Iipay Nation of Santa Ysabel
Tribal Water Quality
Environmental Program

QUALITY ASSURANCE PROJECT PLAN (QAPP)

For
WATER QUALITY ASSESSMENT AND MONITORING
2023

Prepared by
EcoRenew
San Jose, CA

For

Iipay Nation of Santa Ysabel Environmental Program

IIPAY NATION of SANTA YSABEL
QUALITY ASSURANCE PROJECT PLAN (QAPP)
WATER QUALITY ASSESSMENT AND MONITORING

ORGANIZATION:

Tribal Environmental Protection Agency (INSY-TEP)
Water Quality Department

APPROVALS

Signature: ______________________ **Date:** 7/20/2023

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Signature: ______________________ **Date:** 20 July 2023

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Signature: ______________________ **Date:** ______________________

Audrey Johnson, QA Manager, USEPA Region IX

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List of Acronyms

ASTM	American Society for Testing and Materials
BOD	biochemical oxygen demand
DBMS	database management system
DI	deionized
DQO	data quality objective
DTSC	Division of Toxic Substances Control
HCL	hydrochloric acid
ID	identification
IHS	Indian Health Services
SYRB	Santa Ysabel Creek Basin
LCS	laboratory control sample
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
MSR	Management Systems Review

OVM	organic vapor meter
PARCC	precision, accuracy, representativeness, completeness and comparability
PQL	practical quantification limits
PRP	potentially responsible parties
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
RPD	relative percent difference
SOP	standard operating procedure
STORET	Storage and Retrieval (US EPA water quality database)
TSA	Technical Systems Audit
US EPA	U.S. Environmental Protection Agency
V*	fine sediment load
VOA	volatile organic analyte
VOC	volatile organic compound
INSY-TEP	Tribe Environmental Protection Agency
µg/kg	micrograms per kilogram
µg/L	micrograms per liter

Distribution List

The following is a list of organizations and persons who will receive copies of this approved QAPP and any subsequent revisions:

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Alpha Analytical Laboratories, Inc., 2722 Loker Ave W, Ste. A, Carlsbad, CA 92010 (alpha-labs.com) will be performing the analyses.

Introduction

This Quality Assurance Project Plan (QAPP) has been prepared for the Iipay Nation of Santa Ysabel (INSY) tribe for water quality assessment and monitoring activities. These activities will take place on the Iipay Nation Reservation (INR) in San Diego, County (Figure 1) in the Santa Ysabel watershed. The INSY will be establishing water quality (WQ) standards to waters entering the INR. The tasks leading to the development of WQ standards involves the assessment and monitoring of waters within the identified program area (i.e., Santa Ysabel watershed and tributaries). This QAPP will be applied to all water quality monitoring and sampling activities undertaken by the INSY on INR lands. For water quality monitoring and sampling activities undertaken by the INSY Environmental Department outside of INR lands, this QAPP will be applied unless another approved QAPP has precedence within the jurisdiction where the monitoring or sampling is to be performed.

The purpose of this QAPP is to detail the quality assurance (QA) and quality control (QC) procedure and to document technical data generated during scientific projects (i.e., accurate, precise, complete, and representative). QA is defined as an integrated program designed to assure reliability and repeatability of monitoring and measurement data. QC is defined as the routine application of procedures to obtain prescribed standards of performance in the monitoring and measurement process. This QAPP is consistent with guidelines set forth in the U.S. Environmental Protection Agency (US EPA)'s *Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5* (US EPA, 1998) and *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (US EPA, 1998). These and other documents used in the preparation of this QAPP are listed in the References section at the end of this QAPP.

This QAPP outlines the planning, implementation, and assessment criteria required by the USEPA, which applies to all INSY Environmental Department projects involving the generation, acquisition, and use of environmental water quality data. Water quality on the INR needs continual assessment to ensure the health and well-being of the many Tribal and community members who depend on local water sources for all household needs. Additionally, these assessments will protect many natural resources and the ecosystem supporting essential INSY cultural sustenance and lifeways.

This QAPP is intended to be comprehensive. The methods, procedures, and techniques described include procedures used during WQ (surface water, groundwater, aquatic life) assessment and monitoring activities without implying that all described procedures will be used. The specific tasks to be conducted as part of the program will be identified in task- or phase-specific field sampling plans. As necessary or appropriate, additional or modified procedures may be presented in addenda to this QAPP or may be required due to unanticipated field conditions. If procedures are modified in the field, the modifications will be approved by the Iipay Nation Tribal Environmental Program (INSY-TEP) Manager and/or Project QA Officer and completely documented in a field notebook and in appropriate reports. Appropriate persons (e.g., INSY Environmental Director, EPA R9 PO, EPA R9 QA Manager) will be advised of significant changes or modifications in procedures before they are made.

Problem Definition/Background

Geographic Setting

The **Santa Ysabel Reservation** is in northeastern San Diego County, California (Figure 1). The reservation is currently ~17,000 acres divided into three parcels. The original reservation was founded in 1893 and encompassed ~15,000 acres. The Santa Ysabel Indian Reservation ranges from 3,200 feet to 5,700 feet in altitude. The reservation is in the mountains of the eastern Transverse Range and the Peninsular Ranges. Transverse and Peninsular ranges are north-to-south trending mountains gradually sloping west to the coastal plain. The eastern side sharply slopes eastward to the Salton Trough. This mountainous region is underlain by Jurassic aged plutons, which are primarily composed of uplifted granite, granodiorite, and quartz diorite overlying folded marine sediments (Todd, 2015). The ecology of this mountainous topography contains patches of mixed evergreen woodland consisting mostly of bigcone Douglas-fir and canyon live oak. These fragmented, compact groves typically occur in deep canyons and on steep north-facing slopes. This area contains a mix of coniferous forest with ponderosa pine, Jeffrey pine, sugar pine, white fir, incense cedar, hardwoods such as canyon live oak and black oak, and areas of montane chaparral.

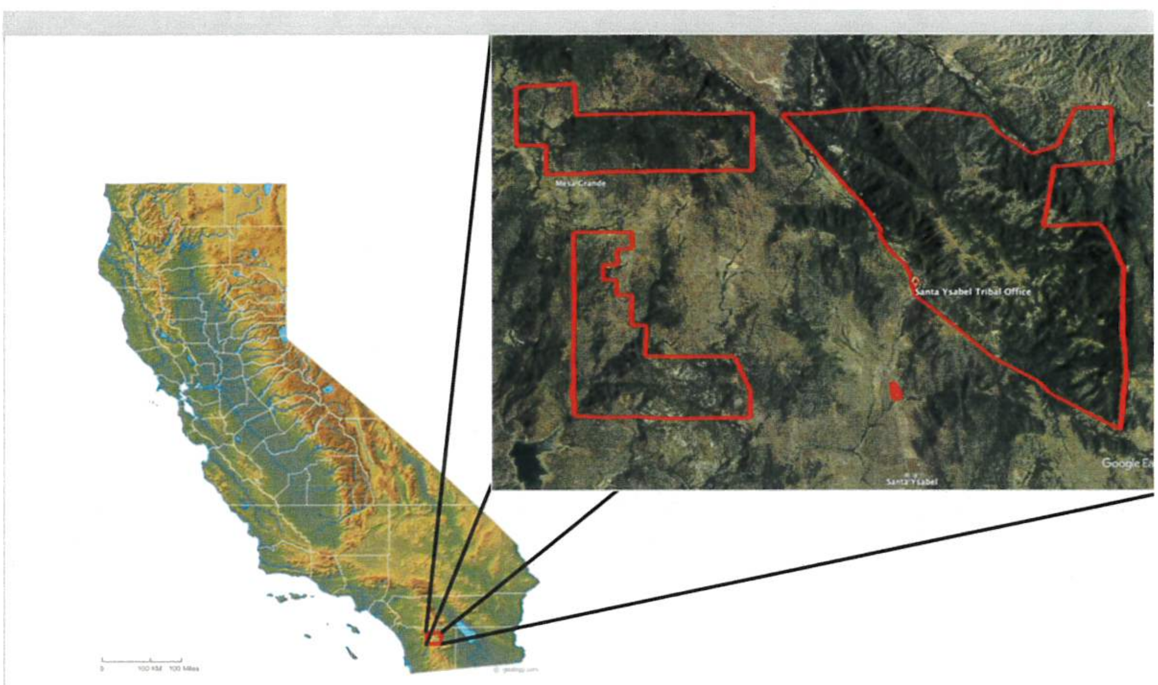

Figure 1. Location map of the Iipay Nation of Santa Ysabel Reservation in north-eastern San Diego County, CA. Inset is a Google Earth image of the three Iipay Nation land parcels.

The Santa Ysabel Creek and its tributaries (Figure 2) have traditionally defined the location and shape of the INSY Tribal ancestral lands, and account for virtually all waters entering or originating on the INR. The INR is located between the Carrizo Creek watershed and the Santa Ysabel Creek watershed (Figure 2).

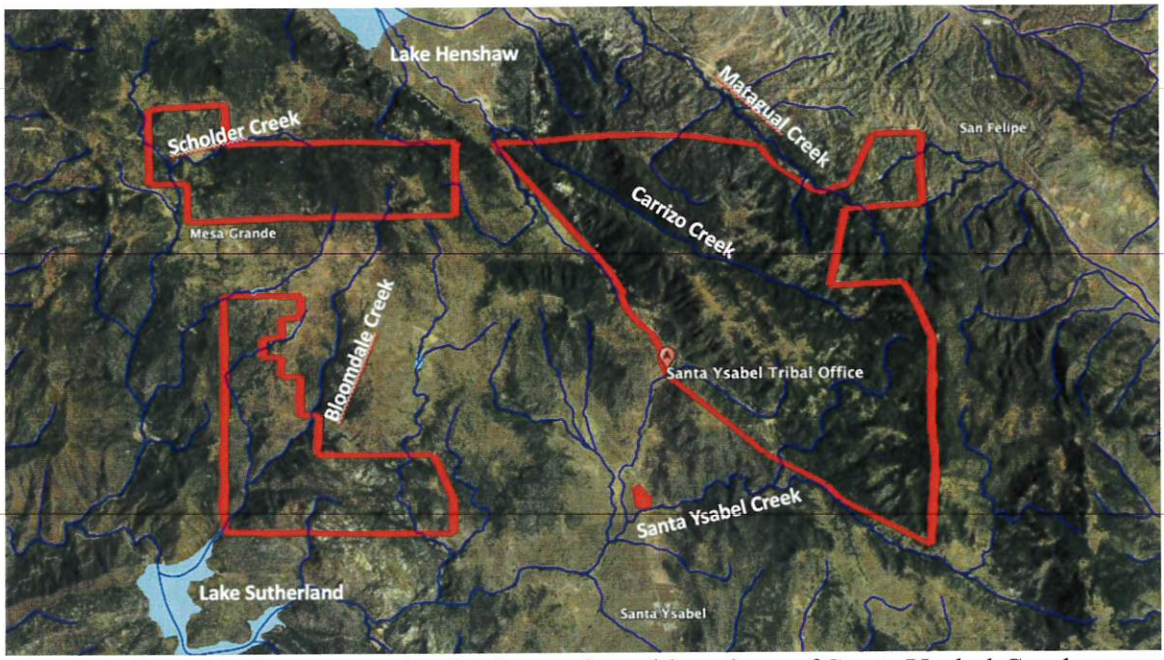

Figure 2. Iipay Nation reservation land parcels and locations of Santa Ysabel Creek, Carrizon Creek Matagual Creek, Scholer Creek, Bloomdale Creek and their tributaries.

San Diego County has a Mediterranean climate. As seen in Figure 2, INR is in the headwaters of the Santa Ysabel Creek. Santa Ysabel Creek, Scholder Creek and Bloomdale Creek flow into Lake Sutherland. Carrizo Creek and Matagual Creek flow into Lake Henshaw. The main creeks are perennial and fed by seasonal rainfall and springs during the dry season. These waterways support the INR residents' household water needs and agriculture activities, predominantly cattle grazing. Soils of the Traverse and Peninsular ranges typically contain Quaternary alluvium (Calpine coarse sandy loam, Crouch coarse sandy loam, Crouch rocky coarse sandy loam, Holland fine sandy loam, Holland stony fine sandy loam - deep, Holland stony fine sandy loam, Loamy alluvial land, Reiff fine sandy loam, Sheephead rocky fine sandy loam, and Tollhouse rocky coarse sandy loam.

Water Quality Issues for the INSY

Activities such as hunting, gathering food and culturally significant materials are particularly important to INSY Tribal members. Tribal people have long depended on plants and wildlife for subsistence and ceremonial uses. The quality and quantity of water in the Santa Ysabel Creek Basin must be maintained at a level that protects the natural resources (e.g., fish and wildlife) and ensures safe drinking water and basic sanitation needs for INR residents.

Currently, there is no documented scientific data regarding water quality conditions on the Santa Ysabel Creek Basin on the Iipay Nation Reservation. However, the US Geological Survey (USGS) maintains a gaging station in Ramona, CA, which is approximately 15 miles downriver from the INR. Land uses impacting water quality include grazing, road construction and maintenance.

Iipay Nation of Santa Ysabel reservation land is in the upper watersheds of Santa Ysabel Creek, Carrizo Creek and Matagual Creek. Water quality problems in the Santa Ysabel Creek Basin and its tributaries are not well documented. Comparability of data among different areas and sources of collection is uncertain. Majority of water flowing through the INR is derived from seasonal rainfall and springs. The water quality regarding human needs, as well as the needs of fish and wildlife, is unknown. The goal of this QAPP is to provide a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality and ensure that data generated by any collection participant is comparable.

Program Description

The purpose of assessing the Santa Ysabel Creek Basin is to establish baseline data for future monitoring of surface and groundwater quality and quantity on the INR with respect to human drinking and household water needs. Of the utmost importance is the protection of all beneficial uses of surface and ground water. In conjunction with the assessment, a monitoring program of the habitat needs of various species and life history stages of native Santa Ysabel Creek Basin wildlife, aquatic life and plants will be conducted. Grants from the U.S. Environmental Protection Agency (US EPA) have been awarded to the INSY Environmental Department (e.g., General Assistance Program, Clean Water Act Section 106, Wetlands Program Development) to build and establish environmental protection services.

The objectives of the data gathering activities, conducted as part of the water quality assessment, are to develop a baseline database of measurements to observe longterm trends, analyze those trends, and implement approved water quality standards. These data generated from the assessment and monitoring activities also will be used to identify the types of projects that should be undertaken to restore and improve water quality.

This document describes the procedures to be followed during water quality assessment and monitoring activities. These activities could include drilling wells and piezometers; lithologic and geophysical logging of boreholes; installing and testing wells and piezometers; collecting groundwater, surface water, drinking water, sediment and biological (pathogens, aquatic macroinvertebrate) samples; and performing aquifer testing. In addition, quantitative precision, accuracy, and completeness and qualitative comparability and representativeness data quality goals are established. Procedures for managing, validating, and reporting data and corrective action functions are also described.

The Tribal water quality-monitoring program will address water quality both in drinking water sources (surface and groundwater) and surface and ground waters not used as drinking water sources.

Where drinking water sources are being assessed, monitoring will be primarily for:

- Metals
- Turbidity
- Volatile organic compounds (VOCs)
- Pathogens (fecal coliform, Escherichia coli (E. coli), total coliform)

In surface waters not used as drinking water sources, monitoring will focus on parameters affecting cultural practices, wildlife and aquatic life, which may include:

- Discharge and velocity
- Flow rates
- Temperature
- Turbidity
- Dissolved oxygen levels
- Nutrients (nitrogen and phosphorus)
- Fine sediment loads (V*) in pools (residual or stagnant)
- PH
- Biochemical oxygen demand (BOD)
- Benthic macroinvertebrates (BMI)
- Chlorophyll
- Aquatic biota (e.g., macroinvertebrate and fish counts)
- Suspended sediment concentrations (entrained)
- Pathogens
- Rainfall

In groundwaters not used as drinking water sources, monitoring will focus on the presence of:

- Hydrocarbons
- Metals
- VOCs

Note: if data determines these elements are not present, sampling and laboratory analysis will discontinue or be decreased for these elements.

These include procedures for the operation, care, and maintenance of equipment with guidelines for specifications ensuring accuracy, precision, completeness, comparability, and representativeness. These procedures and guidelines are adopted from manufacturer's recommendations and specifications for instrument use and further procedures for QA/QC may be adopted pursuant to appropriate scientific community accepted standards.

The INSY-TEP water quality monitoring program will be ongoing and continue indefinitely or until terminated by the INSY Environmental Department. INSY-TEP personnel will be trained and certified (where appropriate). Program QA/QC reporting will be performed using the standard forms provided in Appendix III, which are accompanied by explanatory documentation as appropriate.

Quality Objectives and Criteria for Data

The primary goal of the QAPP is to ensure that the data generated by the program is comparable (i.e., data collected by different staff members or contractors at different times and locations) will be compatible for inclusion in common databases. This will be achieved through a combination of common methods (where appropriate) and performance-based standards. Where common methods have been agreed upon for INSY-TEP, QA/QC measures will be used to assure that methods are applied consistently. Where performance-based standards are appropriate, QA/QC measurements will be used as a measure of performance. The appropriate QA/QC procedures for most all the assessment and monitoring program components (e.g., field operations, water quality, and flow study) have been established by INSY-TEP unless adopted from other successful programs.

Program Quality Assurance Objectives

The overall QA objectives are to develop and implement procedures for obtaining and evaluating data in an accurate, precise, and complete manner so that field measurements, sampling procedures, and analytical data provide information that is comparable and representative of actual field conditions.

Preliminary goals for accuracy and precision have been established for the results of historical chemical analyses of both, where available, field and laboratory QC samples. Sample media and methods have subdivided these goals. In general, these goals have been established as follows:

- For analyses of field QC samples, the goals are based on: (1) the appropriateness of specific types of QC samples for each sample medium, as dictated by sampling limitations, (2) the intended use of the data, and (3) the inherent variability in field QC samples.
- For analyses of laboratory QC samples, the goals are consistent with the Data Quality Objectives, as appropriate.

The precision and accuracy of the analytical laboratory results will be calculated from the analytical results of the QC samples. These results will be presented in summary form in the appropriate data reports.

The program goals for accuracy and precision do not reflect the acceptable variations in data quality that occur when chemicals are detected at or near the achieved detection limits and will not be used to prejudice data near those limits. For example, the analysis of low concentration field duplicate samples may result in low precision (high relative percent difference, or RPD) but the results may still be fully acceptable (e.g., values of 0.5 and 6.0 micrograms per liter [mg/L} of chloroform in duplicate samples analyzed by EPA Method 8010 result in an RPD of 164 percent, but the data are still of acceptable precision). Generally, if the values are within five times the detection level, a high RPD is acceptable.

A goal of 80 to 85 percent completeness has been established for the program chemical data. However, the required level of completeness will vary with the data quality needs of different aspects of the program. If all expected data are not available or suitable to support an aspect of the assessment or monitoring activities, the available data will be specifically assessed to determine if they are adequately complete, or if additional data should be acquired.

The comparability of the data will be maintained using standard analytical methods and by reporting all values in consistent units. For example, no mixtures of English and metric units will be reported for depths, distances, elevations, and such. Related analytical data will be reported in consistent units; solids in milligrams or micrograms per kilogram (mg/kg or mg/kg), fluids in milligrams or micrograms per liter (mg/L or mg/L), or the units given in an approved reference methodology. Results of standard and non-standard analyses will not be compared without explicit presentation of the differences in the methods and their expected effect on the comparability of the data.

The representativeness of the data will be maintained by following appropriate and consistent procedures for drilling, well installation, sample collection, aquifer testing, and other types of data collection, as well as by the application of approved, standard analytical methods. Field QA/QC samples will be used to provide information on the representativeness of the field-sampling event.

A system of corrective actions will be initiated as necessary should the above goals not be met.

Measurement Performance Criteria: Comparability and Representativeness

Data quality objectives (DQOs) are established to ensure that data used to prove or disprove a given hypothesis are of sufficient quality to support or defend the results obtained. The hypothesis formulated for this program is that the waters within the Santa Ysabel Creek Basin have been impaired, physically, chemically, and biologically, by land uses within the respective watersheds. However, because the data will be used to formulate Tribal policy, DQOs that are tailored to the needs of the program need to be addressed.

Qualitative DQOs are defined by two terms: **comparability** and **representativeness**.

- **Comparability**: For the purposes of this program, **comparability** is defined as the degree of uniformity that the methodology used to collect a set of data has with the methodology used to collect another set of data. It reflects the degree of difficulty one would have in comparing and/or merging the two data sets because of differences in the methods used. The typical approach used to maximize comparability is to use universally standard techniques.

- **Representativeness**: For the purposes of this program, **representativeness** is defined as the degree to which a subset of data collected reflects the characteristics of a larger set of data, which could be collected, assuming the subset is a part of the larger set. It assumes that one does not have to sample an entire population to determine the characteristics of the population. Generally, the larger the subset of the population that is sampled, the greater confidence in the results. The homogeneity of the total population and degree the subset reflects the profile of the total population also will have a major influence on the results. The typical approaches used to maximize representativeness are to increase the size of the subset that is sampled, and to check that there is no bias in the sampling methodology (i.e., sampling is truly random).

All the techniques that will be used in this program have the inherent sensitivity needed by the program. Comparability will be enhanced using standard procedures for each technique This is the most effective and efficient means of utilizing the resources available to the program.

