# TABLE BLUFF RESERVATION –
# WIYOT TRIBE

**Tribal Environmental Department**

# DRAFT QUALITY ASSURANCE PROGRAM PLAN (QAPP)
# for
# WATER QUALITY ASSESSMENT AND MONITORING

## September 2004


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**TABLE BLUFF RESERVATION – WIYOT TRIBE**
**QUALITY ASSURANCE PROGRAM PLAN (QAPP)**
**WATER QUALITY ASSESSMENT AND MONITORING**

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Table Bluff Reservation – Wiyot Tribe

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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 |
| HBB | Humboldt Bay 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 Program 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) |
| TBR | The Table Bluff Reservation – Wiyot Tribe |
| TSA | Technical Systems Audit |
| US EPA | U.S. Environmental Protection Agency |
| V* | fine sediment load |
| VOA | volatile organic analyte |
| VOC | volatile organic compound |
| YTEP | Yurok Tribe Environmental Program |
| μg/kg | micrograms per kilogram |
| μg/L | micrograms per liter |

# 1.0 INTRODUCTION

This Quality Assurance Program Plan (QAPP) has been prepared by the Yurok Tribe Environmental Program (YTEP) for water quality assessment and monitoring activities on or near Table Bluff Reservation – Wiyot Tribe (TBR, the Tribe, Wiyot Tribe) in northern California. The Tribe will ultimately be developing water quality standards to be applied to waters of the Reservation. The tasks leading to the development of the standards will involve the assessment and monitoring of waters within the identified program area (i.e., Humboldt Bay). This QAPP will be applied to all water quality monitoring and sampling activities undertaken by the Tribal Environmental Department of TBR on Tribal lands, not just those that have been funded under a Clean Water Act 106 Grant. The Tribe is fully aware of sampling activities that are reimbursable under the 106 program. For water quality monitoring and sampling activities undertaken by the Tribal Environmental Department of TBR outside of Tribal 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 ensure that the quality assurance (QA) and quality control (QC) procedures used to document technical data generated during projects is accurate, precise, complete, and representative of actual field conditions. 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 US EPA and applies to all TBR projects involving the generation, acquisition, and use of environmental water quality data. This QAPP will not discuss decisions that will be made once data is generated. However, if sampling indicates that contaminants are found, a course of action will be presented to the Tribal Council to decide what will be done. Additionally, the Tribal Environmental Department should contact the US EPA, State of California, and Humboldt County to determine if any environmental enforcement is necessary, based on the results of the sampling. Water quality on the Table Bluff Reservation needs continual assessment to ensure the health and well being of the many Tribal members who depend on local water sources for all household needs. In addition, the protection of the many natural resources and the ecosystem that supports them is essential for Wiyot cultural viability.

This QAPP is intended to be comprehensive. Methods, procedures, and techniques described include procedures that may be used during the 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. These specific sampling plans will be submitted to US EPA's QA Office for review. After receiving comments, corrections will be made and returned to the QA Office for final approval.

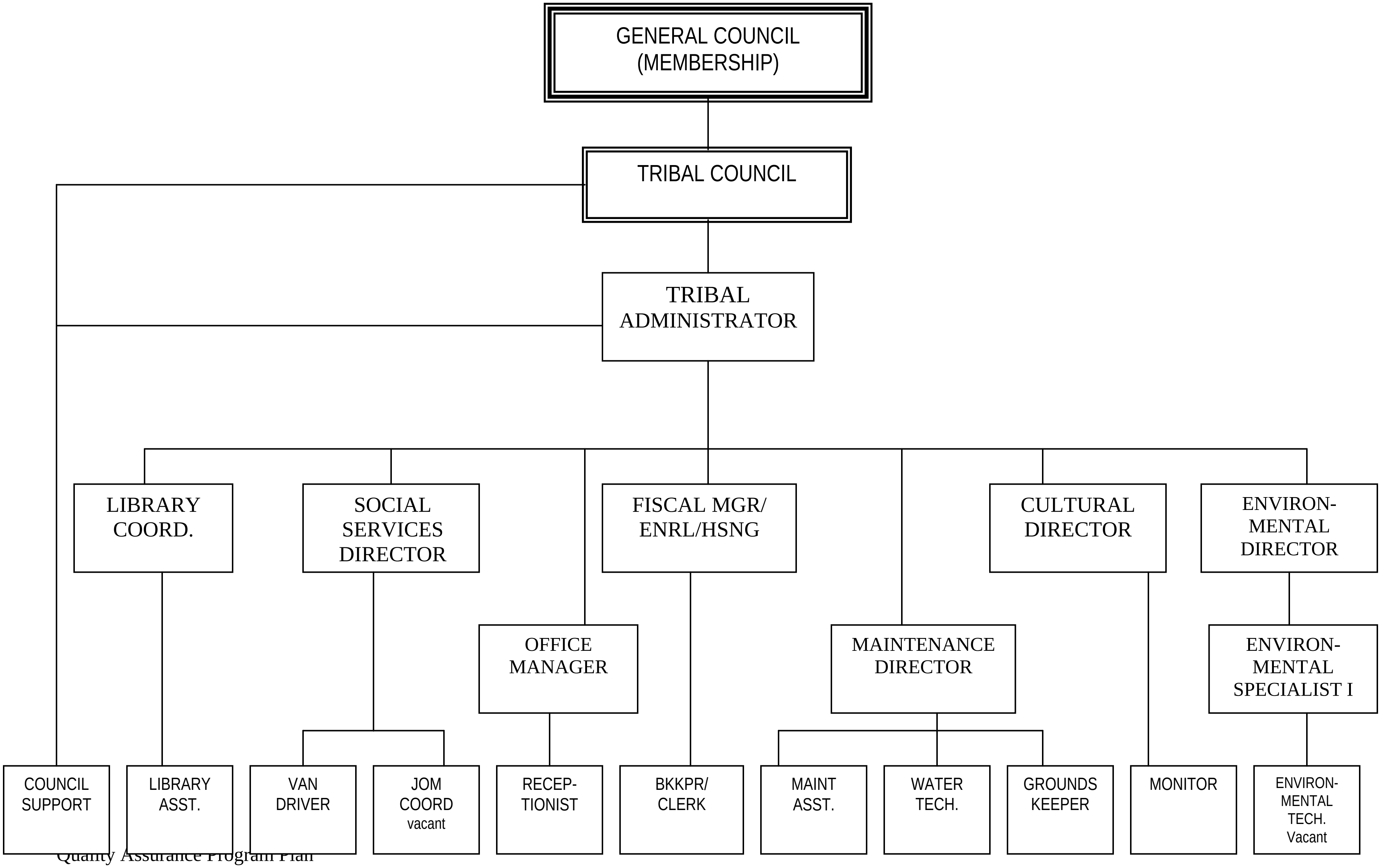
As necessary or appropriate, additional or modified procedures may be presented in addenda to this QAPP or may be required due to unanticipated field conditions. If procedures are modified in the field, the modifications will be approved by the Director of the Tribal Environmental Department of the Tribe, the Project QA Officer and completely documented in a field notebook and in appropriate reports. Appropriate persons will be advised of significant changes or modifications in procedures before they are made.

## 2.0 PROGRAM ORGANIZATION

The water quality program of TBR is housed in the Tribal Environmental Department as shown in Figure 1. The Director of the Department has responsibility for overall program coordination, schedule and budget management, technical oversight, report preparation, and overall program quality. The Director reports directly to the Tribal Administrator of TBR, who has ultimate control over and responsibility for the water quality program.

In order to provide an independent and more focused oversight of program quality, the Tribal Environmental Department of TBR has designated the Director to act as Program QA Officer. The Program QA Officer will have specific responsibility and authority for ongoing review, monitoring, auditing, and evaluation of the field and laboratory QA/ QC program(s). The Program QA Officer will also be responsible for development and supervision of QA/QC procedures for data management, analysis, report preparation, and review. The Program QA Officer may delegate tasks to appropriate personnel. QA/QC problems or deficiencies identified by the delegated personnel during the review, monitoring, and auditing processes will be brought to the attention of the Program QA/QC Officer and addressed as appropriate. If QA/QC problems or deficiencies requiring corrective action occur, the Program QA Officer will select remedial action. Corrective action(s) will be performed under the supervision of the Program QA Officer.

**Figure 1 Program Organization**



The following persons and institutions will receive copies or notice of completion (NOC) of the approved QAPP and any subsequent revisions:

To receive notice of completion only

- Tribal Council

To receive a copy of completed QAPP and notification of amendments

Managers responsible for plan implementation

- Tribal Administrator
- Tribal Environmental Department

Staff responsible for plan implementation

- Director of the Tribal Environmental Department of TBR
- Environmental Specialist I of the Tribal Environmental Department of TBR
- Environmental Technician of the Tribal Environmental Department of the TBR

Other entities

- Appropriate US EPA project officers and managers
- Consultants or contractors (as necessary)

## 3.0 PROBLEM DEFINITION/BACKGROUND

### 3.1 Geographic Setting

Located near the southern end of Humboldt Bay, Table Bluff is situated along coastal bluffs. Tribal lands within and in proximity to the Table Bluff Reservation boundaries include 88.5 acres in Tribal trust status on the upper Reservation and 20 acres on the lower Reservation. 16 acres are held in fee by Tribal members with 1 acre held in fee by the Tribe, and 3 acres held in fee by non-Tribal members. Additionally, the Tribe owns a 1.5-acre parcel on Indian Island in Humboldt Bay.

The upper Reservation is situated on fairly level ground atop a coastal bluff approximately 180 feet above mean sea level; the lower Reservation, approximately 30 feet above mean sea level, is situated along the southern edge of the bluff as it slopes to meet the Eel River Estuary. The Indian Island parcel held by the Tribe is situated along the shoreline of the Island, and runs from the mean low tide mark inward, with the highest point on the property being approximately 6 feet above mean sea level. The Reservation includes slightly greater than one acre of wetlands and ample groundwater. Indian Island abuts the North Bay of Humboldt Bay, and the property owned by TBR has at least one groundwater well, indicating that groundwater of some degree of clarity exists on that parcel, as well. The Reservation is located within the aboriginal territory of its people, the Wiyot.

The Tribe is interested in becoming involved in the protection of several local natural resources, including estuarine, bay, and ocean shoreline water quality, local wetlands, and ground water quality in the Table Bluff Reservation and Indian Island areas.

Fishing, hunting, and gathering of food and culturally significant materials are particularly important to Tribal members who have long depended on fish and wildlife for subsistence.

**Figure 2 Humboldt Bay Basin**

**Figure 3 Table Bluff Reservation**

## 3.2 Water Quality Issues for TBR

There are several threats to the integrity of the waters within and along Tribal properties, all of which are important water bodies to TBR. These threats are outlined below:

<u>On- or Near-Reservation</u>

Many of the shallow groundwater wells on the lower Reservation were condemned due to contamination from malfunctioning septic systems (Wisconsin mounds). The Tribe's current drinking water well is located 50-75 feet from a condemned wellhead, but was drilled to a greater depth to avoid the contaminated aquifer. It is assumed that the present drinking water well draws water from the nearby Eel River estuary. Within 20 feet of the wellhead, beef and dairy cattle are grazed year-round. Other possible threats to the groundwater of the Tribe include illegal dumping, contamination of inadequately secured or closed wellheads, catastrophic chemical spill in the estuary, bacteriological or nitrates contamination from nearby septic systems, and chemical contamination from local land use practices.

The Reservation contains slightly more than one acre of wetland on trust land, which is threatened by cattle grazing in the area and chemical contamination from local land use practices.

<u>Indian Island</u>

Indian Island contains documented chemical contamination. This contamination is due to past land use practices, and has resulted in the site being designated a brownfields site. Besides initially being permanent village locations for the Wiyot people, other former uses of the island included a settlement site with small-scale agriculture, a yacht club and recreational grounds, and an industrial area with both timber mills and marine vessel dry docks. The majority of the contamination on the parcel owned by the Tribe is a result of the operations from the dry dock boat works repair facility located on the site. Soil and groundwater testing at the site indicate that several hazardous materials and metals exist on the site in concentrations in excess of action levels for human health and ground water protection set by the US EPA.

In addition to known existing contamination, the waters of Humboldt Bay, which abut the property, are vulnerable to contamination from nearby continuing and past industrial operations (a pulp mill, a power plant, and discontinued mill sites) as well as from mobile sources.

