:	marco.sigala@sjsu.edu
Date:		Mailing Address:	7544 Sandholdt Rd.
Field Crew:	Marco Sigala, Billy Jakl		Moss Landing, CA 95039

StationCode	Sample Type Code	Location Code	Field Rep	Sample Date	Collection Time	CollectionDepth wat (m) sed (cm) integrated (-88)	Salinity (ppt) EC (µS/cm)	Field Preparation Preservation	Water TSS 2 L HDPE	Water SSC 1 L HDPE		
518STIR00	Grab	X	1			0.1		None	1	1		
518STIR05	Grab	X	1			0.1		None	1	1		
518STIR09	Grab	X	1			0.1		None	1	1		
518STIR12	Grab	X	1			0.1		None	1	1		
518STIR14	Grab	X	1			0.1		None	1	1		
518WS0103	Grab	X	1			0.1		None	1	1		
507RCABRS	Grab	X	1			0.1		None	1	1		
524NFCTN1	Grab	X	1			0.1		None	1	1		
525BLDR01	Grab	X	1			0.1		None	1	1		
525NSLT01	Grab	X	1			0.1		None	1	1		
507DCABSF	Grab	X	1			0.1		None	1	1		
507DCBLLB	Grab	X	1			0.1		None	1	1		
507SPION1	Grab	X	1			0.1		None	1	1		
507SPISFD	Grab	X	1			0.1		None	1	1		
518LSTCHC	Grab	X	1			0.1		None	1	1		
518BENNER	Grab	X	1			0.1		None	1	1		
518COTNWD	Grab	X	1			0.1		None	1	1		
518DUFFYC	Grab	X	1			0.1		None	1	1		
525NSLT01	Grab	X	2			0.1		None	1	1		
								TOTAL	19	19	0	0

Comments:

Samples Relinquished by: Name (Print and Sign)	Date & Time	Samples Received by: Name (Print and Sign)	Date & Time
Marco Sigala			

Figure 7: Example Dr. Kalina Manoylov Chain-of-Custody Form

MPSL-MLML REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY (COC) RECORD

ProjectCode: SPI_Research_2023
AgencyCode: MPSL-MLML
Funding: Sierra Pacific Industries (SPI)
Date:
Field Crew: Marco Sigala, Billy Jakl

Contact Person: Marco Sigala
Phone: 831-771-4173
email: marco.sigala@sjsu.edu
Mailing Address: 7544 Sandholdt Rd.
Moss Landing, CA 95039

StationCode	Sample Type Code	Location Code	Field Replicate	Sample Date	Collection Time	CollectionDepth wat (m) sed (cm) integrated (-88)	Salinity (ppt) EC (µS/cm)	Field Preparation Preservation	Composite Volume (ml)	Sample Volume (ml)	GrabSize or Area Sampled (cm2)	Taxonomy Soft Algae[1] Quantitative	Taxonomy Diatoms[1] Quantitative	Taxonomy Soft Algae Qualitative
518STIR14	Integrated	X	1			-88	0.02	None						1
518WS0103	Integrated	X	1			-88	0.03	None						1
518BENNER	Integrated	X	1			-88	0.04	None						1
518DUFFYC	Integrated	X	1			-88	0.1	None						1
518STIR14	Integrated	X	1			-88	0.02	10% formalin						
518WS0103	Integrated	X	1			-88	0.03	10% formalin						
518BENNER	Integrated	X	1			-88	0.04	10% formalin						
518DUFFYC	Integrated	X	1			-88	0.1	10% formalin						
518DUFFYC	Integrated	X	2			-88	0.1	10% formalin						
518STIR14	Integrated	X	1			-88	0.02	10% formalin					1	
518WS0103	Integrated	X	1			-88	0.03	10% formalin					1	
518BENNER	Integrated	X	1			-88	0.04	10% formalin					1	
518DUFFYC	Integrated	X	1			-88	0.1	10% formalin					1	
518DUFFYC	Integrated	X	2			-88	0.1	10% formalin					1	
											TOTAL	0	5	4