Special Training Requirements/Certifications

Staff involved in the collection of water quality and quantity samples, physical measurements, and any other data pertaining to the assessment and monitoring activities will be trained according to US EPA specified field sampling techniques and procedures. For example, a Water Quality staff person who is measuring water temperature, as a component of an aquatic life study will be trained by their supervisor to employ a measuring method consistent with US EPA approved techniques. In addition, staff will be trained in areas of health and safety when working in hazardous conditions plus database management (e.g., STORET/WQX) and automated data collection methods. Certified program staff will participate in further training as appropriate to refresh program-related skills or to expand INSY-TEP's pool of relevant, available in-house skills. Certifications for specific skills and requirements will be kept current and on file at the INSY Tribal Water Quality Offices in INSY California. Training levels of contractors used will be equivalent or higher than tribal staff, when used and will be documented (i.e., resumes, etc.)

Documentation

Documentation and records of the data collected by the INSY-TEP will be stored and compiled electronically with copies of the records stored in a separate location. Reports of compiled study results will be released/distributed according to the urgency and types of data collected and the amount of time and resources required for preparation. It is the responsibility of the INSY-TEP Environmental Director to prepare and maintain amended versions of the QA Project Plan and to distribute the amended QA Project Plan to the individuals identified in the Distribution List.

Field Operation Records

In the field, records will be documented in several ways, including field logbooks, photographs, pre-printed forms (such as labels and chain-of-custody forms), corrective action reports, and field audit checklists and reports.

Field Documentation and Records

Field activities must be conducted according to the appropriate SOPs (Appendix II A-H). It is the responsibility of the Environmental Director to always maintain updated revisions of SOPs and to distribute updated SOPs to the Environmental Specialist or Technician, as appropriate. All documentation generated by the sampling program will be kept on file in the office of the INSY-TEP Environmental Department.

The information on the sample label or tag must link the collected sample to the field sheet or Chain of Custody (COC) documentation and must be written legibly and in indelible ink. The label or tag shall be attached so that it does not contact any portion of the sample that is removed or poured from the container.

Person performing environmental sampling must always assume the medium (i.e., water, soil, sediment) is hazardous to one's health. The samples can have toxic, corrosive, explosive, and flammable properties. As a safety precaution, any sample suspected to be hazardous or heavily contaminated should be identified as such on sample labels, field sheets and COC documentation.

Field Logbooks

All field measurements will be recorded on designated field logs that will reflect the environmental conditions, sample location, equipment calibration data, and analyte measurement values. Field sampling personnel will legibly record in indelible ink at least the following information for each sample collected:

- Field measurements and observations, such as weather conditions, noticeable odors, etc.
- Sample identification number.

- Sample collection date and time.
- Sample location and depth.
- Collection of any field duplicates or QC samples.
- Type of sampling equipment and cleaning procedures.
- Sampler's name.
- Signature of the individual making the entries.

In addition to the sampling information, the following specific information will also be recorded in the field logbook for each day of sampling:

- Team members and their responsibilities.
- Time of arrival/entry on site and time of site departure.
- Other personnel on site.
- Deviations from sampling plans, site safety plans, and QAPP procedures.
- Changes in personnel and responsibilities with reasons for the changes.
- Levels of safety protection.
- Calibration readings for any equipment used and equipment model and serial number.

The information collected in these logs will be transferred into computerized data spreadsheets and the actual field documentation will be kept in chronological order in an appropriately designated project file. Forms will be available on write-in-the-rain paper from the Environmental Director. **Note:** After entering the required information, the field sampler must sign the field logbook entry.

Photographs

Photographs will be taken upstream and downstream at the sampling locations and at other areas of interest on site or sampling area. They will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook:

- Time, date, location, and weather conditions.
- Description of the subject photographed.
- Name of person taking the photograph.

Sample Labeling

Immediately after each individual water sample is collected, the sample container will be dried, labeled with a unique sample designation, and stored in an ice chest chilled to 4° Celsius. Samples will be maintained at this temperature both in the field and while in laboratory custody pending chemical analysis.

All sample containers must be labeled or tagged to prevent misidentification of samples. Each sample will be designated with a unique number that will include a six-digit date and the military time of sample collection, combined with the sample point, analysis requested, collector, and preservative(s). The format will be date, time, and sample point.

For example, a sample collected on October 12, 2023 at 1:00 pm at sample point SY1 will be identified as: 10122023:1300:SY1. All sample bottles filled at this sample location will be given the same number. In an ambient water quality monitoring program, QC check samples should be collected randomly every sampling period. The contract laboratory should not know the identity of field duplicate samples. Field duplicate, split or field blank can be given their own identification (ID) number. For example, if there are 6 samples (i.e., SY1-6) sites being sampled monthly or bi-annually, the duplicate sample can be labeled SY7 and the field blank SY8. It should be noted in the field logbook and/or on the field sheets what site the field duplicate sample represents (i.e., SY1-6).

If double volumes are collected for QC samples, all bottles will be given the same designation. This system of labeling prevents the inadvertent designation of two samples with the same sample identification. Where duplicates are collected, the sample will be labeled with date, time and a unique identifier (e.g., 10122023:1300:SY1 or CC, MC, 1-6, etc.). Field blanks will be labeled in the same way (e.g., 10122023:1300:SY2, or CC, MC, etc.). The field logbook or field sheets will reflect the type of sample it is using standardized field QC identifier codes in Table 1.

Table 1. Field QC Identifier (QA/QC Codes). USEPA required standard codes for QA/QC samples. Note: These codes are used to denote "sample type."

QC CODE	QC IDENTIFIER	DEFINITION
FBB	field bottle blank	Similar to trip blank but exposed to ambient field conditions and preserved in the field.
FD2-FD9	field duplicate - nth member	The second through the ninth additional aliquots which logically follow FD1. If more than one aliquot is used, all names are changed from duplicates to replicates. Codes do not change.
TRB	trip blank	An aliquot of reagent water used to establish contamination from shipping.

Field Quality Control Sample Records

Field QC samples, such as the duplicates and blanks, will be labeled as either duplicates or blanks in the field logbooks. They will be given unique (fictitious) sample identification numbers and will be submitted "blind" to the laboratory (i.e., only the field logbook entry will document their identification and the laboratory will not know these are QC samples). The frequency of QC sample collection will also be recorded in the field logbook.

Sample Chain-of-Custody Forms and Custody Seals

The procedures and methods for maintaining chain of custody are included in Appendix III. The chain of custody forms and custody seals will be provided by Alpha Analytical Laboratories, Inc. The forms will be used to document collection and shipment of samples for off-site laboratory analysis, while the seals will serve to ensure the integrity of (i.e., there has been no tampering with) the individual samples. All sample shipments will be accompanied by a chain-of-custody form. The forms will be completed and sent with each shipment of samples to the laboratory. If multiple coolers are sent to a laboratory on a single day, forms will be completed and sent with the samples for each cooler. The original form will be included with the samples and sent to the laboratory. Copies will be sent to the INSY-TEP Environmental Director.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of the field personnel, who will sign the chain-of-custody form in the "relinquished by" box and note the date, time, and air bill number. A self-adhesive custody seal will be placed across the lid of each sample container/bottle. The shipping containers in which samples are stored will also be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping, as well as during shipping. All custody seals will be signed and dated. Procedures for completion and distribution of the chain-of-custody forms, as well as the use and placement of the custody seals, are included in Appendix III.

Laboratory Documentation and Records

The analytical laboratory will keep a sample receiving log and all completed chain-of custody forms submitted with the samples collected for this project. The analytical laboratory will also keep records of all analyses performed, as well as associated QC information, including laboratory blanks, matrix spikes, laboratory control samples, and laboratory duplicates. Hard copy data of the analytical results will be maintained for six years by the laboratory. The data package submitted to INSY-TEP should consist of five sections:

- Case narrative.
- Chain-of-Custody (COC) documentation.
- Summary of results for environmental samples.
- Summary of QA/QC results; and
- Raw data.

Summaries of data and results may be presented in a Contract Laboratory Program (CLP) type format or any equivalent that supplies the required information as stated below. All laboratory data qualifiers shall be defined in the deliverable. In cases where the laboratory has varied from established methodologies, they are required to include the Standard Operating Procedures (SOPs) for those methods as an attachment to deliverables. Inclusion of SOPs in deliverables will aid in final review of the data-by-data reviewers and users. The data generated by the laboratory for each sampling event will be compiled into individual data packages/reports. The data packages will include the following information:

Project narrative including a discussion of problems or unusual events (including but not limited to the topics such as: receipt of samples in incorrect, broken, or leaking containers, with improperly or incompletely filled out chain-of-custody forms, with broken chain-of-custody seals, etc.; receipt and/or analysis of samples after the holding times have expired; summary of QC results exceeding acceptance criteria; etc.). The case narrative will be written on laboratory letterhead and the release of data will be authorized by the laboratory manager or their designee.

The Case Narrative will consist of the following information:

- Client's sample identification and the corresponding laboratory identification
- Parameters analyzed for each sample and the methodology used. EPA method numbers should be cited when applicable.
- Whether the holding times were met or exceeded.
- Detailed description of all analytical and/or sample receipt problems encountered.
- Discussion of reasons for any QA/QC sample result exceedances.
- Discussion of any manual integrations.
- Observations regarding any occurrences which may adversely impact sample integrity or data quality.

Sample data and associated Quality Levels

Copies of completed sample receiving logs and chain-of-custody forms for each sample shall be submitted in the data package (EPA, 1998). Copies of any internal laboratory tracking documents should also be included.
Chain-of-Custody forms and/or internal laboratory tracking documents will include the following information:

- Date and time of sampling and shipping.
- Sampler and shipper names and signatures.
- Type of sample (grab or composite).
- Analyses requested.
- Project, site, and sampling station names.
- Date and time of sample receipt.
- Laboratory sample receiver name and signature.
- Observed sample condition at time of receipt.
- Sample and/or cooler temperatures at time of receipt.
- Air bill numbers.
- Custody seal.
- Sample numbers.
- QC check sample records and acceptance criteria.

All data packages will be reviewed by the Laboratory QA Officer to ensure accurate documentation of any deviations from sample preparation, analysis, and/or QA/QC procedures; highlights of any excursions from the QC acceptance limits; and pertinent sample data. Once finalized, the Laboratory QA Officer will provide the data packages/reports to the Laboratory Project Manager who will sign them and submit them to the INSY-TEP Environmental Director or Field Technician. Any problems identified by the Laboratory QA Officer will be documented in the narrative part of the tribe's report. Information about the documentation to be provided by analytical laboratory is also contained in Alpha Analytical Laboratories, Inc. QA Manual (Appendix I), and California Department of Fish & Game manual (Appendix II-B).

Technical Reviews and Evaluations

As part of the QA efforts for the project, on-going technical reviews will be conducted and documented by the Environmental Director and/or the designated QA Officer. These reviews are associated with both field activities and the data generated by the off-site laboratory.

Field Audit Reports

The INSY-TEP Environmental Director, or QA Officer, or designated field auditor will randomly observe selected sampling events to ensure sample collection and field measurements are going according to plan. The results of the observations will be documented in a designated QA Audit Logbook, or in a field sampling audit checklist (e.g., https://www.epa.gov/airmarkets/field-audit-checklist-tool-fact).

The logbook or checklist is to ensure the field auditor has reviewed the relevant field operating procedures and is aware of any special sampling techniques required to perform the sampling activities.

Once back in the office, the Environmental Director will formalize the audit in a Field Audit Report to be forwarded to the INSY-TEP Water Quality Technician/Field Sampler. The Field Audit Report will include a copy of the logbook or field audit checklist.

Corrective Action Reports (following Field Audits)

Corrective action reports will be prepared by the INSY-TEP Water Quality Technician/Field Sampler in response to findings identified by the INSY-TEP Environmental Director during field visits and audits. The reports will focus on plans to resolve any identified deficiencies and non-compliance issues that relate to on-going activities and problems of a systematic nature, rather than on one-time mistakes. Corrective Action reports do not have a specific format, but will be handled as an internal memorandum which will be kept on file with the relevant Field Audit Report.

Laboratory Data Review Checklist

All laboratory review of data will be conducted by Alpha Analytical Laboratories in accordance with the QA Plan (Appendix I). A copy of the Audit Checklist and Corrective Action Report (Appendix I – Alpha Analytical Laboratories will be provided by the Laboratory Manager to the INSY-TEP Environmental Director.

Quarterly and Annual Reports

The INSY-TEP Environmental Director is responsible for the preparation of quarterly reports and annual reports to be submitted to the US EPA Grants Project Officer. The quarterly reports are to be submitted approximately sixty days after the completion of each sampling event. The annual reports are to be submitted in lieu of the last quarterly report for each year and are inclusive of the entire year's activities.

The quarterly report should include, at a minimum:

- Table summarizing the results,
- Final data package (including QC sample results),
- Brief discussion of the field and laboratory activities, as well as any deviations, or modifications to the plans,
- Copies of Field Audit Reports and any associated Corrective Action Reports,
- Copies of Field Activities Review Checklists and Data Review Checklists,
- Discussion of any problems noted with the data, either from laboratory or
- field problems,
- Discussion of any data points showing exceedance of Action Levels, and
- Recommendations/changes for the next sampling event.

The annual reports should include at a minimum:

- Description of the project,
- Table summarizing the results (of all project data collected to date),
- Final data package for the fourth quarter (including QC sample results),
- Discussion of the field and laboratory activities, as well as any deviations, or
- modifications to the plans,
- Trends observed because of the year's monitoring efforts,
- Copies of Field Audit Reports and any associated Corrective Action
- Reports (for the fourth quarter),
- Copies of Field Activities Review Checklists and Data Review Checklists (for the fourth quarter)
- Evaluation of the data in meeting the project objectives, including data
- exceeding Water Quality Standards (WQS),
- Recommendations to the Tribal Council regarding exceedances which are occurring on an on-going basis, and
- Recommendations/changes for future project activities

ßSampling Process Design (Experimental Design)

The Iipay Nation of Santa Ysabel Quality Assurance Project Plan (QAPP) for surface water and groundwater quality and aquatic life data assessment has been developed with the use of federal Environmental Protection Agency (EPA) Clean Water Act Section (106) funds. This document is written in accordance with the EPA Requirements for Quality Assurance Project Plans, (EPA QA/R-5, March 2001; EPA IT/IM Directive No. CIO2105-S, 2023). All sampling and analysis will be conducted in compliance with 40 CFR 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, as amended.

Objective of the INSY water quality program is to assess tribal water resources (surface and groundwater). Representative water quality data will be collected and analyzed according to the QAPP and added into the Tribal Water Quality Database. The INSY Water Quality Assessment Report will provide an assessment of Tribal Waters (sources of water quality stressors, water quality trends). Water quality and quantity data will be used to determine natural resource and non-point source management program design and implementation measures, and development and attainment of water quality standards.

The INSY QAPP will be reviewed annually and updated as necessary, in coordination with USEPA Region IX Quality Assurance Office. The success of INSY's water quality assessment program will be determined according to the degree to which Tribal CWA grant and QAPP objectives are being met.

The INSY-TEP would review and approve all site-specific sampling plans on the INR.

Scheduled Program Activities

The INSY-TEP water quality-monitoring program is still under development. Approval of this QAPP in conjunction with separately developed sampling plans will serve as the foundation of strong future sampling and monitoring plans.

Design of Sampling Plans

Sampling plans will be developed as required, and will at a minimum contain the following elements:

- Introduction
- Background
- Project Data and Quality Objectives
- Sampling Rationale
- Request for Analysis
- Field Methods and Procedures
- Sample Containers Preservation and Storage
- Disposal of Residual Materials

- Sample Documentation and Shipment
- Quality Control
- Field Variances
- Field Health and Safety Procedures
- Validation of Non-Standard Methods

Introduction

The goals of the INSY monitoring and assessment program is to acquire water quality data to use for future protection and sustained use of Tribal water resources, protection of public health and welfare, and the enhancement of water quality.

Background

The Tribe intends to protect and improve surface water and groundwater resources through habitat evaluation, planning, implementation, education, community outreach, and water quality monitoring. The objective of this study/monitoring program is to evaluate water quality trends from the major water resources on the reservation. Results of this study will provide important baseline information on the occurrence and trends of water quality on the INSY Reservation.

Project Data Quality Objectives

Monthly surface water (Scholder Creek, Bloomdale Creek, Carrizo Creek (up- and downstream), Matagual Creek, Schoolhouse Creek (up- and downstream), Wendy's Creek (up- and downstream) and Santa Ysabel Creek) and groundwater (San Felipe Well, Shallow Well, Main Well, Backup Well, Canyon Well, Mountain Well) sampling and annual benthic invertebrate sampling will allow comparison to Tribal water quality standards and/or established US EPA criteria. Groundwater sampling will occur monthly at the sites designated in Figure 3. Surface water sampling will occur monthly at sites seen in Figure 4. Benthic macroinvertebrate sampling will occur annually at all the surface water quality monitoring sites during the determined index period (July-August) established for the location of Tribal Reservation (i.e., latitude, elevation, climate).

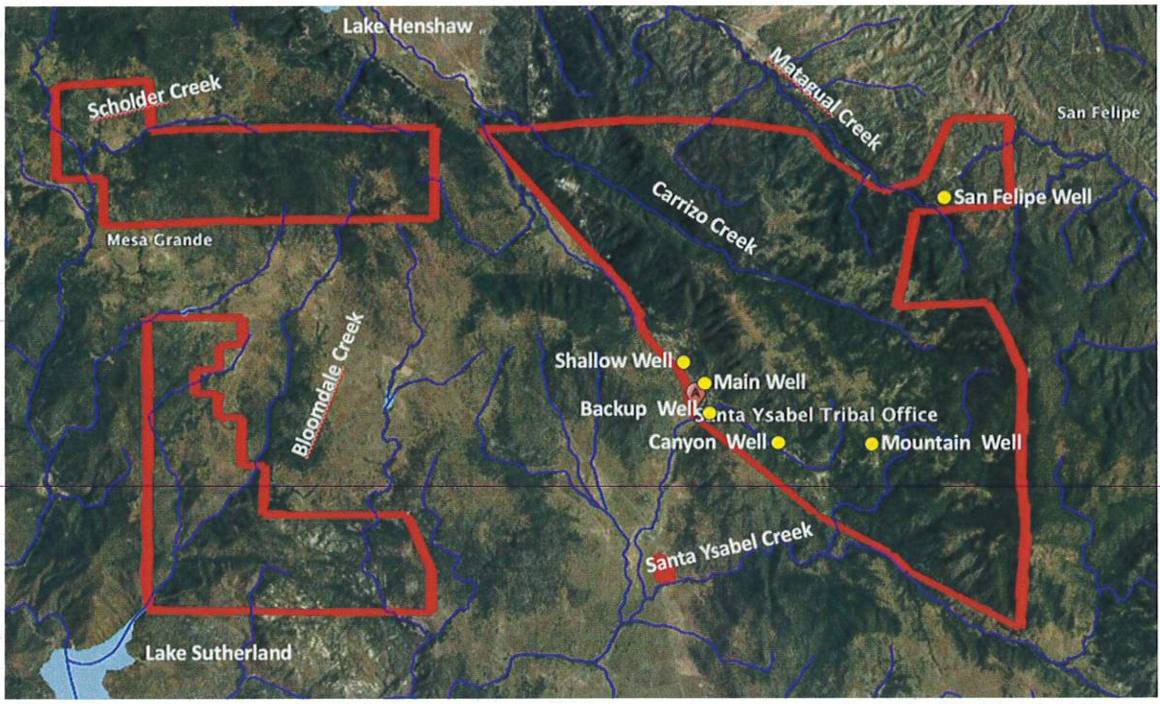

Figure 3. Location map of Iipay Nation Tribal groundwater sampling wells (San Felipe Well, Shallow Well, Main Well, Backup Well, Canyon Well, Mountain Well).

The development of water quality standards as a function of the water quality monitoring program will be fundamentally dependent on

- Existing water quality characteristics,
- The relative degree and/or rate that these characteristics are, or may be, degrading over time,
- Acceptable tolerances for the long-term management of these characteristics considering potential land and consumptive uses.

Therefore, the basic questions that sampling data will be answering are:

- What is the existing water quality within the INSY ecosystem?
- What are the effects of current land uses on the INSY ecosystem?
- Are there empirical indications of detrimental effects on the water quality
- of the INSY ecosystem?
- Based on the water quality characteristics established to be inherent to the INSY ecosystem, what water quality standards should be adopted and enforced?