## 3.3 Water and Culture

### 3.3.1 Significance of Water

Before the damming of wetlands by European settlers, there were over 100 miles of travelable waterway up into sloughs and creeks that empty into the bay. These routes were means to reach important locations, such as other ceremonial grounds and fishing places, with redwood canoes being the main method of conveyance. Food resources such as shellfish, crabs, seals, and other marine resources were often harvested from the water and mudflats in canoes. Shellfish, such as clams, which are still a major staple of many

Wiyot people's diets, are very susceptible to contaminated water.  Today, children are taken out and shown how to gather clams, and they come in direct contact with the mudflats and any contamination that may be present in the water.

### 3.3.2 Ancestral Territory

The Tribe's ancestral territory includes Little River to the north, Bear River Ridge to the south, and from the Pacific Coast out to as far as Berry Summit in the northeast and Chalk Mountain in the southeast.  Main waterways include Humboldt Bay, Little River, Mad River, Jacoby Creek, Freshwater Creek, Elk River, Eel River, Van Duzen River, and Bear River.  The majority of villages were concentrated around Humboldt Bay and along the coast; other villages were located inland, generally near rivers.

### 3.3.3 Significance of fisheries

Fish and shellfish were, and continue to be in the present era, a main staple of the Wiyot diet.  Clean, clear, and appropriately cool waters are vitally important to the continuing viability of the fisheries utilized by the Wiyot people.

### 3.3.4 Ceremonial uses of water

Fresh water, besides domestic uses, is important for ceremonies and food resources. Water is essential in use of medicinal medicines, soaking basket materials, leaching foods, such as acorns, and bathing the sick when in ceremonies, or when used while fasting during ceremonies.

## 4.0 PROGRAM DESCRIPTION

The purpose of assessing the water quality on Table Bluff is to establish baseline data for future monitoring of surface and ground water quality and quantity with respect to cultural, ecological, human drinking, and household water needs. In conjunction with the assessment, a monitoring program of the habitat needs of various species and life history stages of native Humboldt Bay species continues to be conducted. Grants from the U.S. Environmental Protection Agency (US EPA) have been awarded to Table Bluff (e.g., General Assistance Program Grant (since September 1996), Clean Water Act 106 Grant (since September 2002), Public Water Supply Capacity Operator and Management Training Grant (since September 2002)) to build and establish environmental protection services. TBR will use both in-house and contracted services for the assessment and monitoring covered by this QAPP.

The initial objectives of the data gathering activities conducted as part of the water quality assessment are to develop a baseline database of measurements that can then be used by the Tribe to develop water quality standards, prioritize restoration needs and track water quality trends.

This document describes the procedures to be followed during water quality assessment and monitoring activities. These activities could include drilling wells and using piezometers; lithologic and geophysical logging of boreholes; installing and testing wells and using piezometers; collecting groundwater, surface water, drinking water, sediment and biological 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 TBR Water Quality Monitoring Program will address water quality both in drinking water sources (surface and ground water) and surface and ground waters not used as drinking water sources. In addition, the TBR Water Quality Monitoring Program will examine the effect of water quality on subsistence resources.

The Tribe has one drinking water well at the moment, but may drill a replacement well on the upper section of the Reservation. In addition, the Tribe may wish to monitor the well existing at Indian Island for its capacity as a drinking water source. This may mean monitoring in conjunction with the State (because of fee status) or assuming the responsibility for monitoring from the State. In addition, the current well may be capped, and a new well drilled. Where drinking water sources are being assessed, monitoring will be primarily for:

- Coliform bacteria
- metals
- turbidity
- volatile organic compounds (VOCs)

- TPH (total petroleum hydrocarbons) – both gasoline and diesel
- PCP (pentachlorophenol)

All other waters tested by the Tribe will be for cultural practices and ecosystem health. In surface waters not used as drinking water sources, monitoring will focus on parameters affecting fish and other 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)
- chlorophyll
- biota (e.g. macroinvertebrate and fish counts)
- suspended sediment concentrations (entrained)
- rainfall

Sediment and biological (fish and shell fish tissue) materials collected will be tested for parameters including:

- pesticides (analysis to be determined based upon sample location and known pesticide use in that area)
- metals
- PCBs
- Dioxin

Macroinvertebrate samples will be analyzed to investigate the distribution and abundance of a single species, or may involve larger inventories of the entire biotic assemblage. This information will be used to further evaluate the effects of inorganic sediment and chemical contaminants upon the natural aquatic system. This information will supplement other scientific data collected to determine the effects upon the food web.

Standard operating procedures for the collection of environmental data, as well as equipment to be used, are described in Section 10.0. These include procedures for the operation, care, and maintenance of equipment with guidelines for specifications insuring 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.

TBR has not yet developed or implemented Tribal water quality standards. Interim standards to be implemented while Tribal standards are under development will generally duplicate federal and State of California standards, including the National Primary Drinking Water Standards (see Appendix D), and the North Coast Regional Water Quality Control Board Basin Plan (see Appendix D). State of California Title 23 drinking water standards may be used as a secondary source for Tribal interim standards (see Appendix D). Jurisdiction and enforcement of these standards is the responsibility of the TBR Tribal Council.

The TBR Water Quality Monitoring Program will be ongoing, commencing upon USEPA approval of this QAPP and continuing indefinitely or until terminated by TBR. Program personnel will be trained and certified according to the criteria given in Section 6.0. Special equipment to be used in the program is described in Section 10.0. Program QA/QC reporting will be performed using the standard forms provided in Appendix A, which are accompanied by explanatory documentation as appropriate.

# 5.0 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. that 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 other departments or personnel working for TBR, 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. US EPA has already established appropriate QA/QC procedures for most of the assessment and monitoring program components (e.g., field operations, water quality, flow study) unless procedures are adopted from other successful programs.

## 5.1 Program Quality 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. The definitions for accuracy, precision, completeness, comparability, and representativeness to be used in this program are given below.

- Accuracy - the degree of agreement of a measurement with an accepted reference or true value.
- Precision - a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Generally expressed in terms of the standard deviation.
- Completeness - the amount of valid data obtained from a measurement system compared to the amount that was expected and, needed to be obtained, to meet the program data goals.
- Comparability - expresses the confidence with which one data set can be compared to another.
- Representativeness - refers to a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations that are under study.

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. These goals have been subdivided by sample media and methods. 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 presented in Section 5, as appropriate.

The precision and accuracy of the analytical laboratory results will be calculated from the analytical results of the QC samples as specified in Section 14.0. 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 [μg/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. Analytical detection limits are discussed in Section 13.0.

A goal of 80 to 85 percent completeness has been established for the program chemical data (Section 23.1). However, the required level of completeness will vary with the data quality needs of different aspects of the program. In the event that 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 by the use of 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 μg/kg), fluids in milligrams or micrograms per liter (mg/L or μg/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. These are discussed in Section 23.3.

### 5.2 Measurement Performance Criteria

In the event that all expected data are not available or suitable to support an aspect of the assessment and monitoring activities, the available data will be specifically assessed to determine if they are adequately complete, or if additional data should be acquired.

Data quality objectives (DQOs) are established to insure that data used to prove or disprove a given hypothesis are of sufficient quality to support or defend the results obtained. 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 purpose 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 is a reflection of 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 purpose of this program, representativeness is defined as the degree to which a subset of data actually collected reflects the characteristics of a larger set of data that could be collected, assuming the subset is a part of the larger set. It is based on the assumption that one does not have to sample an entire population in order 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. that the sampling is truly random.

Resource constraints are an important concern for the program. Consequently, trade-offs must be made amongst the DQOs to assess their relative importance in developing the data needed to arrive at a decision as to the existence of a water quality problem and whether to pursue abatement measures. The key trade-off for this program is between the quality (emphasis on accuracy and precision) and quantity (emphasis on representativeness).

A primary argument for emphasizing accuracy and precision is that data could be subject to challenge. Challenges to data quality typically occur in litigation cases, determination of liability, or when determining whether specific actions (e.g., medical intervention, abatement) need to be taken for a specific individual and/or property, or similar decisions. A second supporting argument is that the typical methods of determining accuracy and precision also provide insight into the validity of the process, which is likely to increase confidence in the results. A data set that is both accurate and precise is more likely to be deemed acceptable for any given purpose, thereby increasing completeness of the entire data pool.

The primary argument against an emphasis on accuracy and precision is that when resources allow the processing of only a given number of samples, the rigorous methods used to maintain high precision and accuracy in sampling reduce the number of individuals and/or properties that can be characterized, which in turn reduces the representativeness of the samples. The data developed for this program will be used to develop water quality standards and may be used in litigation. Consequently, there is a need to emphasize accuracy and precision for these purposes. The potential requirement for increased confidence in the data to increase completeness can be handled procedurally.

All the techniques that will be used in this program have the inherent sensitivity needed by the program. Comparability will be enhanced by the use of standard procedures for each technique. It is anticipated that comparability will approach 100 percent. Because the standard procedures that will be used in the program are already widely accepted, the focus of the data gathering activities will be on the use of these standard procedures, rather than establishing quality objectives. If information about the accuracy or precision of a particular procedure is readily available, it will be used as part of the data assessment process, but the procedure will not be modified in order to meet a different objective. This is the most effective and efficient means of utilizing the resources available to the program.

## 6.0 SPECIAL TRAINING REQUIRMENTS/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 fisheries staff person who is measuring water temperature as a component of a fish 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 as well as database management (e.g., STORET) and automated data collection methods. Certified program staff will participate in further training as appropriate to refresh program-related skills or to expand the Tribal Environmental Department pool of relevant, available in-house skills. Certifications for specific skills and requirements will be kept current and on file at the Tribal Environmental Department of the Tribe in Loleta, California. Training levels of contractors used will be equivalent or higher than tribal staff, when used and will be documented (i.e. resumes, certifications, etc.).

# 7.0 DOCUMENTATION AND RECORDS

## 7.1 Documentation

Documentation and records of the data collected by Table Bluff will be stored and compiled electronically with copies of the records stored in separate locations. Reports of compiled study results will be released/distributed according to the urgency and type of data collected and the amount of time and resources required for preparation.

## 7.2 Field Operation Records

- *Reporting Format.* Summaries of assessment and monitoring activities will be updated yearly in Table Bluff's Water Quality Assessment following standard scientific reporting formats.
- *Sample collection records.* These records show that the proper sampling protocol was performed in the field. This documentation includes the names of persons conducting activities, sample number, sample collection points, maps and diagrams, equipment/method used, climatic conditions, and unusual observations. "Rite in the Rain" field notebooks with pre-numbered pages will be used for record of observations and references to changes or events in planned activities.
- *Chain-of-custody records.* Chain-of-custody records document the progression of samples as they travel from the original sampling location to the laboratory and finally to the disposal location.
- *QC sample records*. These records document the generation of QC samples such as field, trip, and equipment rinsate blanks and duplicate samples. They also include documentation on sample integrity and preservation and include calibration and standards' traceability documentation capable of providing a reproducible reference point. Quality control sample records will contain information on the frequency, conditions, level of standards, and instrument calibration history.
- *General field procedures.* General field procedures record procedures used in the field to collect data and outline potential areas of difficulty in gathering specimens.
- *Corrective action reports.* Corrective action reports show what methods were used in cases where general field practices or other standard procedures were violated and include the methods used to resolve noncompliance.

## 8.0 DRILLING AND WELL INSTALLATION PROCEDURES

All monitoring wells will be inspected for integrity and upgraded for additional protection, if necessary. Well inspection will include verifying the presence of suitable locking devices for protection from unauthorized access. Protection form vandalism and vehicle traffic will also be considered when inspecting wells. Aboveground riser casings, caps, and grout aprons will be inspected for damage. Permanent identification (ID) markings should include the well designation, total well depth, and well elevation using National Geodetic Vertical Datum and reference point (top of casing, top of box, or ground surface). The well ID should be installed in a manner where the information is easily read and cannot be removed from the well. Usually this is done by etching or painting this information onto a metal tag and installing the tag on the well cap or attaching the tag to the casing in some other manner. Painting this information on the outside of the well casing or inside the protective cover is acceptable but not recommended, because paint chemicals may induce spurious results in subsequent groundwater quality analyses. If painting is the chosen method, it should be done after the well has been sampled and closed. If the well is to be surveyed, survey points on well casing, well box, or grout apron will be permanently marked by etching the grout or notching casing in a conspicuous manner. Surface well seals will be inspected for integrity, local surface spills, and proper drainage away from the well. Casings will be inspected at the surface for cracks or other damage.

Supply wells at the site will be inspected for integrity and usefulness as potential monitoring points. All wellhead fittings will be inspected and repaired, as necessary. Sampling ports, access ports, riser casing, and surface seal integrity will be inspected. Pumps and other equipment will be described as to type, general condition and tested.

Field notes for the well inspection should address the above points and include any other pertinent observations made regarding general construction of the well and siting of the wells relative to potential site hazards. Notes should describe all well locations based on permanent landmarks.