Comments:
[1] Targeted sample
Run External QC sample on StationCode 518BENNER

Samples Relinquished by: Name (Print and Sign)	Date & Time	Samples Received by: Name (Print and Sign)	Date & Time
Marco Sigala			

Figure 8: Example NCL Chain-of-Custody Form

MPSL-MLML REQUEST FOR ANALYSIS AND CHAIN OF CUSTODY (COC) RECORD

ProjectCode:	SPI_Research_2023	Contact Person:	Marco Sigala
AgencyCode:	MPSL-MLML	Phone:	831-771-4173
Funding:	Sierra Pacific Industries (SPI)	email:	marco.sigala@sjsu.edu
Date:		Mailing Address:	7544 Sandholdt Rd.
Field Crew:	Marco Sigala, Billy Jakl		Moss Landing, CA 95039

StationCode	Sample Type Code	Location Code	Field Rep	Sample Date	Collection Time	CollectionDepth wat (m) sed (cm) integrated (-88)	Salinity (ppt) EC (µS/cm)	Field Preparation Preservation	Water Inorganics[1] 500 ml HDPE	Water Inorganics[2] 500 ml amber	Water Inorganics[3] 250 ml HDPE	Water Hardness[4] 250 ml HDPE	Water DOC[5] 40 ml amber
518STIR00	Grab	X	1			0.1		see Comments	1		1	1	5
518STIR05	Grab	X	1			0.1		see Comments	1		1	1	3
518STIR05	Grab	X	1			0.1		see Comments	1		1	1	3
518STIR09	Grab	X	1			0.1		see Comments	1		1	1	3
518STIR12	Grab	X	1			0.1		see Comments	1		1	1	3
518STIR14	Grab	X	1			0.1		see Comments	1		1	1	3
518STIR14	Grab	X	1			0.1		see Comments	1		1	1	3
518WS0103	Grab	X	1			0.1		see Comments	1		1	1	3
507RCABRS	Grab	X	1			0.1		see Comments	1		1	1	5
524NFCTN1	Grab	X	1			0.1		see Comments	1		1	1	3
525BLDR01	Grab	X	1			0.1		see Comments	1		1	1	3
525NSLT01	Grab	X	1			0.1		see Comments	1		1	1	3
507DCABSF	Grab	X	1			0.1		see Comments	1		1	1	3
507DCBLLB	Grab	X	1			0.1		see Comments	1		1	1	5
507SPION1	Grab	X	1			0.1		see Comments	1		1	1	3
507SPISFD	Grab	X	1			0.1		see Comments	1		1	1	3
518LSTCHC	Grab	X	1			0.1		see Comments	1		1	1	3
518BENNER	Grab	X	1			0.1		see Comments	1		1	1	3
518COTNWD	Grab	X	1			0.1		see Comments	1		1	1	3
518DUFFYC	Grab	X	1			0.1		see Comments	1		1	1	3
525NSLT01	Grab	X	2			0.1		see Comments	1		1	1	3
518STIR00	FieldBlank	X	1			0.1		see Comments					3
								TOTAL	21	0	21	21	72

Comments:

[1] Inorganics: Preservation = FieldAcidified (H_2SO_4) - Ammonia as N (NH_3); Phosphorous as P (total; TPHOS); Nitrogen, Total Kjeldahl (TKN); NO3+NO2

[2] Inorganics: Preservation = FieldFiltered - OrthoPhosphate as P (dissolved; OPO4)

[3] Inorganics: Preservation = None - Chloride (Cl); Sulfate (SO4)

[4] Hardness: Preservation= FieldAcidified (HNO3)

[5] DOC: FieldFiltered, FieldAcidified (H3PO4)

Samples Relinquished by:		**Samples Received by:**	
Name (Print and Sign)	**Date & Time**	**Name (Print and Sign)**	**Date & Time**
Marco Sigala			