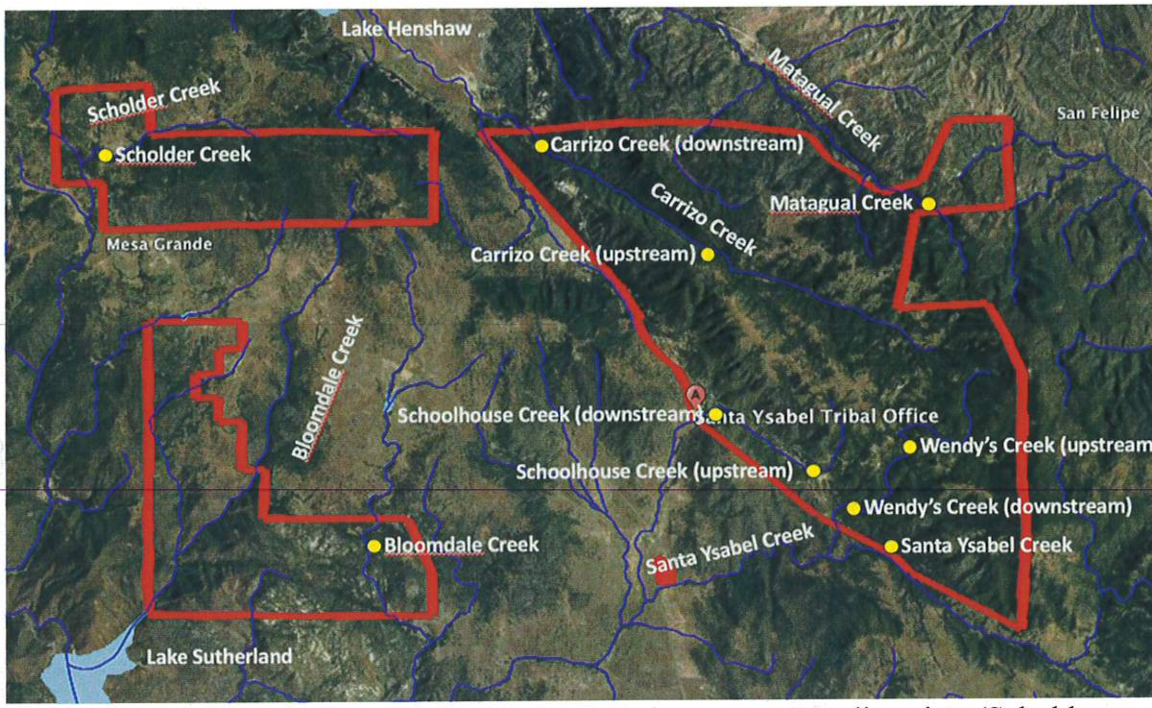

Figure 4. Location map of Iipay Nation Tribal surface water sampling sites (Scholder Creek, Bloomdale Creek, Carrizo Creek (up- and downstream), Matagual Creek, Schoolhouse Creek (up- and downstream), Wendy's Creek (up- and downstream) and Santa Ysabel.

As data are collected, they will be compared with any available historical and State of California water quality data to estimate baseline conditions and the relative change in these conditions over time. Concurrently, as data are compiled, a comparison between the observed water quality characteristics reflecting the INSY ecosystem will be evaluated against existing surface water quality standards and criteria to identify possible water quality discrepancies. As these discrepancies are, or may be, identified, they will be incorporated into the water quality management planning process. The water quality monitoring program may be modified to either increase or decrease the number of parameters monitored depending on the implications and conclusions generated from the analytical results and subsequent informational requirements.

The Tribe's DQO process parallels the EPA DQO process. Data quality indicators (DQIs) for the analysis of samples will include method sensitivity, analytical accuracy and precision, contamination, and completeness (Tables 2, 3 and 4). The acceptable criteria and associated data quality indicators discussed below were chosen to 1. quantify the uncertainty levels (error) associated with the analytical data produced for this project, and 2. ensure that the chosen uncertainty levels will not compromise study objectives. See Table 2 for a list of quality threshold and reporting limits.

Action Limits (Quality Thresholds)

Quantitative measurements that estimate the true value or concentration of a physical or chemical property always involve some level of uncertainty. The uncertainty associated with a measurement generally results from 1) natural variability of a sample; 2) sample handling conditions and operations; 3) spatial and temporal variation; and 4) variations in collection or analytical procedures. Stringent QA and QC procedures are essential for obtaining unbiased, precise, and representative measurements and for maintaining the integrity of the sample during collection, handling, and analysis. Stringent documentation procedures must also be applied to chain of custody and data management activities to assure that reliability of the data is maintained.

Data Quality Indicators (DQIs) are established to ensure that data collected are sufficient and of adequate quality for the intended use. DQIs include both quantitative and qualitative assessment of the acceptability of data. The quantitative goals include accuracy, precision, and completeness and the qualitative goals include representativeness and comparability. DQIs for the field operations will follow those outlined in USEPA Guidance on Systematic Planning Using the EPA QA/G4 (http://www.epa.gov/QUALITY/qa-docs?g4-final.pdf). Field check samples will include a field blank and a field duplicate. Meteorological data satisfying DQIs of national weather station requirements will be considered acceptable for the purpose of this Study. DQIs for other components of this Study are elaborated below and a summary of the DQIs is presented in Table 2 and Table 4.

The specific characteristics to be quantified and monitored over time, with the associated analytical method and target detection limits are summarized in the following table. The specific beneficial uses for this project are for the protection of freshwater aquatic life, cultural practices, agriculture, and recreation.

Since no tribal water quality standards currently exist for INSY reservation, State of California water quality standards will be used to evaluate the quality of the river's water and serve as the Project Action Limits (PALs). Table 2 provide a listing of the parameters to be sampled and the associated PALs. The information demonstrates that the analytical methods selected for this project can provide data with quantitation limits (QLs) reported to concentrations lower than the national water quality standards for most of the parameters of interest, and therefore the data generated will be able to support sound decisions at the PALs. In addition, Table 2, 3 and 4 also provides a summary of the laboratory's analytical detection limits (DLs), those minimum concentrations that can be detected above instrumental background or baseline/signal noise, providing further assurance that the analytical methods can meet the data needs of the project in terms of sensitivity. The QLs listed, as well as the measurement ranges associated with each field parameter (based on information provided in the respective equipment manufacturers) and are deemed acceptable to meet the project objectives.

Sampling Rationale

For this project, water quality is evaluated in accordance with the National Water Quality Recommended Criteria from the Environmental Protection Agency to continue improving environmental health (US EPA, 2015). These are used to assess the condition of water at the reservation and adopt baseline results for the future. These water quality parameters, and their limits are shown on Table 2.

Table 2: Water Quality Standards

Parameter	Analytical Method	Project Action Limits	Target Detection Limit or Range	Units
Physical				
Temperature	Probe/meter	17	0 to 50º	Δ°C
pH	Probe/meter	6.0-8.5	0 to 14	pH units
Conductivity	Probe/meter	800	1 to 1999	µS/cm
Dissolved Oxygen	Probe/meter	5.0	0.0 to 19.9	mg/L
Salinity	Probe/meter			%
TDS	Probe/meter			mg/L
Flow	Probe/meter			CFS
Nutrients				
Nitrite (NO^-_2)	EPA Method 300.0	1	0.05	mg/L
Nitrate (NO^-_3)	EPA Method 300.0	10	0.05	mg/L
Total Kjeldahl Nitrogen (TKN)	Standard Method 4500-N B, 4500 NH3 D		0.3	mg/L
Ammonia (NH_3)	Standard Method 4500-N B, 4500 NH3 D	1.2	0.3	mg/L
Total Phosphorus	Standard Method 4500-PE	0.1	0.05	mg/L
Hardness				
Magnesium	EPA Method 200.7		0.25	mg/L
Calcium	EPA Method 200.7		0.25	mg/L

Hardness	Standard Method 2340B		0.5	mg/L
Parameter	Analytical Method	Project Action Limits	Target Detection Limit or Range	Units
Bacteria				
Fecal Coliform	Standard Method 9221E	200	2	MPN/100 mL
Fecal Coliform	Colilert 18 - IDEX	200	2	MPN/100 mL
Total Coliform	Standard Method 9221B	200	2	MPN/100 mL
E. Coli.	Standard Method 9221F	126	1.1	MPN/100 mL
Metals				
Aluminum (Al)	EPA Method 200.8	5.0	1.5	ug/L
Iron (Fe)	EPA Method 200.8	0.25	0.02	ug/L

C: Celsius
mL: milliliter
µS/cm: micro-Siemens per centimeter
µg/L: micrograms per liter
mV: millivolts
TPH: total petroleum hydrocarbons
mg/L: milligram per liter
MPN: Most probable number
<: Less than
>: Greater than

Each of the analytes listed in Table 2 and Table 4, provides a direct or indirect empirical indication of the effects of current land uses in the ecosystem. **Note:** Reporting limits of at least three times below the regulatory limit (standard) are desired to reliably determine whether a parameter.

Table 3. Field Instrument Detection Limits

Instrument	**Constituent**	**Detection Limit/Range**	**Units**
To be determined	Electrical Conductivity	?? to 1990	µS

	EC		
To be determined	pH	3.0-10.5	pH units
To be determined	Dissolved Oxygen DO	0.2 ppm	ppm (Mg/L)
To be determined	Temperature	-5º to 50º C	ºC
To be determined	Turbidity	5 JTU	JTU (Jackson Turbidity Units)

Non-Random Data Collection Methodology

Typically, a non-random or "judgmental" data collection methodology will be used, whereby INSY-TEP staff will select sites for monitoring and sampling according to the following criteria:

- Where water quality impairment is believed most likely to occur, including surface and ground waters in the vicinity of community wastewater systems, individual homesteads, roadways, surface erosion sites, and identified underground tanks.
- Where protection of water quality is most critical, including drinking water systems and surface and ground water sources supplying such systems.
- Where protection of water quality is of importance to the maintenance of identified fish spawning habitat.

Locations of sampling sites and sampling frequency may be based on the following data quality objectives (DQOs):

- Acquire data meeting PARCC (precision, accuracy, representativeness, completeness, and comparability) criteria to determine whether drinking water is impaired for coliforms, metals and volatile organic compounds (VOCs).
- Acquire data meeting PARCC (precision, accuracy, representativeness, completeness, and comparability) criteria to determine whether surface water (not used for drinking purposes) is impaired for temperature, flow rates and/or dissolved oxygen levels.
- Acquire data meeting PARCC (precision, accuracy, representativeness, completeness and comparability) criteria to determine whether ground water (not used for drinking purposes) is impaired for VOCs.

Field Health and Safety Procedures

INSY-TEP staff will follow all health and safety procedures in the field, including safety equipment and clothing that may be required, explanation of potential hazards that may be encountered, and location and route to the nearest hospital or medical treatment facility.

Validation of Non-Standard Methods

If INSY-TEP staff find it necessary or desirable to use any non-standard sampling methods, US EPA Region 9 Quality Assurance Management Office staff will be consulted for guidance. INSY-TEP reserves the right to approve the use of non-standard sampling methods when collecting data for internal Tribal use not subject to US EPA QA/QC standards.

Sampling Methods Requirements

Sampling methods discussed below are derived from several sources cited in the References section or in the section where the procedure is described. In addition, draft standard operating procedures (SOPs) produced by US EPA's Region 9 office for sampling metals-containing water, ground water, surface water, sediments and for decontamination are found in Appendices II A-F and provide additional guidance on sampling procedures.

For calibration requirements for field instruments, see applicable sections for instrument use in Appendix II-E, “Draft Calibration of Field Instruments.

Water Sampling Procedures

This section contains procedures for collecting surface water samples, ground water samples, and surveying onsite wells. Appendix II-A contains draft US EPA standard operating procedures (SOPs) for collecting and handling water samples. These draft SOPs are referenced below in the appropriate appendices. US EPA Region 9's *Field Sampling Guidance Document (SOP) #1229: Trace Metal Clean Sampling of Natural Waters, 1999*, also found in Appendix II-D, applies to all sampling for metals in surface and ground water. The water sampling schedules and the chemical analyses to be performed are or will be stated in the relevant work plans. For purposes of this QAPP, the term surface water will include wastewater discharges.

Table 4 below summarizes the water quality constituents and determination methods for measurement and analysis.

Table 4: Table of Sample Specifications

Parameter	Analytical Method	Container	Volume	Preservative	Holding Time
Physical					
Temperature	Probe/meter	NA	NA	NA	NA
PH	Probe/meter	NA	NA	NA	NA
Conductivity	Probe/meter	NA	NA	NA	NA
Dissolved Oxygen	Probe/meter	NA	NA	NA	NA
Turbidity	Probe/meter	NA	NA	NA	NA
Flow	Probe/meter	NA	NA	NA	NA
Inorganic					
TDS	Standard Method 2540C	p, g	500 mL	Chill to 4° C	7 days
TSS	Standard Method 2540D	p, g	500 mL	Chill to 4° C	7 days

Parameter	Analytical Method	Container	Volume	Preservative	Holding Time
pH in Soil	SW-846 Mehtod 9045	g	500 g	Chill to 4° C	7 days
Nitrite (NO_2)	EPA Method 300.0	p, g	100 mL	Chill to 4° C	48 hours
Nitrate (NO_3)	EPA Method 300.0	p, g	1000 mL	Chill to 4° C, H_2SO_4 to pH<2	14 days
Total Kjeldahl Nitrogen(TKN)	Standard Method 4500-N B, 4500 NH3 D	p, g	100 mL	Chill to 4° C, HCl to pH<2	48 hours
Ammonia (NH_3)	Standard Method 4500-N B, 4500 NH3 D	p	1000 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Total Phosphorus	Standard Method 4500-PE	p, g	100 mL	Chill to 4° C, HCl to pH<2	48 hours
Orthophosphate	EPA Method 300.0	p, g	500 mL	Filter immediately, Chill to 4° C	48 hours
BOD	Standard Method 5210B	p, g	500 mL	Chill to 4° C	
COD	EPA Method 410.4	p, g	500 mL	Analyze immediately, or Chill to 4° C, add H_2SO_4 to pH<2	AI or 28 days
TOC	EPA Method 415.1, EPA Method 415.2	p, g	100 mL	Chill to 4° C, add HCl to pH<2	28 days
Sulfate	EPA Method 375.2 or EPA SW-846	p, g	200 mL	Chill to 4° C	28 days
Sulfide	EPA Method 376.1	p, g	500 mL	Chill to 4° C, add Zn acetate, NaOH to pH>9	7 days
Anions by Ion Chromotagraphy	EPA Method 300.0 (Rev. 2.1)	p, g	100 mL	Chill to 4° C	14 days
Alkalinity	Standard Method 2320B	p, g	100 mL	Chill to 4° C	14 days
Carbonate	Standard Method 2320B	p, g	100 mL	Chill to 4° C	14 days
Bicarbonate	Standard Method 2320B	p, g	100 mL	Chill to 4° C	14 days
Magnesium	EPA Method 200.7	p,	1000 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Calcium	EPA Method 200.7	p	1000 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Hardness	Standard Method 2340B	p	250 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Organic					
Oil and Grease	EPA Method 1664	G-TLC VOA/ Amber light	1000 mL	Chill to 4° C, H_2SO_4 to pH<2	28 days
1,2-Dibromoethane(EDB) and 1,2-Dibromo-3-Chloropropane in water by Microextraction and Gas Chromatography	EPA Method 504.1	G-TLC VOA/ Amber light	40 mL	Chill to 4° C	28 days

Parameter	Analytical Method	Container	Volume	Preservative	Holding Time
Carbamate and Urea Pesticides	EPA Method 632	G-TLC VOA/ Amber light	250 mL	Chill to 4° C	7 days
N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel treated N-Hexane extractable material (SGT-HEM;Non-Polar material)	EPA Office of Water Method 1664, Rev. A	g	1000 mL	Chill to 4° C, H_2SO_4 to pH<2	28 days
Total Petroleum Hydrocarbons (TPH) as Gasoline and Diesel	SW-846 Method 8015B (Rev. 2)	G-TLC VOA/ Amber light	40 mL	Chill to 4° C	7 days
Halogenated and Aromatic Volatile Organic Compounds (VOCs) by Gas Chromatography	SW-846 Methods 8010A and 8020A or Method 8021A	G-TLC VOA/ Amber light	40 mL	Chill to 4° C, add HCl to pH<2	14 days
Volatile Organic Compounds (VOCs)	SW-846 Method 8260, INSY SOP "VOC Sampling"	G-TLC VOA/ Amber light	40 mL	Chill to 4° C, add HCl to pH<2	14 days
Semivolatile Organic Compounds (SVOCs)	SW-846 Method 8270	G-TLC VOA/ Amber light	40 mL	Chill to 4° C	14 days
Polynuclear Aromatic Hydrocarbons (PAHs)	SW-846 Method 8310	G-TLC VOA/ Amber light	400 mL	Chill to 4° C	40 days
Organophosphorus Pesticides	SW-846 Method 8141A	G-TLC VOA/ Amber light	100 mL	Chill to 4° C, add NaOH or H_2SO_4 to pH>5 and pH <8	14 days
Tetra-through Octa-chlorinated Dioxins and Furans by Isotope Dilution High Resolution Gas Chromatography (HGRC) /High Resolution Mass Spectrometry (HRMS)	EPA Method 1613, Revision A	G-TLC VOA/ Amber light	40 mL	Chill to 4° C	14 days
Chlorinated Herbicides	SW-846 Method 8151, Rev. 0	G-TLC VOA/ Amber light	1000 mL	Chill to 4° C	14 days
Bacterial					
Fecal Coliform	Standard Method 9230CB	WK	100 mL	Chill to 4° C	6 hours
Fecal Coliform	Colilert 18 - IDEX		100 mL	Chill to 4° C	6 hours
Total Coliform	Standard Method 9221B	WK	100 mL	Chill to 4° C	6 hours

Parameter	Analytical Method	Container	Volume	Preservative	Holding Time
E. Coli.	Standard Method 9221F	Sterile plastic	100 mL	$Na_2S_2O_3$ Chill to 4° C	6 to 30 hours
Metals					
Aluminum (Al)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Antimony (Sb)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Arsenic (As)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Cadium (Cd)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Chromium (Cr)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Copper (Cu)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Lead (Pb)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Manganese (Mn)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Nickel (Ni)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Selenium (Se)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Tin (Sn)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Silver (Ag)	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months
Zinc	EPA Method 200.8	p, g	100 mL	Chill to 4° C, HNO_3 to pH<2	6 months

* Immediate analysis using field methods and equipment
<Less than
p: Plastic polyethylene bottle with a polypropylene cap
g: Glass
WK Whirl-Pak®
C: Celsius
mL: milliliter

Groundwater Sampling Techniques

The procedures described below, together with US EPA Region 9's *Field Sampling Guidance Document (SOP) #1220: Groundwater Well Sampling, 1999* (Appendix II-D) provide complete guidance for obtaining and handling groundwater samples. The following discussion emphasizes measurement procedures, and information on selecting and using the sampling equipment. The Groundwater Sampling Form (Appendix II-A) will be used to record data.

Bailer Purge and Sampling

This method may be used to sample wells where concentrations of VOCs exceed 1 mg/L.

- All measuring and sampling equipment will be decontaminated prior to sample collection from each well.
- Well head gases will be measured using a portable gas analyzer after removing the well cap.

- The water level of all wells will be measured and the purge volume of each well calculated prior to any sampling activities.
- The total depth of the well will be measured using a weighted steel tape or electrical sounder and following the steps listed below:
  - Examine tape for kinks and replace if necessary
  - Tag bottom at least twice to get two measurements that are consistent (within 0.5 foot)
  - Note whether or not the bottom feels silty
  - Note each measurement to within 0.5 foot, taken from the clearly marked survey reference point on the top rim of the casing
  - Decontaminate tape after each well.

- Before samples are collected, a decontaminated submersible pump centrifugal pump, or PVC bailer will be used for purging a minimum of three casing volumes from each well.

- Field parameters (temperature, conductivity, pH, dissolved oxygen, and turbidity) will be monitored during purging to verify complete purging of static water in the well. Stabilization of these parameters (no more than +/-1 degree Celsius, +/-3 percent conductivity, +/-0.1 pH Unit, +/- 10 percent dissolved oxygen and turbidity fluctuation) is indicative of adequate purging. Samples will be collected as soon as purging is complete.

- If a well is purged dry before three casing volumes have been removed, the sample will be taken after 24 hours or after the well has recovered to within 80 percent of its pre-purging water level above the bottom of the well, whichever comes first. Reasonable efforts will be made to avoid dewatering wells.

- Water samples will be collected with a stainless-steel bailer or other appropriate sampling device.

- Bailers must never be dropped into the well and must be removed from the well in a manner that causes as little agitation to the sample as possible.

- Sample containers will be filled directly from the bailer discharge line (e.g., bottom emptying device with a valve to allow water to slowly drain from the bailer). Sample containers, volumes, and preservation methods are specified in the Ready Reference Guide for Field Sampling (Appendix II-A). Necessary preservatives will be added to the sample bottles prior to shipment from the analytical laboratory. No preservatives will be added in the field. Bottles that have been prepared with preservatives will not be overfilled.

- To minimize the possibility of volatilization of organics, no headspace shall exist in the containers of samples containing VOCs.

- Wells will be sampled in order of increasing chemical concentrations from lowest to highest, to minimize potential cross contamination.

- Samplers should wear clean gloves (type indicated in the Site Safety and Health Plan). These gloves should be changed or decontaminated between wells to avoid potential cross contamination.

- Purge water will be stored in 55-gallon drums or tanks for subsequent classification and disposal or treatment.

The procedures described below, together with the US EPA Region 9's Field Sampling Guidance Document (SOP) #1225: Surface Water Sampling, 1999 (Appendix II-A), as well as the Surface Water Sample Log Sheet, provide complete guidance for obtaining and handling, as well as documenting surface water samples.

Pump Purge and Sampling

The pump purge and sampling method may be used to sample any of the onsite or offsite wells. Pumping equipment that may be used for purging and sampling includes variable-speed submersible pumps, bladder pumps, and centrifugal pumps. The following procedures should be followed:

- All measuring and sampling equipment will be decontaminated prior to sample collection from each well.