### 8.1 Drilling and Well Installation Procedures

This section describes the routine procedures that will be followed during drilling, trenching, in-situ sampling, and well/piezometer installation. These procedures are designed to assure that: (1) borings are properly logged, (2) wells/piezometers are properly installed, (3) borings and wells are properly sealed, and (4) in-situ samples are properly collected.

### 8.2 Drilling Methods

- Flight augers (hand or portable hydraulic) will be used for shallow borings (less than 20 feet) that cannot be readily accessed by a hollow-stem auger drill rig.
- The hollow-stem auger method will be used for shallow (to about 120 feet below ground level) borings and well installations within the vadose and shallow aquifer zones.
- The air-rotary method, or other drilling method(s) as appropriate, will be used for deep boring (>200 feet below ground level) well installations that require a larger diameter hole or greater depth than can be drilled with a hollow-stem auger.

- To minimize smearing along the sides of the borehole, augers will have a cutting head that is slightly larger in diameter than the remainder of the flights.
- Any downhole equipment will be decontaminated prior to each use as described in Section 11.0.
- Before any auguring or digging is to commence, the Cultural Department must sign off on the project.

### 8.2.1 Lithologic Logging

Soils encountered during drilling will be classified by a field geologist, engineer, or qualified field technician, under the supervision of a licensed geologist. For lithologic logging, soil-cutting samples will be collected at each observed change in lithology or at least every 5 feet. If the data quality objectives indicate a need for detailed lithologic information, continuous coring will be specified in the field sampling plans and borings will be continuously cored. Observations, which include the following information, as appropriate, will be recorded on a standard Borehole Log Form (see example in Appendix A):

- Boring or well designation and location,
- Drilling and sampling methods and equipment,
- Names of field geologist and driller,
- Dates and times started and completed,
- Depth where groundwater was first encountered,
- Sample depths and recovery rates,
- Blow counts, if appropriate,
- Color of soils,
- Grain size of soils,
- Relative percentage of grain sizes,
- Descriptive comments including situations or conditions that impact drilling activities,
- Estimated relative moisture content, plasticity and density,
- Variations in drilling rates and rig behavior,
- Sample description:  depth, ASTM Classification, and Munsell Color Index number and name,
- Volatile concentrations using headspace field screening procedures, where appropriate, and
- Signature or initials of observer.

### 8.2.2 Pilot Borings

Pilot borings may be drilled to provide site-specific data for well design and/or to obtain data necessary to order well-specific materials or to evaluate the stratigraphic distribution of aquifer and aquitard units. Pilot borings may also be drilled to evaluate the lithology and to obtain samples for assessment purposes. Boring locations will be cleared before drilling. A geologist, engineer, or hydrogeologist will supervise the drilling and prepare lithologic logs of the borings as described in Section 8.2.1. A licensed geologist will review all field logs. Discrete soil samples will be collected as needed following procedures described in US EPA Region 9's *Field Sampling Guidance Document (SOP) #1205: Soil Sampling (1999),* (see Appendix B).  Sampling intervals and drilling methods will be specified in the sampling plans for each phase of activities. Selected borings may be continuously cored to provide detailed stratigraphic data.

Following completion of a pilot boring, and, approval given by the Cultural Department if boring is in a culturally sensitive area, it will be reamed to allow for well installation or will be backfilled with Portland cement and water or Portland cement, sand, and water. The ratio of sand to cement should not exceed 1:1 by weight. All ingredients used to formulate the cement will be thoroughly blended. Water ratios to cement should be 5.5 to 7.5 gallons water per sack of cement. The grout will be pumped or poured through a tremie pipe, when adequate space is available, or through the hollow-stem auger from the bottom of the borehole to the ground surface. Sections of auger will be removed as the grout is emplaced. Soil cuttings will be replaced back into the surrounding area unless contamination is suspected. If the latter is the case, the soil cuttings will be stored in 55-gallon drums or bins for subsequent disposal.

### 8.2.3 Borehole Geophysics
Geophysical well logging will be used to: (1) assist in lithologic characterization and definition of stratigraphic units, (2) assist with the selection of screening intervals, (3) locate gravel packs and screened intervals of existing wells, and (4) measure groundwater flow rates. In addition, geological and geophysical subsurface maps can be constructed from the well logs.

A borehole geophysical investigation consists of a variety of methods that are incorporated into a geophysical logging system designed to survey the stratigraphic section intersected by the borehole. Because a single well log does not normally provide the total information desired, it is common practice to record three or more logs in a particular borehole. The following logs may be performed only in selected, uncased boreholes: caliper, natural gamma, spontaneous potential, single point resistance, and 16-inch and 64-inch normal resistivity logs. Natural gamma, temperature, flow meter, and video logs may be performed in selected cased and uncased wells. All geophysical logs will be recorded in both analog and digital format.

Procedures for field use of geophysical logging equipment are as follows:

- Decontaminate all downhole equipment,
- Align vehicle with selected borehole,
- Perform operational checks and adjustments necessary per manufacturer's instructions,
- Perform well logging survey,
- Label records and document pertinent information in the field notebook, and
- Repeat measurements if necessary.

### 8.2.4 Well/Piezometer Installation
The purpose of installing groundwater monitoring wells or piezometers is to facilitate evaluation of groundwater quality, potentiometric levels, and hydrogeologic characteristics of aquifer(s) and aquitards. Standard protocols given below will be followed during well design and construction, installation, and development. Either the Field Supervisor or the Project Manager, prior to drilling and installation of monitoring wells or piezometers, will review well specifications.

A licensed geologist, hydrogeologist, or engineer will supervise well installation, observe drilling, collect soil samples for chemical analysis, and prepare lithologic logs of borings. Drilling and well installation methods will vary according to the type and depth of the intended monitoring well and will be specified in the work plan(s).

The wells may be single casing or double-casing wells as described below. Well construction details for each installed well will be entered on a field Well Completion Form (Appendix A). All drilling, sampling, and well installation equipment and material will be decontaminated as described in Section 11.0.

### 8.2.5 Well Development

After the grout has set for at least 12 hours, each well will be developed by swabbing, surging, bailing, and/or pumping. Depending on the type of well, one or more of these methods may be used. Each well will be developed until the discharged water is visibly clear and free of sediment or until a maximum of 15 casing volumes is removed. Conductivity, pH, temperature, and turbidity will be measured during development. After swabbing, surging, and/or bailing, a pump will be placed near the bottom of the well and pumped at a discharge rate that can be continuously maintained until the water is again visibly clear and free of sediment. The adequacy of well development will be determined by the site geologist or engineer.

All well development fluids will be contained and stored onsite pending the results of chemical analyses. Disposal methods will depend on analytical results as discussed in Section 11.2.

# 9.0 SAMPLING PROCESS DESIGN

This QAPP was developed as a program plan used to support project plans, assure consistency between plans, and to streamline their approval process. This section contains advisory information regarding sampling and monitoring plan design. It is to be considered a guideline for future project activities, and should not limit the development of differing designs as required.

## 9.1 Scheduled Program Activities

Reservation

The Tribal Water Quality Monitoring Program will seek to sample regularly to verify the quality of the Tribal drinking water source, the Tribal wetland, groundwater near illegal dumpsites and failed/failing septic systems, and the waters of the nearby estuary, which may feed into the aquifer feeding the drinking water well.

Indian Island

The Tribal Water Quality Monitoring Program will seek to sample regularly to verify the quality of the waters of Humboldt Bay affecting the parcel, as well as the groundwaters of the Island, which feed the well on the Tribe's Indian Island property. Monitoring wells may be placed on the Tribal parcel by the NCRWQCB under a current Brownfields clean up. Testing at Indian Island relative to the Brownfields clean up will be covered under a separate Sampling and Analysis Plan.

## 9.2 Design of Sampling Plans

Sampling plans to carry out the sampling described in Section 9.1 are laid out below. In order to assist the Tribe with development of future Sampling Plans, US EPA recommended and optional text, as well as instructions and guidance for each component, are provided in Appendix F, "Sampling and Analysis Plan Guidance and Template". Any additional sampling that is not covered in this QAPP that Table Bluff plans to perform will be incorporated into a Sampling and Analysis Plan and submitted to USEPA for approval. In addition, Tribal and other standard operating procedures for many of these elements can be found in this QAPP, and should be used verbatim where possible, or sampling plan text should, at a minimum, correspond with the intent of the QAPP SOPs or EPA guidance.

### 9.2.1 Introduction

Reservation

On-Reservation sampling will be conducted to determine and confirm integrity of waters supplying drinking water to the Tribe, as well as to confirm the continued health of the Tribal wetland and to ascertain groundwater pollution from illegal dumping and failed/failing septic systems and improper waste handling activities.

Indian Island

Sampling at Indian Island will be initially used to determine the extent of contamination at the site from past uses and the success of planned remediation efforts. However, sampling at Indian Island will look toward a future where the Island will again be the site of important Tribal cultural activities and the waters would ideally be used for drinking and full-body contact for ceremonial and recreational purposes. Information for extent of contamination should also reference to the Brownfields Phase II reports and the additional reports that will be generated as more sampling continues for those contaminates that had hits above either human health and/or groundwater protection.

### 9.2.2 Background

Reservation

Previous groundwater and soils sampling has been conducted on the "old" Reservation property, in the vicinity of the drinking water well. This sampling has been conducted to determine the effects of illegal dumping and improper waste handling. This testing showed that there was metals contamination of local soils in dumping areas, and the Tribe is working to correct that contamination by mass removal of contaminated topsoil. In addition, routine sampling of the drinking water well is conducted under the Safe Drinking Water Act guidelines. Records maintained by the USEPA indicate that there have been no violations of Safe Drinking Water Act Standards for the water system owned and operated by the Tribe. No apparent testing has been conducted on the "new" Reservation or at the Tribal wetland. However, these sites should be monitored to determine impacts from the community septic system serving the Community Center and Tribal housing on groundwater and the wetland, as well as the possible impacts of surrounding land uses (agriculture, illegal dumping, Wisconsin mounds) on the wetland and/or groundwaters of the Tribe. Monitoring points will be identified throughout the Reservation to accomplish monitoring of the groundwaters and wetland. Additional monitoring points may be negotiated with off-Reservation landowners to monitor the waters of the nearby estuary.

Indian Island

Testing by EPA Brownfields began in December 2002 to attempt to characterize the extent of site contamination on the Tribe's Indian Island parcel. This testing included soils and waters of the Island property. Testing showed extensive soils contamination, but also showed that the groundwater may not be as heavily impacted by contamination and the Tribe hopes it may be treated to a drinkable standard. No testing has been done by the Tribe on the waters of Humboldt Bay, which flows across part of the property. Monitoring points will be identified to test both the groundwaters and waters of Humboldt Bay at Indian Island. Again, there may be monitoring wells installed on the upland property by EPA Brownfields and NCRWQCB.

### 9.2.3 Project Data Quality Objectives

The hypothesis formulated for this program is that the waters of TBR are threatened or impaired by land uses within their respective watersheds. This project is an investigation to determine the extent and nature of contaminants in groundwater, wetlands, estuaries, and bays affecting the Tribe through traditional analytical techniques. The data quality objectives are three fold: 1) to characterize the extent to which offsite and on-site land uses affect the waters of the Tribe, 2) to identify exceedances of water-quality guidelines, and 3) to generate data as a basis for future water quality standards, guidelines, and regulatory decisions.

**Objective 1**

Presence or absence of contamination from local land uses will be determined through data that is compound-specific. Constituents to be tested for at on-reservation sites include total and fecal coliform, pH, nitrates, metals, and VOCs. At Indian Island, constituents will additionally include turbidity, conductivity, dissolved oxygen, and all chemicals detected in the 2002 report by

Weston Solutions, contracted by US EPA Brownfields for the Phase II assessment (see Appendix G). Some analytes, including temperature, turbidity, and pH will be tested on-site by Tribal staff using mobile testing equipment. In performing on-site testing, the Tribe will utilize Quality Control procedures including sample and method blank, and will send 10% of duplicate samples to the local laboratory for verification of results. Analysis for all other constituents is available through North Coast Labs, a local laboratory with documented Quality Control procedures in place. Additionally, use of QC procedures such as sample documentation, chain-of-custody procedures, field blank, and method blank analysis is recommended.

**Objective 2**
All testing results will be compared to water quality guidelines for constituents established by the State of California's NCRWQCB, and the California Department of Health Services (DHS). The Tribe will refer to the most current available listings for Maximum Contaminant Levels for constituents. Concentrations detected above action levels or MCLs will be reported to the proper authorities. Table Bluff has zero tolerance for violations of existing water quality standards.