- Well head gases will be measured using a portable gas analyzer after removing the well cap.

- The water level of the well will be measured.

- A submersible pump, centrifugal pump, or bladder pump will be set at the top of the screened interval and will be pumped at a rate that will not result in substantial drawdown of the water level. The well will be pumped until field parameters stabilize (pH to ±1 pH units; conductivity to ±3 percent, turbidity and dissolved oxygen to within 10 percent, and temperature to ± 1 degree Celsius) over 2 consecutive readings taken at 3-minute intervals.

- Samples will be collected as soon as purging is complete by continued pumping at 0.1L/min.

- Sample containers will be filled directly from the pump discharge line.

- Preservatives will be added to sample bottles prior to shipment from the analytical laboratory. No preservatives will be added in the field. Bottles that have been prepared with preservatives will not be overfilled.

- To minimize the possibility of volatilization of organics, no headspace shall exist in the containers of samples containing VOCs.

- Wells will be sampled in order of increasing chemical concentrations from lowest to highest to minimize potential cross contamination.

- Purge water will be stored in 55-gallon drums or tanks for subsequent classification and disposal or treatment.

Sampling Information
The following information will be entered on the Ground Water Sampling Log Sheet (Appendix III) at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection
- Sample station and location
- Sample number
- Volume of each sample container
- Type of analysis
- Sample preservation
- Total depth of well (bailer method)
- Purging methods
- Purging rate
- Purged volume
- Unusual conditions (e.g., color, odor, and solids)
- Groundwater level prior to sampling
- Field conditions (e.g., weather, air temperature)
- Sampling technique
- Equipment used
- Indicator parameter measurements (pH, temperature, conductivity, turbidity, dissolved oxygen).

The following information not included on the groundwater sampling form should be included in the field notebook:

- Condition of the well head (condition of well casing, well lock, survey mark)
- Need for maintenance
- Presence of well head gases
- Presence of headspace in sample container.

Water-Level Measurement Procedures

The methods presented below are intended to ensure that water-level measurements are consistent and reproducible when performed by various individuals.

Water-Level Monitoring

Water levels may be measured using a steel tape, electric sounder, and/or pressure transducers. All water-level measurements will be taken from an obvious survey mark established by a licensed surveyor at the top edge of the well casing. The following protocols will be employed while collecting water-level measurements for the investigation.

Electrical Sounder

- The standard equipment for making individual water level measurements will be a battery powered sounder. The sounder must have firmly affixed or permanent marks on the sounder line at regular intervals (minimum interval of 0.01 foot).

- Calibration checks for electrical sounders will be made periodically by (1) checking the sounder markings for the proper spacing by physically comparing against a graduated steel tape and (2) comparing a water-level measurement made with the sounder to the same measurement made with a steel tape. The difference between the two measurements must be less than 0.05 foot per 100 feet depth to water. These checks will be made at the beginning of each sampling sequence and after any incident that may alter the accuracy of the instrument, such as cable stretching, entanglement, or sensor tip replacement. Calibration checks shall be recorded in the field notebook.

- Portions of the cable that are submerged below fluid levels in wells will be cleaned after use according to procedures described in Appendix VI.

- Sounders will be maintained in a clean and functional condition.

- If films exist above the water phase, a separate measurement with water finding paste, a clear acrylic bailer, and/or an oil-water interface probe will be made to determine both depth to film and depth to water.

Steel Tape

A graduated steel tape (with 0.01-foot graduations) can be used for water-level measurements and, when required, for a quality control check of other methods.

- The steel tape will be periodically checked for kinks. Kinked tapes will not be used. If an approximate depth to water is known, the bottom 1 to 2 feet of the tape will be chalked; otherwise, the bottom 5 feet will be chalked before each measurement. The tape will be slowly lowered into the well to avoid contact with a possibly wet casing.

- A steel tape will <u>not</u> be used in wells with cascading water.

- Portions of the tape that are submerged below fluid levels in wells will be cleaned after use according to the procedure described in Appendix VI.

- Tapes will be maintained in a clean and functional condition.

Pressure Transducers

Electronic pressure transducers may be used during aquifer testing. They also may be used for continuous monitoring of water levels over periods of several weeks or months. The operation, calibration, maintenance, and storage of the pressure transducers will be performed in accordance with the manufacturer's specifications.

The depth to water in the well at the time of transducer placement will be measured and recorded. The transducer calibration will be checked in the field by lowering it exactly 1 foot in the water column and noting the change in the meter response. Conditions that could affect transducer operation are noted and recorded in the field logbook. During aquifer tests where pressure transducers will be used, water levels will be periodically checked with a steel tape or electrical sounder.

When pressure transducers are used for continuous water level monitoring over extended periods of time, the calibration of the transducer will be checked at least weekly by measuring the water level with a steel tape or electrical sounder. Water level measurements will also be made using a steel tape or sounder the day of transducer installation and immediately prior to transducer removal from the well.

Aquifer Testing

The specific testing technique, monitoring locations, and test duration will vary according to the purpose of the test and the physical conditions at the test location. The pump test effluent may need to be containerized and tested for chemical constituents prior to disposal, depending on the type and location of the pump test. The hydrogeologist or engineer conducting the test will develop detailed procedures for each aquifer test and associated field measurements. During aquifer tests, the following guidance pertains:

- All downhole equipment will be decontaminated.

- Water levels in wells to be pumped and in monitoring wells will be measured for a sufficient period before the test so that trends antecedent to the test may be identified.

- During the pre-test water level monitoring and during the actual aquifer test, barometric pressure will be monitored.

- The estimated range of discharge rates and length of time for pumping will be determined before the test. The pump will be selected to have adequate capacity to produce the desired pumping rates.

- Methods of measuring pump discharge and water level changes will be field checked prior to beginning the test.

- Discharge measurements will be made frequently during the initial phase of the test to monitor for stabilization of the flow rate. After the flow rate has stabilized, discharge measurements will be made at least hourly. Measurements will be made following any change in running speed of the pump, power surges, or other conditions that may affect pump performance.

- As appropriate, and as indicated by the detailed test procedures, water levels will be measured to give at least ten observations of drawdown for each log cycle of time during an aquifer test.

- Measurement of recovering water levels will be performed. The pump will be equipped with a check valve to prevent backflow of pumped water in the pumping well. Monitoring of recovery will continue until the water level has recovered to at least 80 percent of the pre-test water levels.

- A graphical and tabular record of the test will be prepared in the field during the test. Log and/or semi-log plots of water level response will be made in the field during the test for both drawdown and recovery cycles (where recovery is monitored).

- Field observations in an actual test will be compared with estimates made prior to the test. If anomalous drawdowns are found, equipment, instruments, and surrounding wells will be checked.

- Times will be correlated with a master clock; time zero indicates when the pump is first started.

Aquifer test data will be analyzed according to published techniques and professional hydrogeologic judgment.

Volatile Organic Compound (VOA) Sampling

Standard 40 ml glass screw-cap VOA vials with Teflon lined silicone septa that can be obtained from North Coast Laboratories may be used for liquid matrices.
CAUTION: The vials have been preserved with 1:1 HCl to adjust the pH of the samples to <2.0. DO NOT RINSE this preservative out, and when collecting stream samples be sure that the sample bottle is not placed directly into the stream. When sampling from an open body of water, fill a clean 1-qt. wide mouth bottle or a 1-liter beaker with sample from a representative area and carefully fill containers. A new or decontaminated bottle or beaker should be used for each sample taken.

During purging, the pH of the sample will be measured using a pH meter to test at least one vial at each sample location to ensure sufficient acid is present to result in a pH of less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCl will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be filled so that there is no headspace. The samples will be chilled to 4ºC immediately upon collection. Three vials of each water sample are required for each laboratory.

When sampling from a tap, open the tap and allow the system to flush until the water temperature has stabilized (around 10 min.). Adjust the flow to about 500mL/minute and collect duplicate samples from the flowing stream of water.

Seal the sample bottles, making sure that the septum in the cap has the Teflon side down (the Teflon side is the paper-thin layer as opposed to the thicker rubber layer). After sealing, shake vigorously for one minute and then turn vial upside down and check for air bubbles. If bubbles greater than ¼" (6mm) are present, the sample should be discarded and a new sample collected.
Samples must be chilled to 4°C until analysis.

Sampling Information
The following information will be entered in a bound field notebook at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection
- Station number and location
- Sample number
- Indicator parameter measurements (pH, temperature, electrical conductivity)
- Depth below water surface from which water sample is taken
- Estimated flow direction and gage height readings at the adjacent staff gage
- Current weather conditions
- Evidence of recent precipitation
- General Field conditions.

Drinking Water Sampling
Sampling procedures will be the same as those described above for surface or ground water, according to the type of drinking water source. Drinking water samples from wells will be collected at the wellhead. Data regarding the sample will be recorded on the Drinking Water Sampling Forms. Drinking water samples from surface sources will be collected at the system's water collection intake. Samples will also be taken at one or more taps served by the water source. Taps chosen for sampling must be unscreened; when possible, samples will be taken from outdoor hose bibs instead of indoor faucets. When sampling water from taps, pipes will be purged for at least 60 seconds. *Only* when tap water sample will be analyzed for lead, a sample will also be taken immediately after opening the tap, with no purge time.
Measurement of field parameters and sample packaging, custody, and shipment for drinking water samples will be the same as the procedures used for surface and groundwater samples.

Sampling specifically for total and/or fecal coliform analysis will be done according to the Standard Methods for Examination of Water and Wastewater Sampling Instructions and Procedures for Collecting Bacteriological Water Samples.

Sampling Information
The following information will be entered in a bound field notebook at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection
- Station number and location
- Sample number
- Indicator parameter measurements (pH, temperature, electrical conductivity)
- Depth below water surface from which water sample is taken
- Estimated flow direction and gauge height readings at the adjacent staff gauge
- Current weather conditions
- Evidence of recent precipitation
- General Field conditions.

If the drinking water source is a well, the following information will also be recorded:

- Total depth of well (bailer method)
- Purging methods
- Purging rate
- Purged volume
- Unusual conditions (e.g., color, odor, and solids)
- Groundwater level prior to sampling

Surface water

Surface water samples will be collected as grab samples (independent, discrete samples). Surface water samples will be collected from the center of the surface water body using a clean 5-gallon sampling bucket, Kemmerer-type sampler, or other equipment.

If using a bucket, the sampler shall wade into the water downstream of the sampling point and slowly wade upstream to the sampling point. The sampler shall wait for the current to flush and clear the water thoroughly before sampling. Dipping the sampling bucket into the water in the upstream direction will collect the surface water sample. Extreme care will be taken to prevent disturbing the sediments on the stream bottom and including them as part of the sample. When the sampling bucket is filled, surface water samples will be transferred from the sampling bucket into the appropriate sample containers with preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the sampling bucket to the sample container.

At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled. In the filling sequence for duplicate samples, bottles with the two different sample designations will alternate.

Samples taken from surface waters using a Kemmerer-type sampler, by direct submergence of sample bottles, or by using a bailer will be collected as described below:

- Place a clean Kemmerer-type sampler into the water and allow the sampler cylinder to be flushed for 1 minute. If using a bailer, allow it to fill and empty several times before collection.

- Close the sampler by sending the weighted messenger down the sample line (Kemmerer-type sampler).

- Lift the sampler out of the water and transfer the water to sample bottles or field filtration equipment with minimal agitation. Carefully pour or use a submerged fill technique (i.e., release a spring-loaded valve that allows sample water to exit from the bottom of the sampler through a Teflon tube into the bottom of each vial).

- Filter samples as required. Add preservatives as appropriate. Seal sample bottles. Label samples appropriately, and place in a cooler as described below.

- Using the remaining sample volume, measure and document pH, electrical conductivity, temperature, field alkalinity, and describe the physical condition.

- Measurement of field parameters and sample packaging, custody, and shipment for surface water samples will be the same as the procedures used for groundwater samples

Sediment Sampling

Sediment sampling procedures are described in the draft US EPA Region 9's *Field Sampling Guidance Document (SOP) #1215: Sediment Sampling, 1999* (Appendix II-H). Sediment sampling in rivers, creeks and surface water drainages will be performed using the Scoop or Dipper Method, the Slide-Hammer Method, the Box Sampler Method, or any of the other methods described in Appendix II-H. Sediment samples from ponds, lakes or retention basins will be retrieved using one of the above methods or the Dredge Sampler Method. Data regarding collection of sediment samples will be recorded on the Sediment Sample Log Sheet.

All filled sample jars will be capped, labeled, and immediately placed in a Blue Ice^{Ò}-packed cooler. Any waste materials left over from sampling will be containerized and disposed of as described in Appendix II-H. A professional surveyor will survey in and record the locations of all sampling points.

Sediment Sampling in Rivers, Creeks and Surface Water Drainages
If sample collectors are using waders, they will begin at the furthest downstream sampling point, working their way upstream, and approach each sampling point slowly from downstream to avoid contaminating or disturbing the sampling point. Samples collected from a boat or raft will be taken from the upstream side of the craft. The Scoop or Dipper Method will be used only for collecting samples in the top 0.5 ft. of sediment at locations where the water depth is less than two feet. The Box Sampler Method will be used only for collecting samples from the top 0.5 ft. of sediment.

Scoop or Dipper Method
Samples collected using the Scoop or Dipper Method will be taken as follows:
Push the scoop or dipper firmly downward into the sediment, and then lift upward. Quickly raise the sampler out of the water to reduce the amount of sediment lost to the water current. If a grab sample is being collected, transfer the sediment from the scoop or dipper directly into a sample jar. If a composite sample is being collected, transfer the sediment from each composite interval or location into a stainless-steel bowl and homogenize with a stainless-steel spoon prior to filling a sample jar.

Slide-Hammer Method
Samples collected using the Slide-Hammer Method will be taken as follows:
- Lower the sampler through the water, then beat the core barrel to the desired depth, and record the blow counts in a sample logbook.
- Remove the core barrel from the hole by either rocking it from side to side several times before lifting, or reverse beating the sampler from the hole.
- To collect a grab sample, unscrew the core barrel from the sampler and slide the sample sleeves out onto the sampling table. Using a stainless-steel knife, separate the sample sleeves, and then place Teflon caps over the ends of the sleeves to be sent to the laboratory. If sampling sleeves are not being used, spoon sediment from the core barrel directly into a sample jar.
- To collect a composite sample, sample sleeves are not needed; rather, sediment from each of the intervals to be composited should be transferred into a stainless-steel bowl and homogenized prior to filling a sample jar.

Box Sampler Method
Samples collected using the Box Sampler Method will be taken as follows:
- Hold the sampling pole so the open sampler jaws are positioned several inches above the surface of the sediment, and then firmly thrust the sampler downward. Depress the button at the top of the sampling pole to release the spring-loaded jaws.
- If a grab sample is being collected, transfer the sediment from the box sampler directly into a sample jar. If a composite sample is being collected, transfer the sediment from the locations to be composited into a stainless-steel bowl and homogenize with a stainless-steel spoon prior to filling a sample jar.

Sediment Sampling in Ponds, Lakes and Retention Basins
The Scoop or Dipper, Slide-Hammer or Box Sampler Methods will be used when sampling around the shallow (i.e., less than 5 ft. deep (1.524 m)) edges of ponds, lakes and retention basins. In deeper waters, the Box Sampler or Dredge Sampler will be used, in combination with a wire line. For any sampling that requires collection of sediment from deeper than the top 0.5 feet, the Slide-Hammer Method will be used.

Scoop or Dipper Method
Samples collected using the Scoop or Dipper Method will be taken using the same technique described above.

Slide-Hammer Method
Samples collected using the Slide-Hammer Method will be taken using the same technique described above.

Box Sampler Method
Samples collected using the Box Sampler Method will be taken using the same technique described above, with the following modifications:

- A wire line may be used to lower the sampler through the water, as opposed to the sampling pole.
- When using a cable to lower the sampler, as opposed to a sampling pole, allow the sampler to fall the last 5- to 10-feet (1.524 – 3m)of water to assure that the sampler jaws get deeply embedded into the sediment. Then slide a trip-weight down the cable to trip the spring-loaded jaws.

Dredge Sampler Method
Samples collected using the Dredge Sampler Method will be taken as follows:

- Lower the dredge sampler to the bottom of the pond or lake using a wire line. The faster the sampler is dropped, the deeper the sampler will be embedded into the sediment. When the sampler hits bottom, allow the line to go slack for a few seconds, and then retrieve.
- If a grab sample is being collected, transfer the sediment from the dredge directly into a sample jar. If a composite sample is being collected, transfer the sediment from the locations to be composited into a stainless steel bowl and homogenize with a stainless steel spoon prior to filling a sample jar.

Biological Sampling

Biological and Habitat Conditions
The INSY recommends that at least two people attend 40 hours of training at one of these two places, bring the information back to their respective departments, and train other crew members. For example, California Department of Fish and Game (CDFG) Bioassessment for Citizen Monitors the new Era for Water Quality by Jim Harrington California State Fish & Game

(https://www.waterboards.ca.gov/water_issues/programs/tmdl/records/region_1/2003/ref1944.pdf).

Stream Macroinvertebrate Sampling Protocols

Evaluating the biological community of a stream or river through assessments of algae, macroinvertebrates and fish provides a sensitive and cost-effective means of determining stream condition. Macroinvertebrates (invertebrates large enough to be seen with the naked eye) are fairly stationary and are responsive to human disturbances. In addition, the relative sensitivity or tolerances of many macroinvertebrates to stream conditions is well known.

To adequately assess the overall integrity of aquatic systems, a comprehensive monitoring program that encompasses chemical, physical, and biological integrity should be developed and initiated. Sampling of stream macroinvetebrates for biological assessments is an essential component of any comprehensive stream condition evaluation. INSY Tribal staff when collecting stream macroinvertebrates should use the following techniques.

- Aquatic Invertebrate Sampling: Inventories and bio-assessments of aquatic invertebrates conducted by INSY Water Quality personnel should utilize standard collecting methods. The appropriate sampling method will be determined by the type of water body sampled and the size of the invertebrates to be collected. Commonly used mesh sizes (openings) are 80-253 microns for zooplankton and 0.595 mm (U.S. Standard Number 30) for macroinvertebrates. A variety of techniques could be utilized for collection of macroinvertebrates in streams including: kick nets, Surber samplers, Hess Samplers, Drift nets, Eckman dredges, basket samplers, and zooplankton nets. Rabeni 1996, Lind 1985, and Hilsenhoff 1991 detail collection procedures for numerous standard invertebrate sampling techniques as well as preservation and storage techniques.

INSY tribal personnel should utilize the following procedures when using the following standard macroinvertebrate sampling techniques.

Kick nets

Kick nets are recommended as a qualitative sampling tool for aquatic macroinvertebrates in flowing waters. Kick nets consist of a D-shaped or rectangular frame with a mesh size of 1 mm or less.

> Procedure: Shallow, rock or gravel riffles can be sampled by placing the net firmly against the stream bed and disturbing the substrate directly upstream from the net with hands or feet, allowing dislodged insects and debris to be carried into the net. Empty the contents of the net into a shallow white pan containing 2-3 cm of water. Examine the net carefully for insects clinging to it rinse remaining contents into the pan. Collect insects with a curved forceps and preserve in labeled jars containing 70% ethanol.

Drift nets
Drift nets collect suspended organisms being carried downstream (drift) by currents. They are usually used in a series or replicate samples placed perpendicular to the stream flow. Measure the total cross-sectional area of the net frame and the cross-sectional area of the stream channel, to estimate the percentage of stream flow being sampled. Samples should collect to accurately represent stream conditions, i.e., slow, swift, shallow, deep, etc. Nets could be installed for 24-hour periods, however replicate samples, set for specified time intervals could be used throughout the day to account for diurnal variation in aquatic drift densities.

> Procedure: Set drift nets either vertically or horizontally to representatively sample the stream. They can be anchored with stakes into the streambed or tethered with lines fastened from bank to bank across the stream. The top of shallow nets should be submerged to avoid floating debris; the bottom of the deep nets should be just above the stream bottom to prevent benthic organisms from crawling into the net. Measure the water column velocity directly in front of the center of the net with a flow meter at the start and end of the sampling interval. Document the start and end sampling times and the measured water velocities at those times. Retrieve the nets after the appropriate sampling time, and empty contents into labeled jars with a 70% ethanol solution.

Follow the appropriate chain of custody and storage procedures described in Appendix III.

Surber Samplers
This quantitative sampling device is restricted to use in slow to moderate velocity waters of less than 30 cm deep.

Procedures: Select a sampling site representative of the area desired. The velocity of the flow must not be so great as to cause a "pressure head" of water to flow around the mouth of the net. Wade into the stream from a downstream direction and place the net with the mouth facing upstream in an undisturbed area. Be sure the substrate upstream of the net is undisturbed to prevent dislodging of organisms. Lower square foot frame on substrate and hold it in place. Brush off organisms from larger pieces of substrate while holding them in mouth of net, allowing current to carry them into the net. Discard cleansed substrate outside the frame. Once larger substrates are brushed, use a garden trowel to stir smaller substrates within the square foot frame. Stir the substrates to a uniform depth being careful all organisms are carried into the net mouth. Once complete, invert net into wide mouth, labeled storage jar filled with 70% ethanol.

- Bioassessment Procedures: The INSY bioassessment procedures follow protocols described in the California Stream Bioassessment Procedures, 1999 (CSBP) (Appendix II-B) developed by the California Department of Fish and Game Aquatic Bioassessment Laboratory. The CSBP is adapted from the U.S. Environmental Protection Agency's, "Rapid Bioassessment Protocols for use in streams and Rivers: Benthic Macroinvertebrates and Fish" (EPA 444/4-89-001).

The CSBP is a regional modification of US EPA bioassessment procedures specifically for California streams.

- **Macroinvertibrate collection permit**. Tribal technicians should follow CSBP guidelines for production of high quality, reliable assessments of stream habitat and water quality. It should be noted that tribal technicians must receive appropriate training and be under the direction of a professional aquatic biologist/entomologist while performing bioassessment activities. In addition, a Scientific Collectors Permit for collecting macroinvertebrates from the specific stream must be obtained from the California Department of Fish and Game Regional office prior to conducting field sampling. The scientific collection permit must always be in possession when collecting field samples off reservation sites.

- Tribal technicians to detect point and non-point sources of pollution and to assess ambient water quality conditions should use CSBP procedures. Data should be recorded using the Santa Ysabel Creek Flow Study Aquatic Drift Sampling and Field Record for Biological Sampling Forms.

In situ Water Quality Measurements

Water quality is defined in terms of several parameters. Often a multi-probe water quality instrument is used to measure the water quality parameters of dissolved oxygen, salinity and/or conductivity, temperature, and pH.

The Iipay Nation Water Quality and Tribal Fisheries Department maintains a copy of the office for reference in addition to the Standard Operating Procedures presented here. This manual is also available on the web at http://www.hydrolab.com/html/manuals.htm, and details recommended calibration, installation and data downloading procedures.

Standard Instruments

Liquid-in-glass certified calibration thermometer

The National Institute of Standards and Technology (NIST) should certify calibration thermometers. They should be graduated at 0.1°C and have a temperature range that at least brackets any field measurement likely to be encountered.

Liquid-in-glass handheld field thermometer

These are typically total immersion type glass thermometers filled with alcohol. They should be graduated at a maximum of 0.5°C and have a temperature range of at least that expected to be encountered each should be uniquely numbered or marked. They should be calibrated yearly against a NIST certified thermometer and tagged with last date of calibration.

Temperature data logger (e.g., Onset Computer Corporation Stowaway Tidbit)

These instruments are temperature data recording devices designed to be to place in, and later retrieved from, the media of interest. They employ a thermostat to detect temperature and can typically be set to allow temperature recording at a variety of time intervals. Resolution varies with the thermostat type, and with the unique temperature quantification classes determined by the manufacturer. Temperature data loggers should be calibrated yearly against a NIST certified thermometer.

Water quality instruments with an incorporated thermostat
Thermistors are commonly incorporated into water quality measurement instruments such as dissolved oxygen (DO), salinity/conductivity, pH meters, and others. These instruments can be used to measure water temperature. Perhaps more important however, accurate temperature detection by the device is crucial to the measurement of its primary parameter, especially when the meter is temperature compensated as most are. Proper determination of temperature is crucial to the accurate measurement of DO, conductivity, pH, and more. Thermistor thermometers should be calibrated yearly against a NIST certified thermometer.

Instrument Logbook
A logbook shall be maintained that records all calibration efforts, instrument maintenance, and performance problems encountered with any temperature device. All entries shall be traceable to the instrument operator, date of the action, and the identification or serial number of the temperature device. See Appendix III for the Standard Format for Field Logbook entries.

Stream Measurement
In-stream measurements of temperature shall be carried out in accordance to the needs of the particular project. Water temperatures at a given stream cross-section may vary spatially. When the parameter of interest is the mean water temperature at a particular cross-section, the measurement should not occur in a slow-moving stream margin where temperature is likely to be different than the average of the stream cross-section. Temperatures should be measured in well-mixed locations where thermal stratification, cooling or heating along the margins, and tributary or seep input won't influence the measurement.

Site-specific
For some projects, site-specific temperatures may be of interest. For instance: The temperature in a thermally stratified pool or in a stream margin may be of interest. In these cases, there should be clear documentation that these measurements are influenced locally and do not represent the temperature of the stream cross-section.

Air
Air temperatures should be measured about 5 feet above ground with a dry thermometer. Measurement should occur in a shaded area away from radiant heat sources such as cobble bars or vehicles and out of strong wind. Three to five minutes should be allowed for thermometer to equilibrate. If circumstances prevent any of the preceding conditions from being met, the conditions should be clearly documented with the data at the time of measurement.

All temperature records should be traceable to the location, date, time, instrument, and operator.

Turbidity
Sediment particles are characterized by their size. They range from the finest clays and silt particles to sand, pebbles, gravels, and boulders. Introduced fine sediment particles in streams and rivers are typically transported as suspended sediment in the water column before settling out and depositing. A frequently used substitute for measuring suspended sediments is turbidity. Turbidity is relatively easy and inexpensive to measure and can be correlated with suspended sediment on a site-specific basis. Monitoring turbidity can provide valuable information to identify baseline trends over time as well as the effects of a specific project on water quality.

Turbidity measurements may be most useful for project monitoring, such as timber harvest operations, road construction and removal, stream crossings and road failure sites, gravel mining operations, erosion inputs, grazing activities, and irrigation return waters. Project monitoring samples should be collected upstream and downstream of a planned project, before, during and after the project commences. In addition, monitoring efforts should consider environmental conditions, such as stream flow and precipitation effects, which may affect turbidity prior to initiating a monitoring plan.

Turbidity is the measurement of suspended solids that reduce the transmission of light through water either through scattering or absorption. Two instruments, the HACH 2100P portable turbidity meter and the nephelometer may be used to measure transmitted light, which is inversely related to the amount of light scattered by suspended solids. The HACH 2100P is recommended for field collection and analysis of water turbidity samples by Iipay Nation Quality Staff

HACH 2100P TurbidiMeter Kit

Equipment: HACH 2100P Turbidimeter, Gelex Secondary Standards (to field check turbidimeter accuracy), small plastic (15-ml) sample bottles.

Accuracy Check: Field check the turbidimeter against the Gelex Secondary Standards at the start of each set of measurements. If numerous samples are to be processed, periodically check the instrument against the calibration standards and adjust accordingly.

- Place the first Gelex Standard (0 to 10 range) in the cell compartment of the meter with the white diamond on the vial aligning with the orientation mark on the meter. Close the lid.
- Press "**POWER**", and when 0.00 shows in the display window, press "**READ**". If the reading is not within 5% of the Standard, recalibrate the instrument with the factory Formazine Standard.
- Repeat the procedure with the remaining two Gelex Standards (0-100 and 01 to 1000 ranges).

Procedure: Select an area to sample representative of the environmental conditions to be investigated. For comparison replicate grab samples should also be collected at similar times and conditions as previous samples to document

- Collect a representative sample in a clean, 15-ml sample bottle, avoiding contamination and spillage.
- Press the "I/O" button to turn the instrument on. Place the meter on a flat, stable surface.
- Align the diamond mark on the sample bottle with the orientation mark on the instrument.
- Select the manual or automatic range by pressing the "**RANGE**" key. "**AUTO RNG**" is recommended and will be displayed. Press "**READ**". The display will show a reading in **NTU** (Nephelometric Turbidity Units).

Calibration: The Model 2100P Turbidimeter is calibrated with a Formazin Primary Standard at the factory and does not require calibration before use. Refer to the instrument manual for complete instructions.

Refer to *The Oregon Plan for Salmon and Watersheds - Water Quality Monitoring and Technical Guide Book* (https://www.oregon.gov/oweb/resources/pages/opsw.aspx) for detailed instructions on field collection and accuracy check procedures for the Model 2100P Turbidimeter.

Nephelometer
The Nephelometer measures the light scattered at a 90-degree angle, and is compared to a formazine suspension solution as a standard.

Equipment:
· Nephelometer with standard formazine series and clean nephelometer tubes.
· Graduated cylinder
· Kimwipes or soft tissues.

Procedure:

- Warm up nephelometer according to manufacturers specifications.
- Set to full-scale concentration using the appropriate formazine standard. Check the formazine standards against each other because the formazine standard will deteriorate.
- Mix the water sample completely, but do not shake to avoid incorporation of bubbles in the sample, and place in the nephelometer tube. The sample should be kept at room temperature to avoid condensation on the outside of the tube.
- Wipe all moisture and fingerprints from bottom and sides of the tube, then place in the instrument and cover to exclude light.
- Read nephelometer turbidity units (NTU) directly from the meter. Document all recorded sample NTU the appropriate data sheet or field notebook.

Data reporting
The following data should be recorded for each turbidity sample collected: the sample date, collectors names, sample I.D.#, land ownership information, sample location description (latitude and longitude if possible), significant observations related to the sample, weather conditions, and flow conditions and depths. A photo-document of the sample site is also recommended.

Vertical Visibility
Visibility is the measure of the depth to which one may see into the water. The Secchi disk is a simple device used to estimate this depth. It consists of a weighted 20 cm. diameter circular plate, with opposing black and white quarters. It is attached to a calibrated line so the plate hangs horizontally in the water. To determine the Secchi disk visibility, slowly lower the disk into the water until it disappears, and record the water depth. Lower the disk further, then slowly raise it until it reappears, and record this depth. The average of these two recordings is calculated to generate the final Secchi disk visibility depth.

The Secchi disk visibility is a useful way to compare the visibility of different waters, especially when measured by the same observer. Technicians should always perform Secchi disk measurements in the exact manner as previous measurements to maintain consistency between readings. Weather and water conditions should also be recorded at the time of the Secchi disk reading. Atmospheric conditions, time, position of the sun, roughness of the water or any other factors influencing the reading should also be recorded.

Horizontal Visibility
Horizontal water visibility can influence fish behavior and biological activity, as well as limit collection of direct observational data. Horizontal water visibility is measured using a modified vertical Secchi disk, The Secchi disk itself is essentially the same as a vertical Secchi disk, however, and it is deployed differently. To measure horizontal visibility a snorkeler must be fully submerged in the water to estimate the horizontal distance between him, and the Secchi disk. In flowing waters, the snorkeler is positioned facing downstream with the Secchi disk line extended in a downstream direction. A second technician slowly extends the calibrated line downstream until the Secchi disk disappears from the snorkeler's view, and this length is recorded. The snorkeler then slowly pulls in the disk until the disk is visible again, and this measurement is also recorded. An average is then calculated to generate the final horizontal Secchi disk reading and is documented on daily biological sampling data or water-resistant field notebooks as necessary.

Substrate Inventories
Streambed material, referred to as channel substrate, is composed of a range of different sized particles. For example, some stream reaches have substrate composed mostly of bedrock while others have a mix of bedrock, cobble, sand, and gravels. Stream and river substrates directly influence the structure and function of ecological communities in aquatic environments. Stream substrate conditions influence numerous biological characteristics in streams including stream productivity, macroinvertebrate and fish

populations, and spawning substrate conditions, as well as channel morphology and maintenance. In addition, substrate compositions can be indicative of sedimentation, and channel aggradation and degradation problems. To adequately evaluate stream substrate conditions, the following methods can be utilized by Iipay Nation Tribal Staff to perform stream substrate inventories.

Streams

The Iipay Nation Water Quality and Tribal Fisheries Program should conduct stream substrate inventories using standardized methods currently in use. To facilitate data compatibility with previous aquatic habitat assessments, future assessments should utilize procedures described in the California Department of Fish and Games Salmonid Stream Restoration Manual (Flosi and Reynolds 1994). Substrate inventories should include a description of relative size composition and percentage of fines within the survey area.

Rivers

Mainstem Santa Ysabel Creek substrate inventories should be conducted utilizing the standardized classification system defined in Table 5.

Table 5. Substrate types with associated codes and description.

Code	Substrate Type	Description
0		No substrate or vegetation
1	Organic Debris	Any Size
2	Sand, silt, clay	<0.025 cm
3	Coarse sand	0.025-0.05 cm
4	Small gravel	0.05-2.5 cm
5	Medium gravel	2.5-5.0 cm
6	Large gravel	5.0-7.5 cm
7	Small cobble	7.5-15.0 cm
8	Medium cobble	15.0-23.0 cm
9	Large cobble	23.0-30.0 cm
10	Small boulder	30.0-61.0 cm
11	Medium boulder	61.0-122.0 cm
12	Large boulder	>122 cm
13	Bedrock	

Percent embeddedness of the substrate should also be rated and recorded based on the classifications in Table 6. Embeddedness should also be recorded by rating the percentage of the surface area of a medium cobble is embedded in the streambed.

Table 6. Substrate Embeddedness

Code	% of surface area
1	0-25%
2	26-50%
3	51-75%
4	76-100%

Further assessment by INSY INSY-TEP and INSY Fisheries is completed through a study of the strongly interrelated components of water quantity and water quality. These parameters are further addressed utilizing the following procedures.

Water Quantity - Discharge and Water Velocity Measurement

Standard Instruments
Critical flow and/or velocity measurements shall be performed using common and reliable industry accepted water velocity meters such as Price AA and Price Pygmy rotating-cup, or Marsh-McBirney 2000 electromagnetic type. Meters shall be maintained and calibrated using techniques recommended by the manufacturer of the equipment used. Inspection of meters, top-setting rods, and sounding weight shall occur each day of use. Meter model and serial number or other unique identification of each meter shall be noted whenever velocity or discharge measurements are taken is such a manner that all data recorded may be traceable to the meter used.

Calibration/Spin Test/Maintenance
All calibration/spin test results/and maintenance performed on each meter will be traceable to the date and operator who performed the operation by records maintained in the instrument's logbook.

Price AA and Price Pygmy
Meters shall be examined before and after each daily use. The examination shall include the meter cups, pivot and bearing, and shaft for damage, wear, or faulty alignment. Meter balance and alignment shall be checked prior to each use in the field. Meters shall be cleaned and oiled daily when in use. Surfaces that shall be cleaned and oiled on a yearly basis are the pivot bearing, pentagear teeth and shaft, cylindrical shaft bearing, and thrust bearing at the cap.

A spin test shall be performed daily when in use. Procedures for a spin test are as follows: If any breeze is present outdoors, the test shall be performed in an enclosure such as a building or vehicle to insure no air movement affects the test. The cups are spun by hand and the time it takes the cups to stop is measured. To achieve meter performance specified by the manufacturer, minimum performance on a spin test must be 2.5 minutes for the Price AA and 1.0 minute for the Price Pygmy. For a properly functioning meter, it is important that the cups come to a smooth stop. An abrupt stop is an indicator that maintenance or repair is necessary.

Marsh-McBirney

Meters shall be examined before and after each discharge measurement. Visually inspect probe for fouling.

Meter logbook

A log of all maintenance, calibrations, and repairs for each piece of flow measuring equipment shall be established. The log shall be kept in such a manner that all maintenance and calibrations performed on the equipment are traceable to the person performing them and to the calibration standard utilized. All equipment shall be numbered or model and serial number shall be used to facilitate identification.

Mean column velocity

For waters with a depth less than 2.5 feet, a single velocity measured at 60 percent of the total column depth shall be recorded. For example, if the water depth were 0.5 feet, the velocity measurement would be performed at (0.5 x 0.6) 0.3 feet under the surface. For waters 2.5 deep and deeper, water velocities shall be measured at 20 and 80 percent of the total column depth. For example, if the water depth were 3.0 feet, velocity measurements at depths of (3.0 x 0.2) 0.6 feet and (3.0 x 0.8) 2.4 feet would be recorded and averaged to determine a mean column velocity. Minimum duration of each velocity measurement is typically 40 seconds but may vary according to equipment manufacturer's recommendations.

In instances where complex flows occur at a particular location due to boulders, trees, or other obstructions, additional point velocities shall be recorded. For instance, if complex flows occur at a point where the column depth is less than 2.5 feet, velocities at 20 and 80 percent of the column depth should be measured.

Direction of flow at the point where it is measured affects calculations used for discharge estimation. Direction of flow shall be recorded for each column velocity measurement. A 360-degree bearing system will be used and oriented so that 0 points directly upstream, 180 points downstream, 90 degrees points to the left (looking downstream), and 270 degrees points to the right (looking downstream). The bearing from which the water flows is to be recorded. The direction of water coming straight downstream shall be recorded as 0 degrees. Flow direction of water traveling perpendicular to the stream toward the left bank (looking downstream) shall be recorded as 270 degrees. Flow direction shall be recorded to the nearest 45 degrees.

Focal Point Velocity
A focal point is the 3-dimensional location of an observed fish location or sample collection. Focal point velocity for a fish is the velocity of water that a fish encountered at the time and space of its observation. Typically, upon seeing a fish, snorkelers will mark its location on the streambed, and its distance from the stream bottom will be measured or estimated and noted. Velocity measurements made soon thereafter will include focal velocity measured at the marked location and noted distance from the bottom. The same measurement durations and quality assurance techniques used while measuring mean column velocities shall be employed.

Stream Discharge
River discharge data for the Santa Ysabel Creek itself is acquired from the USGS Gauging Stations.

Methods for measuring stream discharge are outlined in the USDI's Water Measurement Manual (1991) (https://www.usbr.gov/tsc/techreferences/mands/wmm/WMM_3rd_2001.pdf), in the USGS Discharge Measurements at Gaging Stations (1965) (https://www.usbr.gov/tsc/techreferences/mands/wmm/WMM_3rd_2001.pdf), and the USGS Surface Water Quality Assurance Plan (https://pubs.er.usgs.gov/publication/ofr20161020).

Velocity-area method
Water in a channel flows at different rates depending on its location, so the area of the cross-section is divided into subsections, with one or more measurements taken for each. At least 25 to 30 measurements are needed for most channels with no more than 5% of the total discharge (Q) in any one subsection. More subsections should be used for broad or structurally complex cross-sections.

For computing area, the mid-section method uses the vertical line of each measurement as the centerline of a rectangular subsection, and subsection boundaries fall halfway between the centerlines. Discharge in the triangles at the water's edge where the water is too shallow to allow a meter reading, are typically negligible in terms of total discharge.

The mean velocity of each subsection is multiplied by the area of the subsection to compute the discharge (Qn) for the subsection total Velocity (https://ca.water.usgs.gov/FERC/presentations/Discharge-Measurement-Data.pdf; http://courses.washington.edu/esrm304a/Modules/Hydrology/streamlab%20procedures%20esrm%20304.pdf). The sum all subsection discharges is the total discharge (Q) for the cross-section.

The procedure for field measurement using the velocity-area method is as follows:

Step 1 - Stretch a tape across the river at the cross-section. Divide the distance between the water's edges by 25 (at least) to set the interval for metering. Use closer intervals for deeper or complex parts of the channel.

Step 2 - At water's edge, record the distance indicated on the tape. Locate subsequent metering stations along the tape determined from the intervals calculated in step 1. Adjust as necessary to decrease the interval in deep or complex portions of the cross-section. To take a reading, the meter must be completely submerged, faced into the current, and be free of interference. The meter position may be adjusted slightly up or downstream to avoid boulders, snags, or other obstructions.

Step 3 - For each cell, record the depth and the station (from the tape) at which the measurement will occur. For locations that have depths of less than 2.5 feet (0.76 m) and flow patterns with low complexity, one velocity measured at 0.6 of the total depth from the surface will be recorded. For locations with a depth greater than 2.5 feet (0.76 m) or with complex flow patterns, velocities measured at 0.2 and 0.8 of the total depth will be recorded. These will be averaged for a mean column velocity.

The formula for calculating total discharge Q is as follows:

$$Q = \sum a_n \overline{V_n}$$

Where: a is the area of a subsection.

$\overline{V}$ is the mean column velocity for that subsection

Area (a_n) of each cell will be calculated as follows:

$$a_n = d_n \frac{\left(b_{(n+1)} - b_{(n-1)}\right)}{2}$$

Where: b is the distance along the tape from the initial point

d_n is the depth at b .

Stream and Wetland Riparian Areas

Characterization of Iipay Nation Reservation stream, wetlands riparian areas is necessary to assess the degree of wetlands beneficial use support from upper watershed rivers and streams, and to assist in evaluating causes and sources of water quality degradation, if found. The second goal of the Wetlands water quality monitoring program is to provide supporting data to facilitate implementation of beneficial water quality management practices for the Iipay Nation Reservation wetlands.

Project Description

The purpose of the wetlands biological and water quality monitoring program is to generate baseline data on which to make informed water quality control decisions, such as establishing water quality standards, biological criteria and/or objectives to protect and preserve or enhance any existing and potential beneficial uses of water and natural resources.

All sample sites with little or no existing biological and/or water quality data, will have an initial analysis (limited suite) of current water quality parameters.

All of the wetland areas will be assessed using California Rapid Assessment Methods (CRAM) to assess the natural resource (Appendix II-C).

Sampling Design

The sampling program is designed to collect representative data from the wetland resources of the Iipay Nation Reservation. The basis for the sampling program is to generate biological (botanical, aquatic organisms) and water quality data to assess the degree of support of beneficial uses and to protect public health and natural resources. The program is based on performing an initial proper functioning condition (PFC) and CRAM plant community structure assessment of the wetland areas. Next step is to assess water quality and create a baseline of aquatic biological community structure and composition.

Sample locations are selected to represent relevant and relative natural resource and surface water quality throughout the Iipay Nation Reservation (Figure 3). Sample sites have been located with a Global Positioning system and mapped to permit site consistency through sampling events.