**Objective 3**
Data generated shall be used to issue water quality warnings and recommendations to users if contaminants are detected in drinking water sources. The Tribe may use data in developing water quality guidelines, making land use recommendations, updating buffer parameters, and measuring regulatory compliance. Data may also be shared among regulatory agencies, EPA, DPR, NCRWQCB, and interested local agencies, at the Tribe's discretion. Any sharing of data does not imply jurisdiction of state or local agencies over lands of TBR.

### 9.2.4 Sampling Rationale

Non-Random Data Collection Methodology will be used to determine sites for monitoring and sampling based on proximity to potential contamination and where water quality impairment is believed most likely to occur. Figure 4 contains maps with red dots that indicate sampling locations. Sampling stations will be established at the following locations:

- At the Tribal wetland (surface water samples to be analyzed for heavy metals, VOCs, bacteria, pesticides, and other constituents as determined by the Tribe)
- Near known illegal dumpsites (groundwater samples to be analyzed for heavy metals, VOCs, and other materials depending on the contents of the dumpsites)
- At the periphery of the Reservation (groundwater samples to be analyzed for heavy metals, VOCs, pesticides, and other constituents as determined by the Tribe)
- In McNulty Slough (surface water samples to be analyzed for all possible constituents, as determined by program budget)
- On the northern spit at the mouth of Humboldt Bay (surface water samples to be collected in the last hour of an incoming tide only and analyzed for all possible constituents, as determined by program budget),
- Adjacent to the Tribe's Indian Island property in Humboldt Bay (surface water samples to be collected only at mid-tides: when the tide is going from low to high or high to low and analyzed for all possible constituents, as determined by program budget), and

- At the mouth of the Mad River Slough (surface water samples to be collected only on outgoing tides and analyzed for all possible constituents, as determined by program budget).

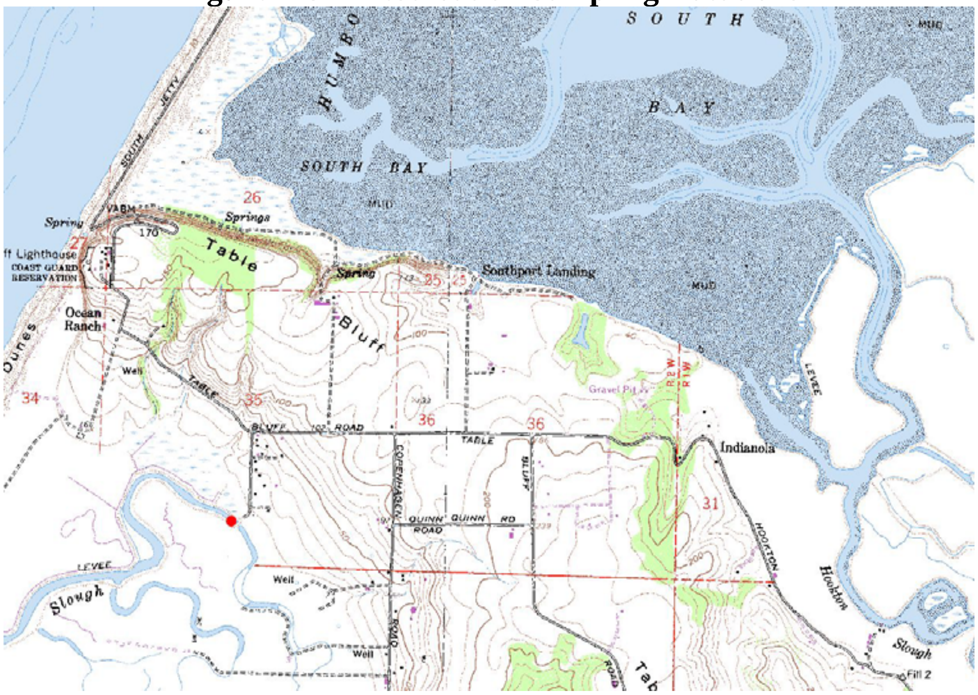
Excluding the on-reservation sites, these sites are indicated in the figures following this section.

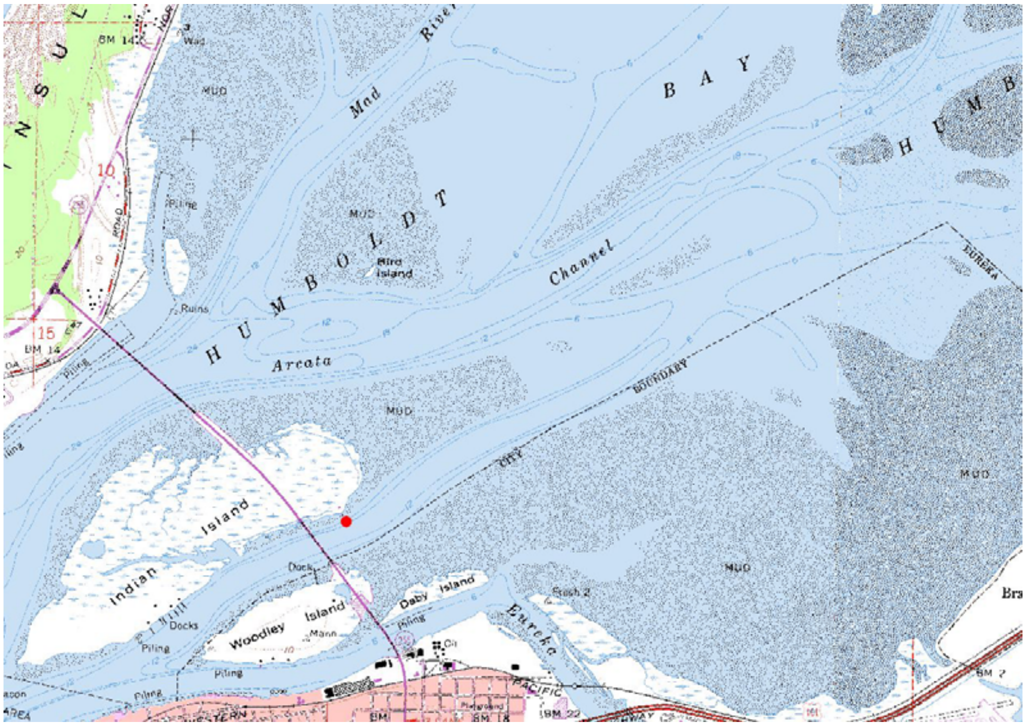
The total number of field water samples anticipated to be collected and analyzed in this study is 30-200 over each one-year period. The actual number of samples will depend on funding. Sites sampled and parameters sampled for are at the discretion of the Tribe. The drinking water system will be sampled monthly for bacteria (groundwater sample), and samples of raw and finished water will be tested annually or as required by the Safe Drinking Water Act.

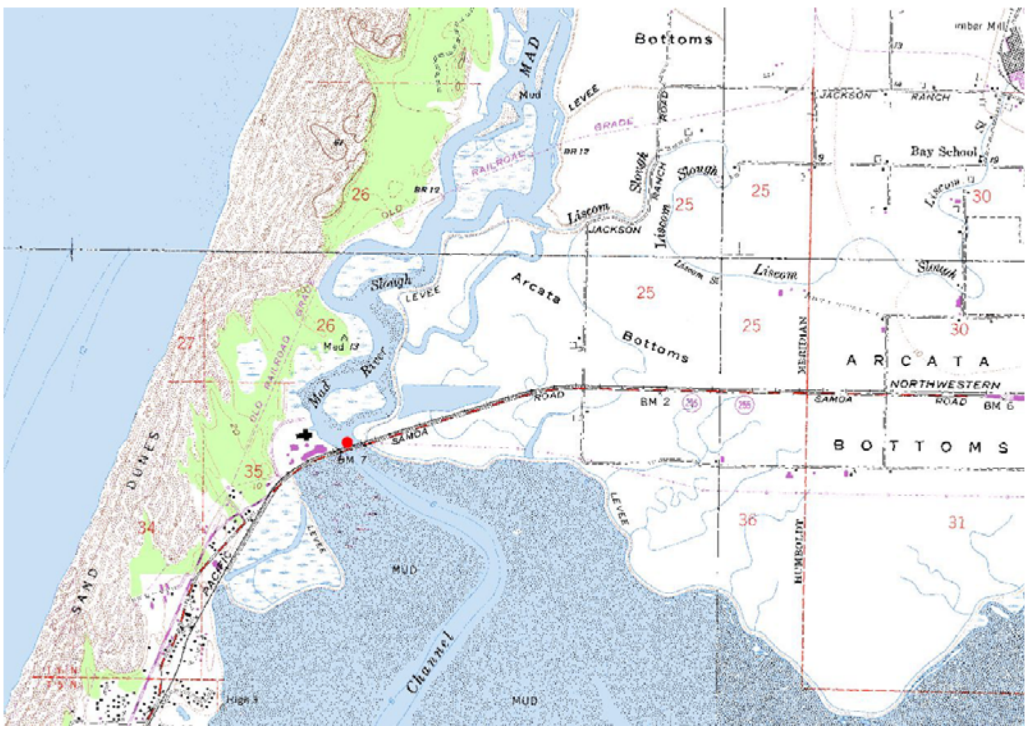
Surface water samples will be collected as grab samples (independent, discrete samples). An automatic pump sampler with a fixed-depth intake may be used to assure prompt sample collection in remote areas. The automatic sampler allows for multiple discrete grab samples over time. The water body sampling point will be a representative measure of good water mixing and represent the average water quality condition. Exact location of the sampling point will be documented annually in latitude and longitude with a GPS unit in order to compare data sampled nearby or in other areas with similar site conditions.

Water samples will be analyzed for contaminants based on knowledge of local land use or previously detected contamination.

**Figure 4 Off-Reservation Sampling Locations**





HUMBOLDT BAY
Mad River
Arcata Channel
Indian Island
Woodley Island
Daby Island
Bird Island
MUD
CITY BOUNDARY
Eureka


Bottoms
MAD
Mad River
Arcata Bottoms
ARCATA BOTTOMS
Liscom Slough
JACKSON RANCH ROAD
Bay School
NORTHWESTERN
SAMOA ROAD
SAND DUNES
HUMBOLDT MERIDIAN
Channel
MUD

### 9.2.5 Request for Analysis

Samples not field-analyzed will be analyzed by EPA-approved methods at North Coast Labs. Recovery time for results will depend on the lab schedule, number of samples submitted, matrix, and the level of QC performed.

### 9.2.6 Field Methods and Procedures

**Equipment**

- Waterproof disposable gloves
- White labeling tape
- Clear tape
- Indelible (black) marker
- Bailer
- 1 Liter amber glass bottles with Teflon lined caps
- 100' tape
- Field logbook
- COC forms **(A-1)**
- Hydrolab Quanta, SW/FW version 1.7

**Critical Field Measurements**

Sample Preservation – the following preservation recommendations for commonly sampled analytes are taken from the USEPA *Methods for Chemical Analysis of Water and Wastes* (1983). TBR will defer to the contract laboratory in decisions concerning sample preservation and storage, as pre-treated sample bottles are provided prior to sampling, and preservation limits are given prior to each sampling event.

| **Analyte** | **Bottle Size (mL)** | **Preservative** | **Holding Time** |
|---|---|---|---|
| pH | 25 | None | Analyze immediately |
| Turbidity | 100 | 4 degrees C | 48 Hours |
| Metals | 200 | HNO3, pH below 2 | 24 hours (Chromium), 28 Days (Mercury), 6 Months (Total Metals) |
| Inorganics: Acidity, Alkalinity, Chloride, Fluoride, Iodide, Silica, Sulfate, Sulfite, Dissolved Ortho-Phosphorous | 50 (ortho-P, chloride, silica, sulfate, sulfite), 100 (acidity, alkalinity, iodide), 300 (Fluoride) | 4 degrees C | 24 hours (iodide), 48 hours (Ortho-P), 14 Days (acidity, alkalinity), 28 days (chloride, fluoride, silica, sulfate) |
| Inorganics: Cyanides | 500 | NaOH, pH over 12 | 14 Days |
| Inorganics: Nitrogen (Ammonia, Kjeldahl, Nitrate, Nitrite), Phosphorous (Hydrolyzable, Total, Total dissolved) | 50 (nitrite, hydrolyzable P, total P, total dissolved P), 100 (nitrate, nitrite), 400 (ammonia), 500 (Kjeldahl) | H2SO4, pH below 2 | 28 days |

Surface water samples will be taken at identified locations utilizing a bailer and amber glass bottles with Teflon lined caps. The following procedures for extracting water samples have been modified from the Environmental Hazards Assessment program (EHAP) *Guide to Sampling Air, Water, Soil, and Vegetation for Chemical Analysis* (Sava, 1994).