The Iipay Nation EPA water quality program will employ a targeted sample design to assess all of the wetlands on the reservation. Wetlands will be survived using CRAM on a yearly basis. Proper functioning condition (PFC) assessments will be done in the year as part of the natural resource adaptive management plan. Where appropriate, benthic macroinvertebrates will be collected yearly during the index period from late-May to early-July depending on established base flow conditions. Wetland associated waterbodies (i.e., springs, streams, bogs, ponds, etc.) will be assessed for water quality parameters (e.g., temperature, specific conductance, dissolved oxygen, hydrogen ion activity (pH), turbidity) nutrients, bacteria, trace metals, and stream flow will be measured monthly.

Wetland types found on the Iipay Nation Reservation are:

- Freshwater emergent wetlands,
- Freshwater forested/shrub wetland
- Riverine, or stream riparian wetland

Summary

References

American Public Health Association, 1995, *Standard Methods for the Examination of Water and Wastewater,* 19th Edition.

Byrnes, Mark E., 1994, *Field Sampling Methods for Remedial Investigations*, CRC Press.

Cross, D.G. and B. Stott, 1975, "The effect of electrical fishing and the subsequent capture of fish," J. Fish Biol, 7:349-357.

Devries, D.R., and R.V. Frie, 1996, "Determination of Age and Growth," Pages 483-512 in *Fisheries Techniques*, 2nd edition, B.R. Murphy and D.W. Willis, editors, American Fisheries Society, Bethesda, Maryland.

Friedman, R., 1974, *Electrofishing and population sampling: A selected bibliography*. U.S. Dept. of Interior, Office of Library Services, Bibliography series 31.

Guy, C.S., Blankenship H.L., and L.A. Nielson, 1996, Pages 366-369, *Fisheries Techniques*, 2nd edition, B.R. Murphy and D.W. Willis, editors, American Fisheries Society, Bethesda, Maryland.

Flosi, G. and Reynolds, F.L., 1994, *California Salmonid Stream Restoration Manual*. California Department of Fish and Game, Inland Fisheries Division, Sacramento, CA.

Hilsenhoff, W.L., 1991, Pages 595-596 in *Ecology and Classification of North American Freshwater Invertebrates,* J.H. Thorpe and A.P. Covich, editors, Academic Press Inc., San Diego, California.

Ice, G. et al., July 1999. *Water Quality Technical Guidebook*, The Oregon Plan for Salmonids and Watersheds.

Kelsch, S.W., and B. Shields, 1996, Pages 121-129 in *Fisheries Techniques*, 2nd edition, B.R. Murphy and D.W. Willis, editors, American Fisheries Society, Bethesda, Maryland.

Lind, O.T., 1985, *Handbook of Common Methods in Limnology*, 2nd edition, Kendall/Hunt publishing Co., Dubuque, Iowa.

North Coast Laboratories, Conversations with laboratory technicians Loretta Tomlin, August 30, 1999, and Steve Ditto, September 15, 1999.

Pratt, V.S., 1954, "Fish mortality caused by electrical shockers," Trans. Am. Fish. Soc., 84:93-96.

Rabeni, C.F., 1996, Pages 135-152 in *Fisheries Techniques*, 2nd edition, B.R. Murphy and D.W. Willis, editors, American Fisheries Society, Bethesda, Maryland.

Reynolds, J.B., 1983, "Electrofishing," Pages 147-163 in *Fisheries Techniques*, L.A. Nielsen and D.L. Johnson, editors, American Fisheries Society, Bethesda Maryland.

Sabine River Authority, No date, *Quality Assurance Project Plan for the Sabine River Authority for Environmental Monitoring and Measurement Activities Relating to the Water Quality Monitoring Programs.*

Schreck, C.B., R.A. Whaley, M.L. Bass, O.E. Maughn, and M. Solazzi, 1976, "Physiology responses of rainbow trout (*Salmon gairdneri*) to electroshock," J. Fish. Res. Bd. Canada. 33(1): 76-84.

SHN Engineers, Conversation with environmental engineer, Mike Foget, September 15, 1999.

Todd, Victoria R., 2015, Geologic Map of the Julian 7.5' Quadrangle, San Diego County, California: U.S. Geological Survey Open-File Report 94–16, 18 p., 1 sheet, scale 1:24,000, http://dx.doi.org/10.3133/ofr9416

US EPA – see U.S. Environmental Protection Agency

U.S. Environmental Protection Agency, 1992, *Annotated Field Sample Plan*, Region IX Hazardous Waste Management Division Field Operations Branch.

U.S. Environmental Protection Agency, 1995, *Guidance For The Preparation of Standard Operating Procedures (SOPs) for Quality Related Documents*. EPA QA/G-6. EPA/600/R-96/027.

U.S. Environmental Protection Agency, 1997, Data *Quality Evaluation Statistical Toolbox (DataQUEST) User's guide*, EPA QA/G-9D, QA96 Version EPA/600/R-96/085.

U.S. Environmental Protection Agency, 1998, *Guidance for Data Quality Assessment; Practical Methods for Assessment.* EPA QA/G-9, QA97 Version. EPA/600/R-96/084.

U.S. Environmental Protection Agency, 1994, *Guidance for the Management Systems Review Process*, EPA QA/G-3.

U.S. Environmental Protection Agency, 1998, Requirements *for Quality Assurance Project Plans for Environmental Data Operations.* EPA QA/R-5.

U.S. Environmental Protection Agency, 1998, *EPA Guidance for Quality Assurance Project Plans.* EPA QA/G5. Office of Research and Development. EPA/600/R-98/018.

U.S. Environmental Protection Agency, 1998, *EPA Requirements for Quality Management Plans.* EPA QA/R-2. External Review Draft Final.

Appendices

Appendix I: Laboratory QA/QC Plan

Iipay Nation of Santa Ysabel will contract with the following laboratory for water chemistry analysis.

Alpha Analytical Laboratories, Inc
2722 Loker Ave W A
Carlsbad, CA 92010
Alpha-labs.com

Jake Keeney, Carlsbad Lab Manager
Office: 760-930-2555
Mobile: 760-859-8104
jake@alpha-labs.com

Alpha Analytical Laboratories' QA/QC Program
Alpha Analytical's QA/QC program consists of quarterly reviews of quality control charts and MDL studies, semi-annual participation in Performance Evaluation Studies for both water and soil matrices, and annual reviews of SOP's, QA/QC summary updates and personnel training records. Alpha Analytical meets and exceeds the most stringent requirements of our certified analytical methods and can accommodate client requests for additional QC, where appropriate. Should you want a copy of our full QA/QC Program Manual, please contact clientservices@alpha-labs.com and we'll be happy to share this internal and confidential documentation.

Appendix II: Standard Operating Procedures

Appendix II-A: Surface Water and Ground Water Sampling

U.S. EPA Region 9 Laboratory, Richmond, CA
Field Sampling Guidance Document #1225
Surface Water and Groundwater Sampling
epa.gov/quality/field-sampling-procedures-epas-pacific-southwest-region-9

Appendix II-B: California Department of Fish and Game Manual

www.waterboards.ca.gov/water_issues/programs/tmdl/records/region_9/2008/ref2679.pdf

Appendix II-C: California Rapid Assessment Method for Wetlands Version 3.0

www.sfei.org/projects/california-rapid-assessment-method-cram

Appendix II-D: Trace Metal Clean Sampling of Natural Waters

U.S. EPA Region 9 Laboratory, Richmond, CA
Field Sampling Guidance Documents #1229
Trace Metal Clean Sampling of Natural Waters
ndep.nv.gov/uploads/env-brownfields-qaplans-docs/SOP_Trace_Metal_Clean_Sampling_of_Natural_Waters_R9.pdf

Appendix II-E: Draft Calibration of Field Instruments

U.S. EPA Region 1
Draft Calibration of Field Instruments
(temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction potential [ORP], and turbidity)
https://www.epa.gov/sites/default/files/2017-11/documents/eqasop-fieldcalibrat3.pdf

Appendix II-F: Streamflow Measurement

Streamflow Measurement
Compiled by Forrest John
United States Environmental Protection Agency, Region 6, Dallas, Texas
ndep.nv.gov/uploads/env-brownfields-qaplans-docs/SOP_Streamflow_Measurement_R6.pdf

Appendix II-G: Guidance on Systemic Planning Using the Data Quality Objectives Process EPA QA/G-4

U.S. EPA Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4
https://www.epa.gov/sites/default/files/documents/guidance_systematic_planning_dqo_process.pdf

Appendix II-H: Sediment Sampling

U.S. EPA Region 9

Field Sampling Guidance Document (SOP) #1215: Sediment Sampling, 1999
https://ndep.nv.gov/uploads/env-brownfields-qaplans-docs/SOP_Sediment_Sampling_R9.pdf

Appendix III: Chain of Custody

Chain of Custody Procedures

This section describes procedures for sample chain custody that will be followed for sample collection, transfer, analysis, and disposal throughout the investigation. The purpose of these procedures is to assure that (1) the integrity of samples is maintained during their collection, transportation, and storage prior to analysis, and (2) sample material is properly disposed of after analysis. Sample custody begins with the shipment of the empty sampling containers to the facility. All sample containers are shipped from the laboratory in sealed coolers or cartons with appropriate tamper-proof seals and custody documentation. As described below, the remainder of the sample custody procedure is divided into field procedures and laboratory procedures.

Field Custody Procedures

Sample quantities, types, and locations will be determined before the actual fieldwork commences. The field sampler will be responsible for the care and custody of the samples until properly transferred. Custody transfer will be documented on the chain of custody form.

Field Documentation

Each sample will be labeled and properly sealed immediately upon collection. Sample identification documents will be carefully prepared so that identification and chain of custody records can be maintained and sample disposition can be controlled. Forms and labels will be filled out with waterproof ink. The following identification documents are utilized during the investigation (sample forms are presented in epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf):

- Sample Labels
- Field Investigation Logbooks
- Groundwater Sampling Forms
- Chain of Custody Forms.

Sample Labels

Sample labels (see example in epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) are necessary to prevent misidentification of samples. Preprinted sample labels will be provided. Where necessary, the label will be protected from water and solvents with clear label-protection tape. Each label contains the following information:

- Project name
- Job number
- Name of collector
- Date and time of collection
- Place of collection (job site)
- Sample number.
- Analyses

Field Logbook

A separate logbook will be maintained for each project. Field procedures relevant to sample collection and field activities will be recorded daily in permanently bound notebooks. Field logbooks will document where, when, how and from whom any vital project information was obtained and logbook entries will be complete and accurate enough to permit reconstruction of field activities. Everyone in the field will maintain a bound field logbook with serially numbered pages. The logbook must be signed and dated prior to daily initiation of fieldwork and each page dated and the time of entry noted in military time. All entries will be legible, written in black ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or other terminology, which might prove inappropriate. Hypothetical information can be entered but should be accordingly noted.

If logbook duties are transferred, the individuals relinquishing and receiving will both sign and date the logbook and record the transfer time. Logbook corrections are made by a single line strikeout of the incorrect entry and entering the correct information, which is initialed and dated by the person making the entry. Unused partial or whole logbook pages are crossed out and unused pages signed and dated at the end of each workday. Logbook entries will, at a minimum, include the following:

- Project name and number
- Sampler's name
- Site name and location
- Field observations and applicable comments important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Arrival and departure date/time
- Team members and their responsibilities, Changes in personnel and responsibilities as well as reasons for the changes
- Field instrument calibration methods, and identification number and instrument readings (e.g., *OVM, HNU*, etc.)
- Chronology and location of activities
- Sampling locations on site map (or site sketch showing sample locations, measured distances
- Sample Information

  - Designation of sample as composite or grab, and type of sample (i.e., matrix)
  - identification numbers,
  - amount collected,
  - Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for groundwater: clear water with strong ammonia-like odor)
  - sampling method and container (size/type) for each sample collected, including QC samples.
  - Sample processing techniques (filtration, compositing, and preservation)
  - Type of sampling equipment.
- Name and affiliation of personnel on site, and personnel contacted, as well as summary of meetings or discussions.
- A summary of any meetings or discussions with any potentially responsible parties (PRPs), representatives of PRPs, or federal, state, or other regulatory agencies
- Deviations from sampling plans, site safety plans, and QAPP procedures
- Levels of safety protection

The following information should also be included in the field notebook as part of Chain of Custody documentation.

- Lot numbers of the sample containers, sample tag numbers, chain-of-custody form numbers, and chain-of-custody seal numbers
- Number of shipping coolers packaged and sent.
- Shipping arrangements (overnight air bill number)
- Name and address of all receiving laboratories

See the Standard Format of Field Logbook Entries at epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf worksheet #29.

Photographs

Photographs will be taken at every sample location and at other areas of interest on site. They will serve to verify information entered in the field logbook. When a photograph is taken, the following information will be written in the logbook or will be recorded in a separate field photography log.

- Time, date, location, and, if appropriate, weather conditions.
- Description of the subject photographed.
- Name of person taking the photograph.

Chain-of-Custody Record

A chain of custody record will be filled out for and will accompany every sample to the analytical laboratory to establish the documentation necessary to trace sample possession from the time of collection. A copy of the chain of custody form will be retained in the investigation files according to project/task number. An example Chain-Of Custody Form is shown in epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf. The following information will be recorded on the form:

- Sample number or identification
- Names of sampler(s)
- Signature of collector, sampler, or recorder
- Location of project
- Project manager's name
- Date of collection
- Place of collection (site location)
- Sample type
- Analyses requested
- Inclusive dates of possession
- Signature of person receiving sample
- Laboratory sample number, where applicable
- Date and time of sample receipt.

Groundwater Sampling Forms

The following information will be entered on the Groundwater Sampling Form (epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection
- Sample station and location
- Sample number
- Volume of each sample container
- Type of analysis
- Sample preservation
- Total depth of well (bailer method)
- Purging methods
- Purged volume
- Unusual conditions (e.g., color, odor, and solids)
- Groundwater level prior to sampling
- Field conditions (e.g., weather, air temperature)
- Sampling technique
- Equipment used
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

Surface Water Sampling Forms

The following information will be entered on the Surface Water Sampling Form (epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection
- Sample station and location
- Sample number
- Volume of each sample container
- Type of analysis
- Sample preservation
- Unusual conditions (e.g., color, odor, and solids)
- Field conditions (e.g., weather, air temperature)
- Sampling technique
- Equipment
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

Drinking Water Sampling Forms

The following information will be entered on the Drinking Water Sampling Form (epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection
- Sample station and location
- Sample number
- Volume of each sample container
- Type of analysis
- Sample preservation
- Unusual conditions (e.g., color, odor, and solids)
- Field conditions (e.g., weather, air temperature)
- Sampling technique
- Equipment
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

If only fecal and/or total coliform is sampled, the laboratory sample form will be used.

Sediment Sampling Forms

The following information will be entered on the Sediment Sample Log Sheet (epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) at the time of sampling:

- Sampler's name or initials
- Time and date of sample collection

- Sample station and location
- Sample number
- Volume of each sample container
- Type of analysis
- Sample preservation
- Unusual conditions (e.g., color, odor, and solids)
- Field conditions (e.g., weather, air temperature)
- Sampling technique
- Equipment
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

Biological Sampling Forms

The following information will be entered on the Biological Sampling form (epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) at the time of sampling:

- Water body name
- Time and date of sample collection
- Sample station and location
- Sample number
- Weather conditions
- Water conditions
- Substrate description
- Habitat characteristics
- Reducing conditions
- Signs of pollution
- Physical/chemical measurements
- Observer's signature

Corrections to Documentation

Original data recorded in field notebooks, chain of custody records, and other forms will be written in waterproof ink. None of these documents will be altered, destroyed, or discarded, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on a document compiled by one individual, that individual will make the necessary correction simply by crossing a single line through the error, entering the correct information, and initialing and dating the change. The erroneous information will not be obliterated. Any subsequent error(s) discovered on a document will be corrected by the person discovering the error. All corrections will be initialed and dated.

Sample Packaging and Transport

Samples will always be accompanied by a Chain-Of-Custody record. When transferring samples, the individuals relinquishing and receiving the samples will sign and date the chain of custody record. Samples will be packaged properly for shipment, including isolation of samples thought to have high chemical concentrations, and dispatched to the appropriate laboratory for analysis. Custody seals are not deemed necessary when the samples will be in continuous possession of technical or laboratory personnel. Custody seals will be used when samples are shipped via courier service. The Chain-Of-Custody record will accompany each shipment. The method of shipment, courier name(s), and other pertinent information will be entered in the Chain-Of-Custody record.

Labeling, Packaging, and Shipment

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The sample will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: sample identification number, station location, date of collection, analytical parameter(s), and method of preservation. Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

All sample containers will be placed in a strong-outside shipping container (steel-belted cooler). The following outlines the packaging procedures that will be followed for low concentration samples.

1. When ice is used, secure the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.
2. Line the bottom of the cooler with bubble wrap to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
4. Secure bottle/container tops with clear tape and custody seal all container tops.
5. Affix sample labels onto the containers with clear tape.
6. Wrap all glass sample containers in bubble wrap to prevent breakage.
7. Seal all sample containers in heavy-duty plastic bags. Write the sample numbers on the outside of the plastic bags with indelible ink.

All samples will be placed in coolers with the appropriate traffic report and chain-of-custody forms. All forms will be enclosed in a large plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Vermiculite will also be placed in the cooler to absorb spills if they occur. Ice used to cool samples will be double sealed in zip-lock plastic bags and place on top and around the samples to chill them to the correct temperature. Each ice chest will be securely taped shut with nylon strapping tape, and custody seals will be affixed to the front, right side and back of each cooler.

The laboratory will be notified the same day samples are shipped or one day before expected delivery. The laboratory will be provided with the following information:

- Sampling contractor's name

- The name and location of the site
- Sample number
- Total number(s) by concentration and matrix of samples shipped to each laboratory
- Carrier, air bill number(s), method of shipment (priority next day)
- Shipment date and when it should be received by lab
- Irregularities or anticipated problems associated with the samples
- Whether additional samples will be shipped or if this is the last shipment

Sample Transfer and Shipment

Bottles and Preservatives

Sample containers will be cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by INSY Water Quality Tribal personnel to the containers prior to shipment of the sample containers to the laboratory, unless provided by the laboratory.

Groundwater Samples

Groundwater samples will be collected in the bottles and vials appropriate for the particular analysis. The samples will be chilled to 4°C immediately upon collection. Vials will be filled so that no headspace occurs. The samples will be chilled to 4°C immediately upon collection. Three vials of each groundwater sample are required for each laboratory. The samples will be shipped in coolers with appropriate chain-of-custody documentation and seals as described in https://19january2017snapshot.epa.gov/sites/production/files/2015-06/documents/esar_field_activity_10-03-2014.pdf.

Surface Water Samples

The same sample transfer and shipment criteria described for groundwater samples in https://19january2017snapshot.epa.gov/sites/production/files/2015-06/documents/esar_field_activity_10-03-2014.pdf will also apply to surface water samples.

Drinking Water Samples

The same sample transfer and shipment criteria described for groundwater samples in https://19january2017snapshot.epa.gov/sites/production/files/2015-06/documents/esar_field_activity_10-03-2014.pdf will also apply to drinking water samples. Samples collected for total and fecal coliform analysis will contain sodium thiosulfate to neutralize residual chlorine (as provided by the laboratory.)

Sediment Samples

Sediment samples will be homogenized and transferred from the sample-dedicated homogenization pail into 8 ounce, wide-mouth glass jars using a trowel. For each sample, one 8-ounce glass jar will be collected for each laboratory. The sample will be chilled to

4 °C immediately upon collection. The samples will be shipped in coolers with appropriate chain-of-custody documentation and seals.

Biological Samples

Biological samples will be collected and handled by Iipay Nation Water Quality/ Fisheries as described in the Standard Operating Procedures referred to in Appendix II-B. Sample collection and testing will be documented using the Tribal Water Quality Chain of Custody (COC) Record (epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf).

Sample Storage and Disposal

The analytical laboratory will retain samples and extracts for up to 30 days after the laboratory reports the data. Unless notified otherwise by the Water Quality Coordinator, the laboratory in a manner consistent with appropriate government regulations should dispose excess or unused samples.

Appendix IV: Calibration and Frequency

Instruments used to measure and collect samples in the field for water quantity and water quality testing will be calibrated according to manufacturer's specifications and procedures, or as outlined in this section.

Water Quality Measurement Instruments

Electrical Sounders

Calibration checks for electrical sounders will be made periodically by (1) checking the sounder markings for the proper spacing by physically comparing against a graduated steel tape and (2) comparing a water-level measurement made with the sounder to the same measurement made with a steel tape. The difference between the two measurements must be less than 0.05 foot per 100 feet depth to water. These checks will be made at the beginning of each sampling sequence and after any incident that may alter the accuracy of the instrument, such as cable stretching, entanglement, or sensor tip replacement. Calibration checks shall be recorded in the field notebook.

Graduated steel tape calibration

Steel tape will be calibrated by reference to new steel tape; Apply manufacturer-supplied temperature correction if applicable for field conditions.

Pressure transducer calibration

The operation, calibration, maintenance, and storage of the pressure transducers will be performed in accordance with the manufacturer's specifications. Make in-house calibration check with water columns prior to aquifer tests, and make weekly field checks against steel tape or electrical sounder.

Flow Meters

Price AA and Price Pygmy
A spin test shall be performed daily when in use. Procedures for a spin test are as follows: If any breeze is present outdoors, the test shall be performed in an enclosure such as a building or vehicle to ensure no air movement affects the test. The cups are spun by hand and the time it takes the cups to stop is measured. To achieve meter performance specified by the manufacturer, minimum performance on a spin test must be 1.5 minutes for the Price AA and 1.0 minute for the Price Pygmy. For a properly functioning meter, it is important that the cups come to a smooth stop. An abrupt stop is an indicator that maintenance or repair is necessary.

Marsh/McBirney
Factory calibration once; checks annually; take periodic timed volumetric measurements periodically during tests.

Temperature

Liquid-in-glass handheld field thermometer
Thermometers should be calibrated yearly against a NIST certified thermometer and tagged with last date of calibration.

Temperature data logger (e.g. Onset Computer Corporation Stowaway TidbiT)
Temperature data loggers should be calibrated yearly against a NIST certified thermometer. Check weekly against ASTM mercury calibration: thermometer.

Dissolved oxygen, Conductivity, and pH

Often the Hyrdolab® Hydrolab®'s DataSonde 4 and MiniSonde is used to measure the water quality parameters of dissolved oxygen, salinity and/or conductivity, temperature, and pH. The Hydrolab owner's manual is kept in the INSY Vlley Tribal Water Quality office for reference in addition to the Standard Operating Procedures presented here. This manual is also available on the web at http://www.hydrolab.com/html/manuals.htm, and details recommended calibration, installation and data downloading procedures.

pH Calibration

Calibrate prior to pH measurement using factory- or laboratory-supplied buffer solutions (traceable to National Bureau of Standards buffers) of pH 4, 7, and 10, which are renewed daily or prior to each use. Apply temperature correction during measurement, if appropriate.

Electrical Conductivity Calibration

Calibrate prior to electrical conductivity measurements using laboratory supplied standard KCL reference. Apply temperature correction during measurement, if appropriate.

Dissolved oxygen meter calibration

Calibrate in-house once a month for zero, full scale, and elevation settings. Calibrate prior to each use with water saturated air method.

Turbidity

HACH 2100P TurbidiMeter Kit

The Model 2100P Turbidimeter is calibrated with a Formazin Primary Standard at the factory and does not require calibration before use. Refer to the instrument manual for complete instructions. If numerous samples are to be processed, periodically check the instrument against the calibration standards and adjust accordingly.

Portable Gas Analyzers

Various portable gas analyzers are currently available on the market for onsite use during field operations. These may include a Foxboro Analytical, Century Organic Vapor Analyzer (OVA), an HNU Model P-101 hydrocarbon analyzer, and a Thermo Environmental Organic Vapor Monitor (OVM). These instruments are used for general qualitative to semi-quantitative survey tasks and are sensitive to the gaseous phase of various organic compounds. The instruments will be calibrated on a daily basis according to manufacturers' instructions. General calibration procedures are as follows:

- Connect the probe to the instrument, turn instrument on, check the battery level, and allow instrument to warm up for 10 to 15 minutes.
- Adjust the zero setting on the meter.
- Introduce calibration gases to the instrument to perform a two-point calibration (when possible) and adjust the instrument as appropriate. The calibration will be performed on the lower concentration gas standard first, then on the higher concentration gas standard.
- Recheck the zero setting.
- Return any instrument that cannot be calibrated to the supplier or manufacturer for service or replacement with a properly functioning instrument.

Combustible Gas Indicators

Gastech Combustible Gas Indicators (GCI) are available for onsite use during field operations. GCIs are used to measure the concentrations of flammable vapor in percent of lower explosive limits. The instruments will be calibrated on a weekly basis according to manufacturers' instructions as follows:

- Connect the probe to the instrument, turn the instrument on, check the battery level, and allow the instrument to warm up for 10 to 15 minutes.
- Adjust the zero setting on the meter.
- Introduce the calibration gas and adjust the internal potentiometer as required.

- Return any instrument that cannot be calibrated for service or replacement with a properly functioning instrument.

Laboratory Instruments

The laboratory instruments used for analysis of investigation samples are calibrated according to and at the frequencies required by the specific referenced method of analysis utilized by the contracted laboratory.

Appendix V: Requirements for Consumables

Identification of Critical Supplies and Consumables

Supplies and consumables used in water quality sampling will be tracked for quality inspection and acceptance using an Inspection/Acceptance Testing Requirements Log and labels affixed to individual pieces of equipment and containers of consumables where appropriate. (see epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf).

Establishing Acceptance Criteria

Acceptance criteria for supplies and consumables are given in the US EPA SOPs provides inspection and acceptance criteria for equipment and apparatus, and provides inspection and acceptance criteria for reagents.

Inspection or Acceptance Testing Requirements and Procedures

A designated sample custodian or alternate will inspect all supplies and consumables upon receipt. Any container or material requiring special criteria, such as sterility, will be checked prior to use.

Tracking and Quality Verification of Supplies and Consumables

The results of all inspections will be recorded on a Supplies and Consumables Tracking Log (see epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf) and kept in project binders. All reagents used will be manufacturer-certified to meet or exceed the requirements for their applications.

Appendix VI: Decontamination and Disposal Procedures

The procedures described below will be used for decontamination of sampling equipment and disposal of investigation-derived wastes.

Decontamination Procedures

Large Equipment Decontamination

The following procedures will be used for decontaminating all large equipment used to assist in the collection of water samples, including drilling augers, drill bits, drill rod, soil-gas rod, direct push rod, cone penetrometer equipment, etc.:

1. Remove soil adhering to augers, drill rod, and other equipment by scraping, brushing, or wiping.
2. Thoroughly pressure wash equipment with potable water and a non-phosphatic laboratory grade detergent using a steam cleaner.
3. Thoroughly rinse equipment with potable water using a steam cleaner.
4. Wrap the equipment in plastic sheeting or aluminum foil to keep it clean prior to use.

Sampling Equipment Decontamination

The following procedures will be used for decontaminating all water sampling equipment. This includes split-spoon and thin-walled tube samplers, knives, spoons, spatulas, trowels, and other hand sampling equipment used to handle soil and sediment samples, and Teflon or stainless-steel water sampling tools such as dippers, bailers, downhole pumps, intake and discharge lines, and barrel filters used to collect water samples. Specific procedures are given for decontamination of equipment used for sampling for inorganic/radiological analytes, organic analytes, and combined inorganic/radionuclide/organic analytes.

Additional guidance concerning decontamination procedures can be found in the draft US EPA Region 9's *Field Sampling Guidance Document (SOP) # 1230 Sampling Equipment Decontamination, 1999*.

Inorganic/radiological procedure

1. Remove soil adhering to sampling equipment by scraping, brushing, or wiping.
2. Wash thoroughly with strong nonphosphate detergent/soap wash water.
3. Rinse thoroughly with tap water.
4. Rinse with ASTM Type II (or equivalent) water.
5. Rinse with dilute hydrochloric or nitric acid solution.
6. Rinse with ASTM Type II (or equivalent) water.
7. Place equipment on a clean piece of aluminum foil and allow to air dry.

Organic procedure

1. Remove soil adhering to sampling equipment by scraping, brushing, or wiping.
2. Wash thoroughly with a strong nonphosphate detergent/soap wash water.
3. Rinse thoroughly with tap water.
4. Rinse with ASTM Type II (or equivalent) water.
5. Rinse with pesticide-grade acetone (or methanol).
6. Rinse with pesticide-grade hexane.
7. Place equipment on a clean piece of aluminum foil and allow to air dry.

Combined Inorganic/Radionuclide/Organic procedure

1. Remove soil adhering to sampling equipment by scraping, brushing, or wiping.
2. Wash thoroughly with a strong nonphosphate detergent/soap wash water.
3. Rinse thoroughly with tap water.
4. Rinse with ASTM Type II (or equivalent) water.
5. Rinse with dilute hydrochloric or nitric acid solution.
6. Rinse with ASTM Type II (or equivalent) water.
7. Rinse with pesticide-grade acetone (or methanol).
8. Rinse with pesticide-grade hexane.
9. Place equipment on a clean piece of aluminum foil and allow to air dry.

After any of the above decontamination routines are used, dry equipment will be wrapped tightly in aluminum foil for storage. Acids, hexane, acetone and DI water will be applied using Teflon squirt bottles. Drippings of all decontamination fluids will be caught using tubs or buckets. Acetone and hexane drippings will be allowed to volatilize into the air, while acids will be neutralized using baking soda.

A decontamination line will be set up crosswind of the sampling operations during decontamination, using one tub for soap wash, one for clean water rinse, and a third for capturing acid and solvent solutions. A foil-covered table will be used as a drying surface for equipment.

Groundwater Sampling Equipment Decontamination

All equipment that may contact potentially contaminated soil, drilling fluid, or water will be decontaminated prior to and after use. Decontamination consists of steam cleaning (high pressure, hot water washing) or phosphate-free detergent wash, and distilled, DI, or clean water rinse, as appropriate. All decontamination is conducted in such a manner that cleaning fluids can be disposed of as described in https://www.epa.gov/sites/default/files/2016-01/documents/field_equipment_cleaning_and_decontamination205_af.r3.pdf.

Drilling, sampling, and monitoring well installation equipment will be decontaminated as follows:

- Downhole equipment on drill rigs, such as augers, drill rods, and drill bits, as well as parts in contact with drilling fluids or cuttings, such as mud tanks and sand separators, will be steam cleaned prior to use at the drill site. Visible soil and grease will be removed at this time.
- Soil sampling equipment (e.g., split-barrel, standard penetration, or continuous core samplers, sampling tubes, etc.) will be cleaned prior to each use and between sampling. The sampler will be steam cleaned or washed in a phosphate-free detergent solution and rinsed in DI water. Visible soil will be removed at this time. Wash solutions and rinse water will be replaced prior to beginning each boring.
- Casing, screen, couplings, and caps used in monitoring well installation will be steam cleaned prior to installation. Visible foreign matter will be removed at this time.

- The exterior surfaces and accessible interior portions of submersible, centrifugal, and positive-displacement pumps will be steam cleaned prior to each use or prior to each sampling round.
- Bailers will be steam cleaned or washed in phosphate-free detergent solution and rinsed twice in distilled or DI water prior to each use. Rope or string (used with bailers or disposable sampling bottles) that has been in contact with the water in the well or boring will be discarded and replaced with new string after each sample is collected.
- Steel tapes, well sounders, transducers, and water quality probes will be rinsed in distilled or DI water or wiped clean after each use. Generally, only the wetted end of these devices requires cleaning.
- Decontamination of equipment will be described in the field notebook.

Disposal Procedures

Disposal of investigation-derived wastes will be managed to achieve two basic objectives:

- waste minimization, and
- managing waste consistent with the final remedy for the site (i.e. offsite or onsite disposal).

Waste minimization will be achieved through the following practices:

- Drilling boreholes no larger than is needed to collect groundwater samples to reduce the amount of drill cuttings,
- Using tools such as cone penetrometers and soil-gas probes, which generate very little waste, to assist site characterization studies, and
- Decontamination of reusable equipment where possible, instead of using disposable equipment.

Depending on the location of the investigation, soils and fluids produced during the installation, development, and sampling of monitoring wells and borings will be sampled and analyzed for selected chemicals. Handling and disposal will be in accordance with applicable US EPA and DTSC regulations, as appropriate. These materials will be temporarily stored in bins, tanks, or 55-gallon drums until analyses are complete and an acceptable means of disposal has been determined. All bins, tanks, or 55-gallon drums will be clearly labeled and stored in a secure location until final disposal is arranged.

Appendix VII: Analytical Methods Requirements

An accredited laboratory will perform all laboratory analyses. All laboratory procedures will be performed according to the appropriate US EPA methods, including:

- Chemical analyses of water samples will be performed according to *Methods for Chemical Analysis of Water and Wastes,* EPA 600/4-79-020.

- Sediment analyses will be performed according to EPA 8000-Series protocols https://www.epa.gov/hw-sw846/8000-series-chromatographic-separation-methods.
- Biological analyses will be performed according to *Fish Field and Lab Methods for Evaluating the Biological Integrity of Surface Waters,* EPA 600/R-92-111.
- EPA Data Quality Indicator SOPs https://www.epa.gov/quality/guidance-data-quality-objectives-process-epa-qag-4-august-2000.

Chemical analyses will be performed on samples of groundwater and soil. The primary classes of target chemicals to be analyzed during the investigation include chlorinated volatile organic compounds (VOCs) and metals. Other types of analyses may be performed dependent on the project data needs. All analyses will be performed using EPA-approved methods. The analytical program for the investigation will utilize the services of a laboratory specified in the relevant work plans.

Specific analytical methods for each class of chemicals and the practical quantification limits (PQL) will be in accordance with the laboratory procedures cited in Appendix E in the EPA Data Quality Indicator Standard Operating Procedures. PQL is defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The instruments will be calibrated daily according to manufacturer's specifications.

Field analysis will be performed according to applicable methods and operating procedures as required. Calibration for field instrumentation will follow manufacturer's recommendation or as specified in the Calibration of Field Instruments, Appendix II-E.

Appendix VIII: Quality Control (QC) Requirements

Two types of QC checks will be employed to evaluate the performance of a laboratory's analytical procedures: field QC checks and laboratory QC checks. The QC checks represent the controlled samples introduced into the sample analysis stream that are used to evaluate the accuracy and precision of the chemical analysis program. The QC check samples will be introduced or analyzed on the basis of the size of sample lots. A sample lot or batch will consist of greater than zero but fewer than 20 samples that are extracted and analyzed as a batch by the laboratory.

Field QC Checks

Field QC checks will be accomplished by submission of controlled samples that are introduced blind to the laboratory(s) from the field (i.e., external QC samples). Two types of samples will be used: blanks, and duplicates. All QC samples will be given a unique sample number in the field, which will not indicate to the laboratory that the sample is a QC check. The three types of field/external QC samples are described below. The matrix- and analysis-specific description and frequency of field/external QC samples is listed below.

External Blanks

Two types of external blanks (field and equipment/rinsate) will be collected and submitted blind to the laboratories. Blanks will consist of deionized, organic-free water supplied by the laboratories. Low concentration equipment rinsate blanks will be collected in 1-liter amber glass bottles or other container type specified in US EPA SOPs. No preservative is required for these blanks. The blanks will be chilled to 4°C immediately upon collection. Two bottles of each equipment rinsate sample are required for each laboratory. When equipment decontamination is necessary, one equipment rinsate sample per day will be collected from the last rinse of the decontamination process during water and soil gas sampling. The rinsate sample will be taken following sampling of the most contaminated well, if that information is available. The "blank" water identified above will be used to fill the equipment or poured over sampling equipment and then placed into the appropriate containers.

One blank will be submitted with every 10 samples collected or one per day, whichever is greater.

Low concentration field blanks will be collected in 1-liter amber glass bottles or other container type specified in US EPA SOPs. No preservative is required for these blanks. The blanks will be chilled to 4 immediately upon collection. Two bottles of each field sample are required for each laboratory. 1:1 HCL will be added to the vial prior to sample collection. If the pH is less than 2, the tested vial will be discarded. If the pH is less than 2, additional HCL will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be filled so that no headspace occurs. The samples will be chilled to 4°C immediately upon collection. Three vials of each field blank are required for each laboratory.

External Duplicates

In general, for each type of sample analysis used during the investigation, field duplicates of samples will be submitted to the laboratory(s) performing the analyses. Duplicate samples will be collected at a frequency of 10 percent of the total number of field samples collected.

Laboratory QC Checks

Specific requirements and procedures for laboratory QC will be monitored by the laboratory to ensure that the analytical data are generated with known quality and that corrective actions will be taken whenever needed. A summary of the internal (laboratory) QC samples should be provided by the contracted laboratory.

Laboratory Custody Procedures

A laboratory designated sample custodian will accept custody of the shipped samples and verify that the information on the sample label matches that on the chain of custody form(s). Pertinent information as to sample condition upon receipt, method of shipment, pickup and delivery, and courier will also be checked on the chain of custody form(s). The custodian will then enter the appropriate data into the laboratory sample tracking system. The laboratory custodian will use the sample number on the sample label or assign a unique laboratory number to each sample. The custodian will then transfer the sample(s) to the proper analyst(s) or store the sample(s) in the appropriate secure area. The laboratory will also check the temperature of the sample cooler upon arrival. Laboratory personnel will be responsible for the care and custody of samples from the time they are received until the sample is exhausted. Data sheets and laboratory records will be retained by the laboratory as part of the permanent documentation for a period of at least 3 years.

Internal Blanks

Internal blanks are used to detect system bias introduced in the laboratory. For water samples, laboratory pure water blank is processed through all sample preparation procedures and analyzed as a method blank. For soil samples, blank sand or other suitable blank matrix will be used. One blank will be analyzed per each analytical batch of samples.

Internal Duplicates

A field sample will be split into two portions during laboratory preparation. Each portion will then be processed through the remaining analysis steps as a duplicate. Precision information will be provided for evaluating variability of preparation and analysis. One pair of duplicates will be analyzed per lot or batch of samples, for inorganic analyses.

Internal Spikes

Two types of internal spikes will be performed by the laboratory, a laboratory control sample (LCS) and a matrix spike and matrix spike duplicate (MS/MSD).

LCS analyses are spikes on blank matrix to assess accuracy independent of matrix effects. These matrices are deionized water for water samples and reagent sand for soil samples. The LCS is prepared by adding a known amount of target analyte to the matrix. If LCC analyses do not meet the recovery criteria specified, the LCS sample will be reanalyzed to determine if the failure is due to a transient instrumental condition. If the second analysis does not meet the recovery criteria, the LCS and the entire analytical batch will be re-extracted and reanalyzed within the holding time.

The MS is prepared in the laboratory by adding a known amount of target analytes into the field sample prior to laboratory preparation. These spikes simulate the matrix effect on analyses for field samples. Percent recoveries are calculated for these target analytes as a measure of the accuracy of the total analytical method. The spiked samples will be analyzed in duplicate (matrix spike duplicate) for organic analyses for an assessment of the precision of the analytical method. An MS/MSD pair will be analyzed per lot or batch of samples.

Surrogate Spikes

Surrogate spikes are used to evaluate whether laboratory equipment is operating within the prescribed limits of laboratory quality control and are checked by the laboratory for accuracy and proper chemical identification. Surrogate spikes will be added, as appropriate, for organic analyses to all blanks, standards, and environmental samples.

Appendix IX: Instrument/Equipment Requirements

Testing, Inspection, and Maintenance

Inspections and acceptance testing of all materials for field sampling will be performed according to the appropriate SOPs. Laboratories selected to provide sample analysis will use US EPA protocols given in the laboratory procedure manuals for testing, inspection and maintenance of instruments and equipment https://www.epa.gov/sites/default/files/2020-03/documents/lom_nla_2017_version_1.1.pdf.

Appendix X: Validation and Verification Methods

Chemical data will be evaluated according to procedures outlined in https://www.epa.gov/sites/default/files/2015-06/documents/g8-final.pdf to independently validate the laboratory data. The evaluation will include inventory of all laboratory deliverables and checking internal and external QC results to see that they are within specified limits.

Should poor laboratory performance be identified from the precision or accuracy evaluations or from detected concentrations in field blank samples, the Project Manager or designated personnel will notify the laboratory and initiate appropriate corrective action.

Despite all efforts to achieve the objectives of the QAPP, the potential for introduction of measurement error exists in field procedures, in a laboratory's chemical analyses, and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from a laboratory.

Completeness

The completeness of the investigation data represents an estimate of the volume of data expected from the field program versus the amount of data actually entered into the data base that is available for interpretation. Measurement completeness (C) can be described as the ratio of acceptable measurements obtained to the total number of planned measurements for an activity. For this extended meaning, completeness is defined as:

$$C = \frac{\text{number of acceptable items}}{\text{total number of planned items}} \times 100$$

The overall program goal for completeness using this definition is 80 to 85 percent. Based on results of field QC and laboratory QC checks, data will be validated and qualified. Should the data not meet quality assurance goals for accuracy and precision, the data may be rejected, depending on the reason for qualification, and therefore not be included in the determination of completeness. However, all data will be reported, with appropriate qualifiers, so acceptability for future data use can be determined.

Completeness is also assessed prior to preparation of data reports and includes checking that all entries in the database are correct, properly entered, and that typographical errors (if any) in the database are corrected and the data re-entered properly.

Reporting Requirements

All water quality data collected under the Iipay Nation water quality program will be provided for review as complete data sets to the Iipay Nation Water Quality Program Manager, and in summary form (metadata, statistical summary, and outlier report) to the INSY-TEP Manager. The INSY-TEP Manager will provide copies of summary data to the Tribal Council and/or Tribal Administrator upon request or at the discretion of the INSY-TEP Manager.

Corrective Actions

If any occasions arise that indicate field or laboratory measurement error has occurred, one or more of the corrective action(s) described below may take place. Corrective actions will be selected and implemented on a case-by-case basis by the INSY-TEP Manager and/or the QA officer and performed under their supervision.

Field Situations

The need for corrective action will be identified from field audits as well as by other means (e.g., equipment malfunction). If problems become apparent that are identified as originating in the field, immediate corrective action will take place. If immediate corrective action does not resolve the problem, appropriate personnel will be assigned to investigate and evaluate the cause of the problem. Once a corrective action is implemented, the effectiveness of the action will be verified such that the result is elimination of the problem.