For samples requiring hydrochloric acid preservative:

1. Must wear waterproof disposable gloves for all steps to avoid contamination. Change gloves for each sample.
2. Prior to collecting sample mark each bottle using white labeling tape with a unique number, date, and location name.
3. To determine the amount of acid necessary to lower the pH to less than two, fill a sample bottle with water, add the preservative, and test the sample with pH paper to determine if a sufficient amount of acid has been added. Repeat as necessary. Once the correct amount of preservative has been determined, proceed with these steps.
4. Fill two bottles with water for each chemical or class of chemicals. Mark cap of bottle with a “P” for primary sample or “B” for backup sample with an indelible marker.
5. Place bottle in bailer and remove cap. Exercise caution so removed cap does not come into contact with possible sources of contamination. A shirt pocket is acceptable; do not put cap on ground.
6. Obtain a well-mixed sample by immersing the sample bottle below the water surface. Allow water to enter bottle as you move the bottle vertically through the water profile. Avoid skimming the water surface. Fill bottle completely to eliminate all airspace, replace cap, remove bottle from bailer.
7. Record all information on chain of custody form and in field logbook. Take site photos at unique sampling locations.

For samples to be analyzed for inorganics or metals (for which a completely full bottle is not necessary):

1. Must wear waterproof disposable gloves for all steps to avoid contamination. Change gloves for each sample.
2. Prior to collecting sample mark each bottle using white labeling tape with a unique number, date, and location name.
3. Fill two bottles with water for each chemical or class of chemicals. Mark cap of bottle with a “P” for primary sample or “B” for backup sample with an indelible marker.
4. Place bottle in bailer and remove cap. Exercise caution so removed cap does not come into contact with possible sources of contamination. A shirt pocket is acceptable; do not put cap on ground.
5. Obtain a well-mixed sample by immersing the sample bottle below the water surface. Allow water to enter bottle as you move the bottle vertically through the water profile. Avoid skimming the water surface. Fill bottle completely to eliminate all airspace.
6. Remove bottle from bailer. Carefully remove a sufficient amount of water to allow testing for pH by pouring from the sample bottle into a clean bottle reserved for this purpose. Using pH strips or a pH meter, test the pH of the sample. On the sample bottle, replace cap.

7. Record all information on chain of custody form and in field logbook. Take site photos at unique sampling locations.

For all other samples:
1. Must wear waterproof disposable gloves for all steps to avoid contamination. Change gloves for each sample.
2. Prior to collecting sample mark each bottle using white labeling tape with a unique number, date, and location name.
3. Fill two bottles with water for each chemical or class of chemicals. Mark cap of bottle with a "P" for primary sample or "B" for backup sample with an indelible marker.
4. Place bottle in bailer and remove cap. Exercise caution so removed cap does not come into contact with possible sources of contamination. A shirt pocket is acceptable; do not put cap on ground.
5. Obtain a well-mixed sample by immersing the sample bottle below the water surface. Allow water to enter bottle as you move the bottle vertically through the water profile. Avoid skimming the water surface. Fill bottle completely to eliminate all airspace, replace cap, remove bottle from bailer.
6. Record all information on chain of custody form and in field logbook. Take site photos at unique sampling locations.

**Non-Critical Field Measurements**
Other water quality measurements will include: water flow, temperature, dissolved oxygen, conductivity, pH, oxygen reduction potential, and depth. These measurements will be taken downflow (where applicable) of sample point, following sample collection, to minimize the possibility of sample contamination or any other impacts. Operation, maintenance, and calibration for the Continuous multiprobe water quality sonde will follow existing manual protocols and procedures.

**Field Logbook**

Field procedures relevant to sample collection and field activities will be recorded in permanently bound write-in-the-rain 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. 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
- Filed instrument calibration methods, and identification number and instrument readings
- Sampling locations on site map
- Sample information
- Levels of safety protection

### 9.2.7 Sample Containers Preservation and Storage

**Sample Containers**

Sample Containers will be obtained from the Laboratory prior to sampling events. Containers will consist of new, one-liter, narrow neck, amber glass bottles with Teflon-lined caps. The laboratory, if necessary, may substitute high-integrity plastic containers. Bottles used previously are washed with detergent, double-rinsed, with distilled water, rinsed with ethyl or propyl alcohol, and oven dried. If necessary for analysis, North Coast Labs or any other contract lab will add chemical preservatives to sample containers prior to shipment of empty containers to the Tribe for sampling events. The contract lab will test the samples when they arrive at the lab to determine if the correct amount of preservative is present once the samples arrive. If the tested bottle does not have the sufficient amount of preservative present then the lab will add more to properly preserve the sample before it is analyzed. For volatile samples field crews will determine the amount of acid necessary to lower the pH to less than two by filling a sample bottle with water, adding the preservative, and re-testing the sample with pH paper to determine if a sufficient amount of acid has been added. This process will be repeated as necessary until the proper pH is met. The tested bottle will be discarded. Common samples and their needed preservatives are discussed in Section 9.2.6.

**Packaging and Transporting**

This Standard Operating Procedure (SOP) for packaging and transporting samples has been adapted from the California Department of Pesticide Regulation, EHAP, 1020 N Street, Sacramento, CA 95814, SOP Number QAQC004.00

*Equipment*

- Ice Chests
- Wet ice or Chemical ("Blue") ice for cooling samples
- Permanent black marker
- White label tape

- Thermometer (accurate to 1C and meets National Institute of Standards and Technology tolerances for accuracy)
- Bubble plastic or other packaging materials appropriate to sampling containers

Unless otherwise specified, all samples will be maintained at 4 degrees Celsius after collection until delivery at the analytical laboratory. Volatile samples will be delivered within 24 hours.

#### 9.2.8 Disposal of Residual Materials

The sampling plan will follow the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides the guidance for the management of Investigation-Derived Wastes (IDW). In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

#### 9.2.9 Sample Documentation and Shipment

All samples sent to North Coast Laboratories will be accompanied by appropriate documentation, forms for which are supplied by the Laboratory with shipment of empty sample containers. A copy of sample documentation will be retained and filed appropriately by the Tribe. All shipments will be made via same-day courier or hand-delivery to the Laboratory. In the event of after-hours sampling, shipment will be made at the first available opportunity to minimize delay of analysis.

#### 9.2.10 Quality Control

**Field Blank**

A field blank container will be prepared with the other bottles, packaged and transported to the sample site, filled with distilled or deionized water at the sample site, stored and transported with the other sample bottles, and submitted for analysis. The resulting expected "nondetected" (ND) analysis would increase the confidence that samples were not contaminated during preparation, field sampling, shipping, storage, or analysis.

**Confirmation Samples**

In order to enhance the integrity of field analysis, 10% of the duplicate field samples will be sent to a lab for traditional analysis.

**Field Duplicate Samples**

In order to check on the reproducibility field measurements, 10% of all field samples will be split and analyzed.

**QC Samples**

Laboratory Quality Control Samples will be supplied to the laboratory for its use for QC purposes. Two sets of water sample containers are filled and all containers are labeled with a single sample number. The laboratory will be alerted as to which sample is to be used for QC analysis by a notation on the sample container label and the chain-of-custody record or packing list.

### 9.2.11 Field Variances

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the QA Office will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

### 9.2.12 Field Health and Safety Procedures

OSHA standards for health and safety will be met.

## 9.3 Validation of Non-Standard Methods

In the event that Tribal Environmental Department staff finds 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. TBR 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.

# 10.0 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 Appendix B and provide additional guidance on sampling procedures.

For calibration requirements for field instruments, see applicable sections for instrument use in Section 10, applicable section in Section 16.0, “Calibration and Frequency”, or the “Field Instrument Calibration Schedule” in Appendix B.

## 10.1 Water Sampling Procedures

This section contains procedures for collecting surface water samples, ground water samples, and surveying onsite wells. Appendix B contains draft US EPA standard operating procedures (SOPs) for collecting and handling water samples. These draft SOPs are referenced below in the appropriate sections. US EPA Region 9's *Field Sampling Guidance Document (SOP) #1229:Trace Metal Clean Sampling of Natural Waters*, *1999*, also found in Appendix B, 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 and estuarine/bay waters.

Table 10.1 below summarizes the water quality constituents and determination methods for measurement and analysis. Complete descriptions of these sampling and preservation methods are included in “EPA Data Quality Indicator Standard Operating Procedures,” Appendix E.

**Table 10.1 EPA Water Quality Constituents and Determination Methods**

| Water Quality Constituent | Determination Method |
|---|---|
| VOCs | CLP, SOW, SAMLCO |
| Dioxins & Furans | EPA Method 1613 |
| Hardness, Total (mg/L as $CaCO_3$) | EPA Method 130.2 |
| Total Dissolved Solids (TDS) | EPA Method 160.1 |
| Total Suspended Solids (TSS) | EPA Method 160.2 |
| Inorganic Anion by Ion Chromatography | EPA Method 300.0 (Rev. 2.1) |
| Nitrogen, Kjeldahl, Total | EPA Method 351.1, 351.2, 351.4 |
| Nitrate plus Nitrite as Nitrogen | EPA Method 353.2, or 353.3 |
| Sulfate | EPA Method 375.2 or EPA SW-846 |
| Sulfide | EPA Method 376.1 |
| Chemical Oxygen Demand (COD) | EPA Method 410.4 |
| Total Organic Carbon in Water | EPA Method 415.1, EPA Method 415.2 |
| 1,2-Dibromoethane (EDB) and 1,2-Dibromo-3-Chloropropane in water by Microextraction and Gas Chromatography | EPA Method 504.1 |
| Carbamate and Urea Pesticides | EPA Method 632 |
| 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 |
| 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 |
| Carbonate, Bicarbonate, and Total Alkalinity | Standard Methods 2320 (Titration Method) |
| Biochemical Oxygen Demand (BOD) | Standard Method5210 B (5-day BOD test) |
| Total Petroleum Hydrocarbons (TPH) as Gasoline and Diesel | SW-846 Method 8015B (Rev. 2) |
| Halogenated and Aromatic Volatile Organic Compounds (VOCs) by Gas Chromatography | SW-846 Methods 8010A and 8020A or Method 8021A |
| Phenols by Gas Chromatography | SW-846 Method 8040, Rev. 1 |
| Organochlorine Pesticides and Polychlorinated Biphenyls | SW-846 Method 8081 or 8080 |
| Organophosphorus Pesticides | SW-846 Method 8141A |
| Chlorinated Herbicides | SW-846 Method 8151, Rev. 0 |
| Volatile Organic Compounds (VOCs) | SW-846 Method 8260, YTEP SOP “VOC Sampling” |
| Semivolatile Organic Compounds (SVOCs) | SW-846 Method 8270 |
| Polynuclear Aromatic Hydrocarbons (PAHs) | SW-846 Method 8310 |
| pH in Liquid and Soil | SW-846 Method 9040 (liquid) and SW-846 Method 9045 (soil) |
| Ammonia as Nitrogen | EPA Method 350.1/350.3 |

### 10.1.1 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 B) provide complete guidance for obtaining and handling groundwater samples. The following discussion emphasizes measurement procedures, while Appendix B provides information primarily on selecting and using the sampling equipment. The Groundwater Sampling Form (Appendix A) will be used to record data.

#### 10.1.1.1 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 (Section 11.0) 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 (Section 10.1.2.1) 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 B).
- Preservatives will be added to the sample bottles prior to shipment from the analytical laboratory.
- Upon sample collection, 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. 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 (Section 11.0).

#### 10.1.1.2 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 (Section 11.0) 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.
- 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. 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 (Section 11.0).

#### 10.1.1.3 Sampling Information

The following information will be entered on the Ground Water Sampling Log Sheet (Appendix A) 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.

### 10.1.2 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

#### 10.1.2.1 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.

#### 10.1.2.1.1 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 the procedure described in Section 11.0.
- 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.

#### 10.1.2.1.2 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 not 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 Section 11.0.
- Tapes will be maintained in a clean and functional condition.

#### 10.1.2.1.3 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.

### 10.1.3 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. Detailed procedures for each aquifer test and associated field measurements will be developed by the hydrogeologist or engineer conducting the test. A sample Aquifer Test Data form for collection of aquifer test data is provided in Appendix A. During aquifer tests, the following guidance pertains:

- All downhole equipment will be decontaminated as described in Section 11.0.
- 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-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.

## 10.2 Surface Water Sampling

The procedures described below, together with the US EPA Region 9's *Field Sampling Guidance Document (SOP) #1225: Surface Water Sampling, 1999* (Appendix B), as well as the Surface Water Sample Log Sheet (Appendix A), provide complete guidance for obtaining and handling, as well as documenting surface water samples. The procedures below, as well as those described in Appendix B, cover sampling in streams, rivers, lagoons, and embayments, and are intended to provide complete direction to TBR staff in collection of surface water samples.