Laboratory Situations

The laboratory QA/QC manager in consultation with the INSY-TEP Manager will initiate the need for corrective action resulting from QA audits. Corrective action may include, but is not limited to:

- Reanalyzing the samples, if holding-time criteria permit.
- Evaluating and amending sampling and analytical procedures.
- Accepting data with an acknowledged level of uncertainty.
- Resampling and analyzing.

If the above corrective actions are deemed unacceptable, an alternate laboratory will be selected to perform necessary or appropriate verification analyses.

Immediate Corrective Action

Any equipment or instrument malfunctions will require immediate corrective actions. The laboratory quality control charts are working tools that identify appropriate immediate corrective actions to be taken when a control limit has been exceeded. They provide the framework for uniform actions as a part of normal operating procedures. The actions taken should be noted in field or laboratory logbooks, but no other formal documentation is required unless further corrective action is necessary. These on-the-spot corrective actions will be applied daily as necessary.

Long-Term Corrective Action

The need for long-term corrective action may be identified by standard QC procedures, control charts, and/or performance or system audits. Any quality problem that cannot be solved by immediate corrective action falls into the long-term category.

The essential steps in a corrective action system are:

- Identification and definition of the problem.
- Investigation and determination of the cause of the problem.
- Determination and implementation of a corrective action to eliminate the problem
- Verification that the corrective action has eliminated the problem.

Documentation of the problem is important in corrective action. The responsible person may be an analyst, laboratory QA manager, sampler, or the INSY-TEP Manager. In general, the INSY-TEP Manager or designated representative will investigate the situation and determine who will be responsible for implementing the corrective action. The INSY-TEP Manager will verify that the corrective action has been taken, appears effective, and, at appropriate later dates, verify that the problem has been resolved.

For field activities, the INSY-TEP Manager will document the required corrective action. The corrective action will be discussed with the appropriate Tribal departments prior to implementation if the severity of the problem warrants such discussion.

Appendix XI: Reconciliation with Data Quality Objectives

When the data validation indicates that a control parameter is not within limits specified in this QAPP, the impact of the outlier on the usability of the associated data will be assessed. The usability of data associated with QC results outside of data quality objectives is dependent on the degree of the exceedance, whether the potential bias is high or low, and whether the uncertainty implied by the exceedance is significant.

Based on the results of the data validation, qualifiers will be applied to analytical data to indicate the usability of the data. The qualifier application scheme in https://www.denix.osd.mil/edqw/denix-files/sites/43/2023/02/Module-5-Data-Validation-Guidelines-Metals-by-ICP-MS-Final-1.pdf. Ranking of Data defines the way exceedances of QA/QC parameters will be treated and how qualifiers will be applied.

Appendix XII: List of Acronyms

ASTM	American Society for Testing and Materials
BOD	biochemical oxygen demand
DBMS	database management system
DI	deionized
DQO	data quality objective
DTSC	Division of Toxic Substances Control
HCL	hydrochloric acid
ID	identification
IHS	Indian Health Services
SYRB	Santa Ysabel Creek Basin
LCS	laboratory control sample
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
MSR	Management Systems Review
OVM	organic vapor meter
PARCC	precision, accuracy, representativeness, completeness and comparability
PQL	practical quantification limits
PRP	potentially responsible parties
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
RPD	relative percent difference
SOP	standard operating procedure
STORET	Storage and Retrieval (US EPA water quality database)
TSA	Technical Systems Audit
US EPA	U.S. Environmental Protection Agency
V*	fine sediment load
VOA	volatile organic analyte
VOC	volatile organic compound
INSY-TEP	Tribe Environmental Protection Agency

mg/kg	micrograms per kilogram
mg/L	micrograms per liter

Appendix XIII: Data Acquisition Requirements

This section identifies 1) the types of data needed from non-measurement sources including computer databases, and literature files, 2) describes any limitations of these data and, 3) documents the rationale for original collection of data and its relevance to this program.

Databases and literature sources listed below were collected due to their immediate reference to the Santa Ysabel Creek Basin, fisheries, water resources,

- STORET database, EPA
- Data Source Database, Tribal Water Quality Department
- INSY Tribal Fisheries Library
- BASINS database, EPA
- CDEC database, California Department of Water Resources
- Quality of Water database, U.S. Geological Survey

Acceptance criteria for the use of such data are based on the direct relevance to the project in question. Data must be geographically relevant, collected by an identifiable source of predictable quality. Data deemed questionable in quality or uncertainty will be regarded and used similarly to the use of anecdotal data and will not be incorporated into decision making processes. Data acquired from agencies employing an EPA approved QAPP will be automatically accepted as valid data. The INSY-TEP Manager will make all decisions regarding data quality and relevance.

Data Management

INSY-TEP will designate a data manager responsible for performing or overseeing all data management. Data management tasks will fall into the following categories:

Data Recording

Data recording will be performed using standard data recording sheets. Standard forms are shown in epa.gov/sites/default/files/documents/ufp_qapp_worksheets.pdf, worksheet #29.

This worksheet should be used to record information for all documents and records that will be generated for the project. It describes how information will be collected, verified, and stored. Its purpose is to support data completeness, data integrity, and ease of retrieval. Examples are provided.

Sample Collection and Field Records			
Record	Generation	Verification	Storage location/archival
Field logbook or data collection sheets	Field Task Leader (name)	Project director (name)	Project file
Chain of custody forms			
Air bills			
Contractor daily QC reports			
Deviations			
Corrective action reports			
Correspondence			

Data Validation
The data manager will oversee all data reduction, data reporting and data entry, which will be performed by the data manager or an authorized staff member or consultant. The data manager will visually inspect all entered data sets to check for inconsistencies with original field or laboratory data sheets. Where inconsistencies are encountered, data will be re-entered and re-inspected until the entered data is found to be satisfactory.

Data Transformation
Any transformations of data will be clearly labeled and explained as necessary on the same data sheet or computer file in which the transformation is performed. Where irreversible data transformations are performed, such as production of a graph from numeric data, the source and location of the original data set will be clearly indicated.

Data Transmittal
All field and laboratory water quality data generated under the INSY-TEP water quality program will be delivered directly to the designated INSY-TEP environmental data manager. The data manager will be responsible for the incorporation of data into a standard database, to be created using Microsoft Access or comparable database software and a standard desktop personal computer having sufficient memory and computing speed to operate the database software. Data entry format will be consistent with EPA STORET data format.

Data Reduction

Data sets shall be reduced only in cases where suspect or invalid data is being purged from the data set, or where redundant data is being eliminated for clarity of data presentation. Any reduced data set will be labeled as such, with a reference to the source and location of the full original data set.

Data Analysis

Standard methods will be used for statistical and graphical data analysis, as described in US EPA's *Guidance for Data Quality Assessment: Practical Methods for Assessment, 1998.* (EPA QA/G-9). The data manager will also use spreadsheet or graphing software as appropriate for producing graphical presentations of data.

Data Tracking

All staff and consultants will report directly to the data manager on the status and location of all data sets. Data will not be given to or shared anyone other than INSY-TEP personnel or INSY-TEP consultants without direct approval of the data manager and the INSY-TEP manager.

Data Storage and Retrieval

Data storage and retrieval will generally be performed using the US EPA's STORET system. Where direct entry into INSY-TEP STORET system is not possible or not preferred, the data manager will develop and consistently use standardized database (Access, Oracle or other comparable commercial database software) tables for data storage and viewing.

Appendix XIV: Assessments and Response Actions

Assessment Activities and Project Planning

Overall water quality project planning will be the responsibility of the INSY-TEP's Water Quality Program Manager, in consultation with the INSY-TEP Manager. Assessment will take place in four forms:

- Overall water quality program evaluation, including Management Systems Review.
- Ongoing surveillance by program managers.
- Technical systems audits; and
- Peer review.

Assessment of the Subsidiary Organizations

Management Systems Review (MSR) techniques will be used as described in *Guidance for the Management Systems Review Process, 1998* (EPA QA/G-3) to review organization, policies and procedures used by the INSY-TEP water quality program.

Assessment of Project Activities

Project activities, including water quality sampling and continuous monitoring, handling and transport of samples, laboratory analysis and data entry and analysis, will be assessed on an ongoing basis by the INSY-TEP Water Quality Coordinator, with monthly reports to the INSY-TEP's Manager and to the Fisheries will report bi-annually to the INSY-TEP manager to appraise him/her of new or changing projects that include water quality sampling.

At the end of the first year of water quality monitoring performed under this QAPP, the Iipay Nation Water Quality Department will hire a consultant to perform a Technical Systems Audit (TSA) to review all facilities, equipment, personnel, training, procedures, and record keeping involved in water quality assessment.

Peer review will be performed by environmental staff of other Tribes, consultants, and local university science natural resources faculty and graduate students, as described in https://www.epa.gov/sites/default/files/2015-05/documents/402-b-04-001c-20_final.pdf.

Documentation of Assessments

Number, Frequency, and Types of Assessments

Management Systems Review and surveillance of the water quality program by the INSY-TEP Manager and INSY-TEP Water Quality Program Manager will be performed on an ongoing basis over the life of the water quality program.

A qualified outside consultant (e.g., another tribal, or state, or EPA water quality manager) will perform the Technical Systems Audit at the end of the first year of water quality monitoring performed under this QAPP. If the initial TSA finds that the water quality program requires major improvements or reorganization to meet INSY-TEP DQOs, then a second Technical Systems Audit will be scheduled for the end of year two, with needed changes to be implemented in the interim. If the initial Technical Systems Audit calls for few programmatic changes, subsequent TSAs will take place at two-year intervals.

Peer review will take place as needed at the discretion of the INSY-TEP Manager and INSY-TEP Water Quality Program Manager and subject to the availability of peer reviewers.

Assessment Personnel

The INSY-TEP Manager will perform Management Systems Review and surveillance of the water quality program and INSY-TEP Water Quality Program Manager, with support from program staff and outside consultants as needed.

Technical Systems Audits will be performed by qualified outside consultants to assure objectivity. Consultant qualifications will include experience performing TSAs and familiarity with water quality monitoring.

Peer review will be performed by outside agencies such as environmental staff of other Tribes, consultants, and local university science and natural resources faculty and graduate students. The Iipay Nation Tribal collaborates closely with environmental program staff of Kumeyaay Nation Tribes. These Tribes share a common interest in protecting and restoring water quality in the Kumeyaay Nation Lands (e.g., San Diego County). Staff of these neighboring Tribes will review INSY-TEP water quality activities and offer support in evaluating and improving water quality data collection procedures. Paid consultants and university faculty are also available to work with the Tribe to review and suggest improvements to INSY-TEP water quality monitoring procedures.

Schedule of Assessment Activities

Assessment activities will be scheduled as described in https://www.epa.gov/sites/default/files/2015-05/documents/402-b-04-001c-20_final.pdf.

Reporting and Resolution of Issues

All assessment reports prepared by INSY-TEP staff, consultants, or peer reviewers will be provided to the INSY-TEP Manager and INSY-TEP Water Quality Program Manager. The INSY-TEP Manager will provide copies or summaries of these reports to the Iipay Nation Tribal Council and/or the Tribal Administrator on an as-needed basis.

The INSY-TEP Water Quality Program Manager will be responsible for implementation of any corrective action called for by the assessment process. Corrective actions may include, but will not be limited to: substitution of alternative methodologies for sampling, analysis or reporting; reassignment of task responsibilities to program staff; or replacement of consultants, contract laboratory, or other non-Tribal program participants.

Appendix XV: Data

Reports to Management

As necessary, the appropriate documents will be prepared and distributed to summarize both the field activities performed and the results obtained. These submittals, to the extent applicable, could include the following:

- Presentation of analytical results
- Summaries of field data from field measurements such as surface water flows, staff gage readings, and water quality parameters
- Lithologic description logs
- Results of aquifer tests.

Raw data from field measurements and other sample collection activities will be appended to the report, as appropriate. Where field data have been reduced or summarized, the method of reduction will be documented in the report.

Any needed corrective actions will be the responsibility of the INSY-TEP Water Quality Program Manager, who will request assistance from the INSY-TEP Manager if unable to resolve any problems.

Data Requirements

Data collected during an investigation will be appropriately identified, validated, and included in a report. Data reduction will be performed according to standard mathematical and/or statistical procedures, such as those appearing in recognized technical references. Calculations performed will be QC-reviewed by senior professional staff. Where test data have been reduced, the method of reduction will be described in the text of the report.

Analytical results and selected field measurements may be entered into a computer Database Management System (DBMS). Entry of the data is checked according to data entry verification routines that use visual inspection to compare the hard copy of data files with the original laboratory reports. The DBMS may be used to store data and to perform data manipulations (e.g., sorting, statistical tests) as required to interpret data, evaluate their quality, and provide data reports.

Field Measurement Data

Qualified personnel will perform validation of data obtained from field measurements by checking procedures utilized in the field and comparing the data to previous measurements. Data that cannot be validated will be so documented.

The following reporting requirements will be followed for field data:

- pH: Field measurements will be reported to 0.1 pH units.
- Electrical conductivity: Field measurements will be reported to two significant figures.
- Temperature: Field measurements will be reported to 0.1 degrees Celsius.
- Turbidity: Field measurements will be reported in standard nephelometric turbidity units (NTU). The precision will vary depending on the turbidity of the sample.
- Water levels: Measurements will be repeated until at least two are documented to agree to the nearest 0.01 foot.
- Flow rates: Rates will be reported as single instantaneous readings or single determinations of flow rate integrated over time. Precision reported will depend on the actual flow rate.
- Aquifer test data: Drawdown and recovery data will be plotted in the field for evaluation of aquifer response and will be reported according to the type of analysis performed.

- Soil sample depths: Tape measurements will generally be made to the nearest 0.1 foot; however, the accuracy of the measurement is dependent on depth. Measurements made by known lengths of drill string will be made to the nearest 0.5 foot.
- Elevations of sampling sites: Permanently marked measuring points for all wells will be surveyed to the nearest 0.01 foot and referenced to Mean Sea Level. Approximate elevations of non-surveyed sampling sites will be determined to the nearest 1.0 foot.
- Locations of sampling sites: Locations of sampling sites will be determined to the nearest 1.0 foot.
- Lithologic descriptions: Sample descriptions will be consistent with the ASTM system. Grain size will be adequately described for sand and coarser fractions.

Laboratory Analytical Data Review

Laboratory review of analytical data will be in conformance with laboratory standard operating procedures. One hundred percent of laboratory-generated data will be subjected to this internal data review. If matrix interferences become apparent during sample analysis, method modifications such as additional cleanup steps, sample volume changes, and analytical procedure revisions will be attempted and documented. If method modifications do not remedy the problem, alternative procedures will be proposed. The laboratory will assign qualifiers to the data to indicate impacts to data use. The laboratory, as appropriate for the type of analysis, will evaluate the following information:

- Sample chain of custody documentation is complete and correct.
- Sample preparation information is complete and correct.
- Sample integrity has been maintained.
- Instrument performance criteria have been met.
- Calibration criteria have been met.
- Holding times, sample preservation, and sample storage criteria have been met.
- Analyte identification and quantification are correct.
- QC samples and method blanks are within control limits.
- Documentation (including the case narrative) is complete and correct.

Treatment of Outliers

Corrective action measures will be taken to resolve problems and restore proper function to the analytical system when data indicate that the analytical system is not performing adequately. These measures may be necessary when the following occurs:

- QC data are not within the control limits for precision and accuracy.
- Blanks contain contaminants above the acceptable levels.

- Calibration data or instrument performance parameters are not within acceptance criteria.
- Undesirable trends are observed in the QC data or calibration data.
- There are unusual changes in instrument sensitivity or performance.
- Deficiencies are detected during audits or from the results of Performance Evaluation (PE) samples.

The program manager will conduct initiation of corrective action resulting from the evaluation of QC results. Corrective action may include, but is not limited to, the following:

- Reanalyzing the samples.
- Documenting of interferences or matrix effects that result in poor analytical performance.
- Evaluating and changing sampling or analytical procedures.
- Resampling and reanalysis, if the completeness or usability of the data set does not meet the criteria for acceptability.

External Data Validation

Data will be validated by the Tribal QA/QC Officer. Chemical water quality data will be evaluated to validate the laboratory data. The evaluation will include inventory of all laboratory deliverables and checking internal and external QC results to see that they are within specified limits.

A laboratory internal quality control check samples may not be sufficient to assess the validity of the data. Therefore, external QA samples are incorporated as an assessment of laboratory capabilities (e.g., accuracy, precision, contamination). To determine accuracy a certified reference sample, or matrix spike, or blank spike will be added for every 10 samples collected. To determine precision a sample duplicate, or reference duplicated, or spike duplicate will be added for every 10 samples collected. To determine contamination a deionized (DI) water blank, or a soil/sediment soil reference blank, or rinsate blank will be added for every 5 samples collected.

Should poor laboratory performance be identified from the precision or accuracy evaluations or from detected concentrations in field blank samples, the INSY-TEP Manager or designated personnel will notify the laboratory and initiate appropriate corrective action.

Despite all efforts to achieve the objectives of the QAPP, the potential for introduction of measurement error exists in field procedures, in a laboratory's chemical analyses, and in the data reporting process. Every reasonable effort will be made to compare and double-check data reported from a laboratory.

When the analytical results are received the designated QA Officer will review and validate the following:

- Holding times.
- Reporting limits.
- External QA results.
- Laboratory QC results.
- Historical outliers.

Historic Data Validation

The INSY-TEP has amassed a large collection of historic water quality for the Santa Ysabel Creek basin from various sources. The Tribe has years of water quality Data, and thus non-Tribal agencies and individuals collected nearly all the available data. Most of this data is not accompanied by rigorous QC information, such as specific collection, handling and analysis protocols for the tested water samples. Even in cases where EPA-approved protocols may have been used, they are generally not well documented.

For this reason, the INSY has adopted QC standards for accepting or rejecting historic data as useable, and for classifying acceptable data according to its degree of reliability. The following QC protocols will be used for evaluating historic data.

Objectives Clarification

Before accepting, rejecting or classifying historic data, the purpose or purposes for which the data will be used shall be clarified. Data that may eventually be used in litigation or for establishing legally binding water quality standards call for rigorous QC to defend the data's integrity under scrutiny. On the other hand, anecdotal, non-quantitative historic information may be used without intensive QC for the purposes of identifying long-term water quality trends.

Ranking of Data

A ranking system will be used to classify historic data in broad categories, for example "highly reliable," "reliable," "acceptable" and "do not use."

- "Highly reliable" data will include only data collected by or for the INSY under accepted QC protocols *after* the date of implementation of an EPA-approved QAPP.
- "Reliable" data will include data collected before or after QAPP implementation by any party, so long as it is accompanied by acceptable QC documentation in a US EPA-approved format.
- "Acceptable" will be used to describe data that have little or no QC documentation but show few unexplained outliers and are generally consistent with "reliable" data found in other data sets where one might reasonably expect comparable values, for example in an adjacent stream basin during the same time period.
- "Do not use" will refer to data that do not have any QC documentation and show large numbers of outliers and/or are not consistent with "reliable" data sets.

Ranking will be based on available QC documentation, outlier count, probable precision of the data given the methods and equipment used and the year in which data were collected, and any available background information on the performance record and reputation of the agencies or individuals that produced the data.

Data ranking will allow staff to set standards for data use in a specific project. For example, a staff member could choose to accept all "highly reliable," "reliable" and "acceptable" data for use in an internal report to staff calling attention to a suspected long-term increase in turbidity on specific creeks. The same staff member might designate only "highly reliable" data acceptable for use as evidence in water quality-related legal proceedings.

Use of Metadata

Any data that are entered in the Iipay Nation Tribal water quality database, be they current data collected by Tribal staff or historic data from other sources, should include QC "metadata," i.e. information about the data and how it was collected. QC metadata can include exact location and time of sampling; names of field and laboratory personnel; sample collection, transport, storage and analysis procedures; and information about special circumstances that could make the data non-representative. The Tribe's water quality database should include fields for entering this information, and it may not accept data that is entered without accompanying metadata. If requested metadata are not available, staff shall enter "not available" in the appropriate field, rather than leave the field blank.

Source Identification

Project staff will examine the document or electronic file that contains the data, looking for metadata. If the document or file does not include such information but does include information about the agency or individual that collected the data, staff will contact the agency or person and ask what QC metadata are available. Staff should also investigate and document the responsible agencies, laboratories or people overall record for producing reliable data.

Outlier Check

Data that deviate abnormally from the overall data set will be examined carefully to determine, if possible, whether the data represent an actual high or low value, or might be attributable to errors in sample analysis or data entry.

However, it is extremely important not to weed out all outlier data as erroneous. In many cases, an apparent outlier represents an actual deviation in water quality, the very conditions that a water quality program is attempting to identify and correct. The best approach is to find and flag outliers, but not remove them from the data set. If they turn out to represent actual water quality conditions, they are legitimate data; on the other hand, if they are shown to be erroneous, they may point out systemic errors in sample handling or data entry that render the whole data set unusable.

Using Excel or a similar spreadsheet, an automated outlier search routine can be written, for example to flag all data points more than one standard deviation above or below the mean value. This will of course be more useful for parameters that tend to show constant

values. For data that are in electronic format, producing a graph from the data will make outliers much easier to spot.

Data entry errors might be discovered by comparing original data logs with data derived from the logs that are used in reports, or by looking for patterns such as double keystrokes. For example, if numbers like 110 shows up occasionally among values normally on the order of 10, data entry error is likely.