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 the water body is a non-wadeable water body, a boat will be used for the collection of samples.

If using a bucket, the sampler shall enter the water downflow of the sampling point and slowly wade upflow to the sampling point. The sampler shall wait for the current to flush and clear the water thoroughly before sampling. The surface water sample will be collected by dipping the sampling bucket into the water in the upflow direction. Extreme care will be taken to prevent disturbing the sediments on the stream/bay 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.

### 10.2.1 Volatile Organic Compound (VOC) Sampling

Standard 40 ml glass screw-cap VOC 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 samples be sure that the sample bottle is not placed directly into the flow. 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.

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, invert the container and lightly tap the vial. Turn vial upside down and check for air bubbles. If bubbles greater than ¼”are present, the sample should be discarded and a new sample collected. Samples must be chilled to 4°C until analysis.

### 10.2.2 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
- Depth below water surface from which water sample is taken
- Estimated flow direction and surface water height readings, if available
- Current weather conditions
- Evidence of recent precipitation
- General field conditions.

## 10.3 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 (Appendix A). 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.

When sampling VOCs from a tap the bottle handling procedures will follow methods specified in section 10.2.1. 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.

Sampling specifically for total and/or fecal coliform analysis will be done according to the Humboldt County Department of Public Health Laboratory "Water Sampling Instructions" and "Procedures for Collecting Bacteriological Water Samples" (Appendix B).

### 10.3.1 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.

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

## 10.4 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 B). 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 Section 10.4.1. Sediment samples from estuaries or bays 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 (Appendix A). The protocol described below and in Appendix B are intended to provide direction in the sampling of sediments situated below both deep and shallow aqueous layers. This information is intended to provide comprehensive direction to TBR staff in the collection of sediment samples.

All filled sample jars will be capped, labeled, and immediately placed in a Blue Ice® packed cooler. Any waste materials left over from sampling will be containerized and disposed of as described in Section 11.0. A professional surveyor will survey in and record the locations of all sampling points.

### 10.4.1 Sediment Sampling in Rivers, Creeks, Estuaries, Embayments, and Surface Water Drainages

Water sampling shall be conducted in water bodies that are considered either "wadeable" or "non-wadeable." Wadeable water bodies will be sampled on foot, whereas non-wadeable water bodies will be sampled from a boat. If sample collectors are using waders, they will begin at the furthest downstream sampling point, working their way upflow, and approach each sampling point slowly from downflow in order to avoid contaminating or disturbing the sampling point. Samples collected from a boat or raft will be taken from the upflow 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.

#### 10.4.1.1 Scoop or Dipper Method (Wadeable or Non-Wadeable)

Samples collected using the Scoop or Dipper Method will be taken as follows:
Push the scoop or dipper firmly downward into the sediment, then lift upward. Quickly raise the sampler out of the water in an effort 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.

#### 10.4.1.2 Slide-Hammer Method (Wadeable or Non-Wadeable)

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,

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.

#### 10.4.1.3 Box Sampler Method (Wadeable or Non-Wadeable)

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, 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.

## 10.4 Biological Sampling

Biological sampling is generally performed by the TBR Water Quality Monitoring Program or an appropriately experienced contractor, who assess watershed and habitat health for the purposes of fisheries preservation and restoration, as well as for development and enforcement of water quality management plans on the Table Bluff Reservation. Monitoring, data collection, analysis and sampling are all performed as defined by approved sampling and monitoring plans, using standard methods and specified instrumentation. This ensures comparable and reliable data for use and interpretation by fisheries biologists, restoration teams, planners, and regulatory agencies.

This section has been divided into two separate sections according to this definition. The Biological and Habitat Conditions section will include descriptions of parameters that are used to evaluate such conditions and will include subsections on water quantity, water quality, and substrate inventory. The Biological Sampling section will describe parameters that are used to evaluate health of the organisms within the habitat, specifically fish and macroinvertebrate sampling. Macroinvertebrate tissue will not be analyzed for parameters listed in Table 10.1.

### 10.5.1 Biological and Habitat Conditions

#### 10.5.1.1 Macroinvertebrate Sampling Protocols

Evaluating the biological community of a water body through assessments of algae, macroinvertebrates and fish/shellfish provides a sensitive and cost effective means of determining the condition of the natural aquatic system. 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 water quality conditions is well known.

In order 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 macroinvertebrates for biological assessments is an essential component of any comprehensive condition evaluation. The Table Bluff Environmental staff should use the following techniques when collecting macroinvertebrates.

Macroinvertebrate samples will be analyzed to investigate the distribution and abundance of a single species, or may involve larger inventories of the entire biotic assemblage.
This information will be used to further evaluate the effects of inorganic sediment and chemical contaminants upon the natural aquatic system. This information will supplement other scientific data collected to determine the effects upon the food web.

Aquatic Invertebrate Sampling
Inventories and bio-assessments of aquatic invertebrates conducted by Table Bluff or contracted services by an appropriately experienced contractor 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 including: kick nets, Surber samplers, Hess Samplers, Drift nets, Eckman dredges, Young-modified Van Veen Grabs, Ponar grabs, 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.

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

1. **Kick nets (Wadeable).** Kicknets are recommended as a qualitative sampling tool for aquatic macroinvertebrates in flowing waters. Kicknets 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 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 a readied, clean pan. Collect insects with a curved forceps and preserve in labeled jars containing 95% ethanol.

2. **Drift nets (Wadeable or Non-Wadeable)**. Drift nets collect suspended organisms being carried downflow (drift) by currents. They are usually used in a series or replicate samples placed perpendicular to the flow. Measure the total cross-sectional area of the net frame and the cross-sectional area of the channel, to estimate the percentage of flow being sampled. Samples should be collected to accurately represent local 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 and/or tidal flow.

Procedure: Set drift nets either vertically or horizontally to representatively sample. They can be anchored with stakes into the substrate or tethered with lines fastened from bank to bank across the water body. The top of shallow nets should be submerged to avoid floating debris; the bottom of the deep nets should be just above the 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 95% ethanol solution.

Follow the appropriate chain of custody and storage procedures described in section 12.0.

3. **Surber Samplers (Wadeable, Shallow Non-Wadeable).** 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 water from a downflow direction and place the net with the mouth facing upflow 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 95% ethanol.

3. **Ponar Grabs, Young-modified Van Veen Grabs (Non-Wadeable).** These tools are recommended for sampling estuarine, open coastal, and non-wadeable water bodies.

Procedures: The procedures for utilizing the Ponar or Young-modified Van Veen Grabs in the field are detailed in the *California State Water Resources Control Board Surface Water Ambient Monitoring Program Quality Assurance Management Plan, Section B2*, attached here in Appendix B.

<u>Bioassessment Procedures</u>

Table Bluff's bioassessment procedures follow protocols described in the California Stream Bioassessment Procedures, 1999 (CSBP) (Appendix C) developed by the California Department of Fish and Games 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. As much of the waters of interest to TBR are non-wadeable, two additional documents are valuable in the preparation of this document: The U.S. Environmental Protection Agency's "Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Non-Wadeable Rivers and Streams" and the U.S. Environmental Protection Agency's "Office of Water – Analytical Methods – Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue."

Tribal technicians should follow appropriate guidelines for production of high quality, reliable assessments of 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, shellfish, and fish from the specific water body 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 on off-Reservation sites.

CSBP procedures should be used by tribal technicians to detect point and non-point sources of pollution and to assess ambient water quality conditions.

#### 10.5.1.2 Temperature Measurement

**Standard Instruments**

**Liquid-in-glass certified calibration thermometer**

Calibration thermometers should be certified by the National Institute of Standards and Technology (NIST). 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.

**Thermistor thermometer**

**Temperature data logger (e.g. Onset Computer Corporation Stowaway TidbiT)**

These instruments are temperature data recording devices designed to be placed in, and later retrieved from, the media of interest. They employ a thermistor to detect temperature and can typically be set to allow temperature recording at a variety of time intervals. Resolution varies with the thermistor type, and with the unique temperature quantification classes determined by the manufacturer. For instance, the Onset Computer Corporation's Stowaway TidbiT data logger employs a thermistor with a resolution of 0.1°C, but is capable of recording only 255 unique temperature values. At 0.1 intervals, there are 421 unique values between -5°C to +37°C (the operating range of a typical Stowaway TidbiT). So, the effective resolution of a Stowaway TidbiT varies between 0.1 and 0.2°C depending on the temperature encountered and the manufacturer's placement of the unique temperature classes. Temperature data loggers should be calibrated yearly against a NIST certified thermometer.

**Water quality instruments with an incorporated thermistor**

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 A for the Standard Format for Field Logbook entries.

**Measurement**

- **Water Body**

  Measurements of temperature shall be carried out in accordance to the needs of the particular project. Water temperatures at a given 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 margin where temperature is likely to be different than the average of the 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. In instances where measurements along an entire cross-section would be unmanageable, such as across Humboldt Bay, cross sections will be determined using maps, and portions of those cross sections will be sampled, as appropriate. Additionally, point samples may be appropriate, and should be adequately documented.

- **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 five 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.

#### 10.5.1.3 Substrate Inventories

Substrate is composed of a range of different sized particles. For example, some areas have substrate composed mostly of bedrock while others have a mix of bedrock, cobble, sand, and gravels. 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. In order to adequately evaluate substrate conditions, the following methods can be utilized by the Tribal Environmental Department staff to perform stream substrate inventories.

Streams

Stream substrate inventories should be conducted using standardized methods currently in use by the California Department of Fish and Game. 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

Riverine substrate inventories should be conducted utilizing the standardized classification system defined in Table 2 and is currently in use by the Yurok Tribe, the U.S. Fish and Wildlife Service, U.S.G.S, Bureau of Reclamation, Hoopa Tribal Fisheries, and the Karuk Tribe. Substrate inventories of the river should utilize standardized substrate size classifications in order to facilitate data compatibility and long-term data collection. Dominant, subdominant substrate components should be visually estimated based on size classifications in Table 10.2. Substrate composition (based on actual abundance), within one square foot around each fish observation or stream survey point should be rated and recorded on standardized data sheets.

Embayments

Substrate inventories in embayments should be conducted utilizing methods employed by the California State Water Resources Control Board in their Surface Water Ambient Monitoring Program Quality Assurance Management Plan, Section B2 (attached here in Appendix B).

**Table 2 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 | |

Spawning substrates should be assessed by evaluating the redd's mound, pit, and the immediate area's substrate composition. Percent embeddedness of the substrate should also be rated and recorded based on the classifications in Table 10.3. Embeddedness should also be recorded by rating the percentage of the surface area of a medium cobble is embedded in the bed.

**Table 3 Substrate Embeddedness**

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

#### 10.5.1.4 Water Quantity

**Discharge and Water Velocity Measurement**

**<u>Standard Instruments</u>**

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.

**<u>Calibration/Spin Test/Maintenance</u>**

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 minutes 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 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 duration's and quality assurance techniques used while measuring mean column velocities shall be employed.

## Stream Discharge

River discharge data for the Eel River is acquired from USGS Gauging Stations. The USGS data collection procedure is included in "Surface-Water Quality-Assurance Plan for the California District of the U.S. Geological Survey" (Appendix C).

Methods for measuring stream discharge are outlined in the USDI's *Water Measurement Manual* (1991), in the USGS *Discharge Measurements at Gaging Stations* (1965), and the USGS Surface Water Quality Assurance Plan (Appendix B).

### 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 ($Q_n$) for the subsection. The sum of 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:
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.

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. Make adjustments 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.

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 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 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 $b$.

**10.5.1.5 Water Quality**

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.

If Table Bluff uses a multi-probe water quality instrument to measure water quality parameters there will be a copy of the owner's manual stored in the Tribal Environmental Department of TBR office for reference in addition to the Standard Operating Procedures presented here. These manuals normally contain information and details including recommended calibration, installation and data downloading procedures.

**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 performed by the Table Bluff 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* (Appendix B) 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:
1. Warm up nephelometer according to manufacturers specifications.
2. Set to full-scale concentration using the appropriate formazine standard. Check the formazine standards against each other because the formazine standard will deteriorate.
3. 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.
4. Wipe all moisture and fingerprints from bottom and sides of the tube, then place in the instrument and cover to exclude light.
5. 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 20cm. 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, it is deployed differently. To measure horizontal visibility a snorkeler must be fully submerged in the water to estimate the horizontal distance between himself, 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 disk is then slowly pulled in by the snorkeler 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.

### 10.5.2 Biological Sampling

Biological sampling in this section entails monitoring the health of the fishery through study of the life forms dependent on it for survival, and is accomplished by sampling fish and macroinvertebrates found within the system.

#### 10.5.2.1 Electrofishing

Electrofishing is a fish capture technique that momentarily stuns fish with an electric current. The Tribal Environmental Department should contract electrofishing activities to an appropriately experienced and permitted contractor. This data can generate fish populations for base-line data or long-term monitoring purposes. Population estimates are also performed using standard multi-pass depletion methods (Reynolds 1983).

Prior to conducting electrofishing activities, biologists and technicians must have a valid CDFG Scientific Collection Permit in possession. Additionally, each technician and biologist should be trained in safety procedures and be knowledgeable about stream conditions, electrical theory, and fish physiology to prevent injury to themselves and to fish.

All electrofishing activities conducted by Table Bluff must follow guidelines established by the National Marine Fisheries Service and the California Department of Fish and Game at the "Electrofishing Workshop" held in Yreka, California (NMFS, CDFG 1998). California Department of Fish and Game's Draft Electrofishing Recommendations are included in Appendix C. The guidelines describe detailed procedures for electrofishing application, safety, and fish work-up and safety procedures. Additionally, any electrofishing activities must be in compliance with ESA guidelines for sampling any threatened or endangered salmonid species.

Biological data collected from fish captured by electrofishing should follow guidelines described in the Section 10.5.2.2.

#### 10.5.2.2 Biological Sampling Methods Standardization

As much of the waters of interest to TBR are non-wadeable, two documents are valuable in the preparation of this document: The U.S. Environmental Protection Agency's "Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Non-Wadeable Rivers and Streams" and the U.S. Environmental Protection Agency's "Office of Water – Analytical Methods – Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue."

<u>Fish</u>

Table Bluff may collect data on tribally significant fish/eel species in the Humboldt Bay and Eel River and their tributaries. In order to ensure data compatibility and reliability, these standardized methods should be followed when collecting biological data on tribal trust species.

Target species recommended by the U.S. Environmental Protection Agency for the Estuarine and Marine areas between the Klamath River and Morro Bay include:
Finfish: Leopard Shark, White Croaker, Redtailed Surfperch, Striped Seaperch, Black Rockfish, Yellowtail Rockfish, Bocaccio, Pacific Sanddab, Speckled Sanddab, Starry Flounder, English Sole, Coho Salmon, and Chinook Salmon.

The following biological data should be collected and recorded on the Table Bluff Biological Sampling Data Sheet (Appendix A) by tribal staff or contractors when ever possible during sampling of juvenile and adult salmonids for scientific study. Chain-of-Custody records, as shown in Appendix A, should be used for samples going for laboratory analysis.

1. **Forklength**. Forklength is the length from the tip of the mouth to the inner fork in the tail. Juveniles are measured in millimeters and adults in centimeters.
2. **Total Length**. Total length is the length from the tip of the mouth to the end of the fork squeezed together. Juveniles are measured in millimeters and adults in centimeters.
3. **Weight**. Weights should be measured to the nearest tenth of a gram.
4. **Tissue**. Appropriate tissue samples should be collected utilizing standard procedures described by Devris and Frie 1996, as well as The U.S. Environmental Protection Agency's "Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Non-Wadeable Rivers and Streams" and the U.S. Environmental Protection Agency's "Office of Water – Analytical Methods – Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue.". Tissue samples may include: blood, organs, or whole animals, and be tested for pathogens and diseased tissue.
5. **Scale Samples**. Where applicable, scales for fish aging should be collected using standard methods described by Devries and Frie 1996. Scales should be collected with a sharp, clean knife blade from both the right and left sides of the fish. Scales should be scraped in an anterior direction from beneath the dorsal fin of both juvenile and adult salmonids. Collected scales will be stored on wax paper and labeled sample envelope. Envelopes should be labeled with the date, site and location, crew, species, forklength, and weight if possible and stored in a dry area. Scales should be analyzed using standard methods described in Devries and Frie

In addition to biological data, the date, time, location and crew-members performing the sampling activity should be recorded. Weather conditions and air and water temperatures should also be measured and recorded. When possible, dissolved oxygen levels should also be recorded during sampling activities. Fish handling procedures should incorporate protocols to prevent fish injury and associated stress; technicians will follow guidelines for fish care and handling described by Kelsch and Shields 1996.

<u>Shellfish</u>
Target species recommended by the U.S. Environmental Protection Agency for the Estuarine and Marine areas between the Klamath River and Morro Bay include:
Shellfish: Blue Mussel, California Mussel, Pacific Littleneck Clam, Soft-shell Clam, Dungeness Crab, Red Crab, Pacific Rock Crab.

Biological Data to be collected includes size and weight of each specimen.

In addition to biological data, the date, time, location and crew-members performing the sampling activity should be recorded. Weather conditions and air and water temperatures should also be measured and recorded. When possible, dissolved oxygen levels should also be recorded during sampling activities. Fish handling procedures should incorporate protocols to prevent fish injury and associated stress; technicians will follow guidelines for fish care and handling described by Kelsch and Shields 1996.

Shellfish will be collected and analyzed according to The U.S. Environmental Protection Agency's "Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Non-Wadeable Rivers and Streams" and the U.S. Environmental Protection Agency's "Office of Water – Analytical Methods – Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue" found in Appendix C.  Such sampling will be performed under a separate Sampling and Analysis Plan.

# 11.0 DECONTAMINATION AND DISPOSAL PROCEDURES

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

## 11.1 Decontamination Procedures

### 11.1.1 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-phosphate 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.

### 11.1.2 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*, (Appendix B).

#### 11.1.2.1 Inorganic/radiological procedure

1. Remove soil adhering to sampling equipment by scraping, brushing, or wiping.
2. Wash thoroughly with strong non-phosphate 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.

#### 11.1.2.2 Organic procedure

1. Remove soil adhering to sampling equipment by scraping, brushing, or wiping.
2. Wash thoroughly with a strong non-phosphate 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.

#### 11.1.2.3 Combined Inorganic/Radionuclide/Organic procedure

1. Remove soil adhering to sampling equipment by scraping, brushing, or wiping.
2. Wash thoroughly with a strong non-phosphate 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.

### 11.1.3 Groundwater Sampling Equipment Decontamination

All equipment that may come in contact with 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 section 11.0.

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 as discussed in section 11.0, 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.

### 11.2 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.

## 12.0 SAMPLE HANDLING AND CUSTODY PROCEDURES

This section describes procedures for sample 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.

### 12.1 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.

### 12.2 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 Appendix A):

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

#### 12.2.2 Sample Labels

Sample labels (see example in Appendix A) 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.

#### 12.2.3 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. Each individual 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 used
- Name and affiliation of personnel on site, and personnel contacted
- 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 in Appendix A.

#### 12.2.4 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. Photos will be marked accordingly and stored with copies/transcriptions of the field log notes in the Tribal Environmental Department.

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

#### 12.2.5 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 Appendix A. 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.

#### 12.2.6 Groundwater Sampling Forms

The following information will be entered on the Groundwater Sampling Form (Appendix A) 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).

#### 12.2.7 Surface Water Sampling Forms

The following information will be entered on the Surface Water Sampling Form (Appendix A) 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 used
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

#### 12.2.8 Drinking Water Sampling Forms

The following information will be entered on the Drinking Water Sampling Form (Appendix A) 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 used
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

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

#### 12.2.9 Sediment Sampling Forms

The following information will be entered on the Sediment Sample Log Sheet (Appendix A) 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 used
- Indicator parameter measurements (pH, temperature, conductivity, turbidity).

#### 12.2.10 Biological Sampling Forms

The following information will be entered on the Biological Sampling form (Appendix A) 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

#### 12.2.11 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.

### 12.3 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.

#### 12.3.1 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 placed 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

## 12.4 Sample Transfer and Shipment

### 12.4.1 Bottles and Preservatives

Sample containers will be cleaned and will not be rinsed prior to sample collection. As specified in Section 9.2.7 all preservatives, if required, will be added by the laboratory that is contracted to perform the analysis. The contract lab will be notified of the analytes to be sampled for in advance and will deliver sample bottles with the appropriate type and amount of preservative for the particular analyte. The contract lab will test the samples when they arrive at the lab to determine if the correct amount of preservative is present once the samples arrive. If the tested bottle does not have the sufficient amount of preservative present then the lab will add more to properly preserve the sample before it is analyzed. For volatile samples field crews will determine the amount of acid necessary to lower the pH to less than two by filling a sample bottle with water, adding the preservative, and re-testing the sample with pH paper to determine if a sufficient amount of acid has been added. This process will be repeated as necessary until the proper pH is met. The tested bottle will be discarded.

### 12.4.2 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. Three vials of each groundwater sample are required for each laboratory. Where appropriate, samples or sample containers will be treated with preservative as determined by this QAPP (Section 9.2.6) and/or the contract laboratory referencing EPA methods. As specified in section 9.2.7 all preservatives, if required, will be added by the laboratory that is contracted to perform the analysis. The contract lab will be notified of the analytes to be sampled for in advance and will deliver sample bottles with the appropriate type and amount of preservative for the particular analyte. The contract lab will test the samples when they arrive at the lab to determine if the correct amount of preservative is present once the samples arrive. If the tested bottle does not have the sufficient amount of preservative present then the lab will add more to properly preserve the sample before it is analyzed. For volatile samples field crews will determine the amount of acid necessary to lower the pH to less than two by filling a sample bottle with water, adding the preservative, and re-testing the sample with pH paper to determine if a sufficient amount of acid has been added. This process will be repeated as necessary until the proper pH is met. The tested bottle will be discarded. The samples will be shipped in coolers with appropriate chain-of-custody documentation and seals.

#### 12.4.3 Surface Water Samples

The same sample transfer and shipment criteria described for groundwater samples in Section 12.4 will also apply to surface water samples.

#### 12.4.4 Drinking Water Samples

The same sample transfer and shipment criteria described for groundwater samples in Section 12.4 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).

#### 12.4.5 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.

#### 12.4.6 Biological Samples

Biological samples will be collected and handled by Table Bluff personnel as described in the Standard Operating Procedures referred to in Section 10.5, and found in Appendix C. Sample collection and testing will be documented using the Tribal Environmental Department Chain of Custody (COC) Record (Appendix A).

### 12.5 Sample Storage and Disposal

Samples and extracts will be retained by the analytical laboratory for up to 30 days after the data are reported by the laboratory. Unless notified otherwise by the Tribal Environmental Department, excess or unused samples should be disposed by the laboratory in a manner consistent with appropriate government regulations.

## 13.0 ANALYTICAL METHODS REQUIREMENTS

All laboratory analyses will be performed at an accredited laboratory. 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 for sediment samples.
- 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

Chemical analyses will be performed on samples of groundwater and soil. The primary classes of target chemicals to be analyzed for 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 on a daily basis according to manufacturer's specifications.

Field analysis will be preformed according to applicable methods and operating procedures as required. Calibration for field instrumentation will follow manufacturer's recommendation or as specified in the "Field Instrument Calibration/Maintenance Schedule" in Appendix B.

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## 14.0 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.

### 14.1 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.

#### 14.1.1 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. The blanks will be chilled to 4°C immediately upon collection. Two bottles of each equipment rinsate sample are required for each laboratory. As specified in Section 9.2.7 preservative will be added to the glass bottles prior to sample collection by the contract lab. The contract lab will be notified of the analytes to be sampled for in advance and will deliver sample bottles with the appropriate type and amount of preservative for the particular analyte. The contract lab will test the samples when they arrive at the lab to determine if the correct amount of preservative is present once the samples arrive. If the tested bottle does not have the sufficient amount of preservative present then the lab will add more to properly preserve the sample before it is analyzed. For volatile samples field crews will determine the amount of acid necessary to lower the pH to less than two by filling a sample bottle with water, adding the preservative, and re-testing the sample with pH paper to determine if a sufficient amount of acid has been added. This process will be repeated as necessary until the proper pH is met. The tested bottle will be discarded. 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 site, 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. The blanks will be chilled to 4°C immediately upon collection. Two bottles of each field sample are required for each laboratory. As specified in Section 9.2.7 preservative will be added to the glass bottles prior to sample collection by the contract lab. The contract lab will be notified of the analytes to be sampled for in advance and will deliver sample bottles with the appropriate type and amount of preservative for the particular analyte. The contract lab will test the samples when they arrive at the lab to determine if the correct amount of preservative is present once the samples arrive. If the tested bottle does not have the sufficient amount of preservative present then the lab will add more to properly preserve the sample before it is analyzed. Where appropriate, preservative will be added to an empty vial or the vial may be pre-treated with preservative (see Section 9.2.6) prior to sample collection. The pH of the sample vial will be measured to ensure sufficient acid is present to result in a pH less than 2. If the pH is greater than 2, additional preservative 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.

#### 14.1.2 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.

### 14.2 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.

#### 14.2.1 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.

### 14.2.2 Internal Blanks

Internal blanks are used to detect system bias introduced in the laboratory. For water samples, a 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.

### 14.2.3 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.

### 14.2.4 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.

### 14.2.5 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.

## 15.0 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 listed in Section 13.0 for testing, inspection and maintenance of instruments and equipment.

## 16.0 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.

### 16.1 Water Quantity Measurement Instruments

#### 16.1.1 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.

#### 16.1.2 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.

#### 16.1.3 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.

#### 16.1.4 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 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**

Factory calibration once; check annually; take periodic timed volumetric measurements periodically during tests.

## 16.2 Water Quality Measurement Instruments

### 16.2.1 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.

### 16.2.2. Dissolved oxygen, Conductivity, and pH

Often a continuous multiprobe water quality sonde is used to measure the water quality parameters of dissolved oxygen, salinity and/or conductivity, temperature, and pH. The continuous multiprobe water quality sonde owner's manual is kept in the Table Bluff office for reference in addition to the Standard Operating Procedures presented here.

**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.

### 16.2.3 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.**

### 16.2.4 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.

#### 16.2.5 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.

### 16.3 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.

# 17.0 REQUIREMENTS FOR CONSUMABLES

## 17.1 Identification of Critical Supplies and Consumables

Supplies and consumables used by Tribal Environmental Department of TBR 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 Appendix A).

## 17.2 Establishing Acceptance Criteria

Acceptance criteria for supplies and consumables are given in the US EPA SOPs, included as Appendix B of this QAPP. In each procedure, Section 5.0 provides inspection and acceptance criteria for equipment and apparatus, while Section 6.0 provides inspection and acceptance criteria for reagents.

## 17.3 Inspection or Acceptance Testing Requirements and Procedures

All supplies and consumables will be inspected upon receipt by a designated sample custodian or alternate of the Tribal Environmental Department Table Bluff. Any container or material requiring special criteria, such as sterility, will be checked prior to use.

## 17.4 Tracking and Quality Verification of Supplies and Consumables

The results of all inspections will be recorded on a Supplies and Consumables Tracking Log (see Appendix A) and kept in project binders. All reagents used will be manufacturer-certified to meet or exceed the requirements for their applications.

## 18.0 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 TBR water quality program area

- STORET database, EPA
- 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. All decisions regarding data quality and relevance will be made by the Director of the Tribal Environmental Department of Table Bluff.

## 19.0 DATA MANAGEMENT

The Tribal Environmental Department of Table Bluff will designate a data manager responsible for performing or overseeing all data management. Data management tasks will fall into the following categories:

### 19.1 Data Recording

Data recording will be performed using standard data recording sheets. Standard forms are shown in Appendix A.

### 19.2 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.

### 19.3 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.

### 19.4 Data Transmittal

All field and laboratory water quality data generated under the Table Bluff water quality program will be delivered directly to the designated Table Bluff 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.

### 19.5 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.

### 19.6 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.

### 19.7 Data Tracking

All of the Table Bluff Tribal Environmental Department 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 **with** anyone other than authorized personnel or consultants without direct approval of the director of the Tribal Environmental Department of TBR.

### 19.8 Data Storage and Retrieval

Data storage and retrieval will generally be performed using the US EPA's STORET system. Where direct entry into the Tribal Environmental Department of the Table Bluff 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.

# 20.0 ASSESSMENTS AND RESPONSE ACTIONS

## 20.1 Assessment Activities and Project Planning

Overall water quality project planning will be the responsibility of TBR Tribal Environmental Director. 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.

### 20.1.1 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 TBR Water Quality Program.

### 20.1.2 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 Table Bluff's Director of the Tribal Environmental Department.

At the end of the first year of water quality monitoring performed under this QAPP, Table Bluff will hire a consultant to perform a Technical Systems Audit (TSA) to review all facilities, equipment, personnel, training, procedures, and record keeping involved in the Table Bluff 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 section 20.2.2 below.

## 20.2 Documentation of Assessments

### 20.2.1 Number, Frequency, and Types of Assessments

MSR and surveillance of the water quality program by the Tribal Environmental Director will be performed on an ongoing basis over the life of the water quality program.

The TSA will be performed by a qualified outside consultant 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 Table Bluff's DQOs, then a second TSA will be scheduled for the end of year two, with needed changes to be implemented in the interim. If the initial TSA 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 Tribal Environmental Director and subject to the availability of peer reviewers.

### 20.2.2 Assessment Personnel

MSR and surveillance of the water quality program will be performed by the Tribal Environmental Director, with support from program staff and outside consultants as needed.

TSAs will be performed by qualified outside consultants in order 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. TBR collaborates closely with environmental program staff of the Yurok Tribe (YTEP). Staff of neighboring Tribes will review Table Bluff's water quality activities and offer support in evaluating and improving water quality data collection procedures. YTEP in particular, already having a US EPA-approved QAPP in place, have been and will be especially helpful in development of the Table Bluff Reservation water quality program. YTEP staff has collaborated with the Tribal Environmental Director in the initial assessment and design of the Table Bluff Reservation Water Quality Program.

Paid consultants and university faculty are also available to work with the Tribe to review and suggest improvements to Table Bluff's water quality monitoring procedures.

### 20.2.3 Schedule of Assessment Activities

Assessment activities will be scheduled as described in section 20.2.1 above.

### 20.2.4 Reporting and Resolution of Issues

All assessment reports prepared by the Tribal Environmental Department staff, consultants, or peer reviewers will be provided to the Tribal Environmental Director. The Director will provide copies or summaries of these reports to the Tribal Council and/or the Tribal Administrator on an as-needed basis.

Table Bluff 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.

## 21.0 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, fish trapping results, fish habitat surveys
- 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 Director.

## 22.0 DATA REQUIREMENTS

Samples analyzed by an outside laboratory will deliver the appropriate data package within a reasonable amount of time, as specified by the laboratory and agreed upon by the Tribe. The data package contains the results of the parameter(s) measured and all other pertinent information to the analysis performed by the laboratory. 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.

### 22.1 Field Measurement Data

Validation of data obtained from field measurements will be performed by qualified personnel 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 be in agreement 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.

### 22.2 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 following information will be evaluated by the laboratory, as appropriate for the type of analysis:

- 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.

### 22.3 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.

Initiation of corrective action resulting from the evaluation of QC results will be conducted by the program manager. 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.

### 22.4 External Data Validation

Chemical water quality data will be evaluated by the department's technician or designated personnel 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 Tribal Environmental Director 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.

### 22.5 Historic Data Validation

The Tribal Environmental Department of Table Bluff has not amassed a large collection of historic water quality for the Eel River Estuary and the Humboldt Bay basin. The Tribe is only now establishing an independent water quality program, and thus nearly all of the available data have been collected by non-Tribal agencies and individuals. Most of this data may not be 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 may not be well documented.

For this reason, Table Bluff needs to adopt 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.

#### 22.5.1 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 close 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.

#### 22.5.2 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 TBR 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.

#### 22.5.3 Use of Metadata

Any data that are entered in the Table Bluff water quality database, be it 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.

#### 22.5.4 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 agency's, laboratory's or person's overall record for producing reliable data.

#### 22.5.5 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 fairly 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 show up occasionally among values normally on the order of 10, data entry error is likely.

# 23.0 VALIDATION AND VERIFICATION METHODS

Chemical data will be evaluated according to procedures outlined in Section 22.0 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 (Section 23.3).

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.

## 23.1 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 database 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.

## 23.2 Reporting Requirements

All water quality data collected under Table Bluff's Water Quality Program will be kept by the Tribal Environmental Director in summary form (metadata, statistical summary and outlier report). Raw data will also be kept on file by the Director. The Tribal Environmental Director will provide copies of summary data to the Tribal Council and/or Tribal Administrator upon request or at the discretion of the Director.

### 23.3 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 Tribal Environmental Director.

#### 23.3.1 Field Situations

The need for corrective action will be identified as a result of 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 end result is elimination of the problem.

#### 23.3.2 Laboratory Situations

The need for corrective action resulting from QA audits will be initiated by the laboratory QA/QC manager in consultation with the Director of the Tribal Environmental Department of Table Bluff. 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.

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

#### 23.3.3 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.

#### 23.3.4 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 Director of the Tribal Environmental Department of Table Bluff Reservation. In general, the Director or designated representative will investigate the situation and determine who will be responsible for implementing the corrective action. The Director 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 Director of the Tribal Environmental Department of Table Bluff Reservation 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.

## 24.0 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.

On the basis of the results of the data validation, qualifiers will be applied to analytical data to indicate the usability of the data. The qualifier application scheme previously indicated in Section 22.5.2 Ranking of Data defines the manner in which exceedances of QA/QC parameters will be treated and how qualifiers will be applied.

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## 26.0 APPENDICES

**Appendix A. .............................................. Data Collection and Data Validation Forms**
**Appendix B. ......................................... Water Quality Standard Operating Procedures**
**Appendix C. ................................................ Biological Standard Operating Procedures**
**Appendix D. ............................. Federal and State Drinking Water Quality Standards**
**Appendix E. ................ EPA Data Quality Indicator Standard Operating Procedures**
**Appendix F. .............................. Sampling and Analysis Plan Guidance and Template**
**Appendix G. ............... Indian Island Brownfields Assessment Phases I and II Reports**

# APPENDIX A.

# DATA COLLECTION AND DATA VALIDATION FORMS

## Appendix A.
## Data Collection and Data Validation Forms

- Aquifer Test Data
- Borehole Log Form
- Chain-of-Custody Record for Water Quality Samples
- Chain-of-Custody Record
- Drinking Water Sample Log Sheet
- Equipment and Consumables Record
- Field Record for Biological Sampling
- Ground Water Sample Log Sheet
- Sample Label/ Custody Seal (EPA, 1999)
- Sediment Sample Log Sheet
- Surface Water Sample Log Sheet
- Supplies and Consumables Tracking Log
- Standard Format for Field Logbook Entries
- Standard Quality Assurance Reporting Format
- Water Sample Log Sheet
- Well Completion Form
- Bacterial Water Sample Form (Humboldt County Department of Public Health, 2000)
- Inspection/Acceptance Testing Requirements Log

# APPENDIX B.

# WATER QUALITY STANDARD OPERATING PROCEDURES

**Appendix B.**
**Water Quality Standard Operating Procedures**

- Oregon Water Quality Monitoring - Technical Guidebook (The Oregon Plan, 1998)
- Field Sampling Guidance Document #1220, Groundwater Well Sampling (EPA, 1999)
- Field Sampling Guidance Document #1230, Sampling Equipment Decontamination (EPA, 1999)
- Field Sampling Guidance Document #1215, Sediment Sampling (EPA, 1999) Field Sampling Guidance Document #1205: Soil Sampling (EPA, 1999)
- Field Sampling Guidance Document #1225, Surface Water Sampling (EPA, 1999)
- Field Sampling Guidance Document #1229, Trace Metal Clean Sampling of Natural Waters (EPA, 1999)
- Ready Reference Guide for Field Sampling (Trace Analysis Laboratory, 1990)
- Water Sampling Instructions and Procedures for Collecting Bacteriological Water Samples (Humboldt County Public Health Laboratory, 1998)
- California State Water Resources Control Board Surface Water Ambient Monitoring Program Quality Assurance Program Plan, Section B2 (SWRCB, 2002)

# APPENDIX C.

# BIOLOGICAL STANDARD OPERATING PROCEDURES

**Appendix C.**
**Biological Standard Operating Procedures**

- California Stream Bioassessment Procedure (CA Department of Fish and Game, 1999)
- Draft Electrofishing Recommendations (CA Department of Fish and Game, 1999)
- USGS Surface-Water Quality-Assurance Plan for the California District of the USGS (USGS, 1996)
- Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Non-Wadeable Rivers and Streams (U.S. Environmental Protection Agency, 2000)
- Office of Water – Analytical Methods – Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue (U.S. Environmental Protection Agency, 2001)

# APPENDIX D.

# FEDERAL AND STATE DRINKING WATER QUALITY STANDARDS

## Appendix D.
## Federal and State Drinking Water Quality Standards

- Chapter 3, "Water Quality Objectives," from the Water Quality Control Plan for the North Coast Region (North Coast Regional Water Quality Control Board, 1993)
- California Title 23 Drinking Water Standards (CA Department of Health Services, 1990)
- National Primary Drinking Water Standards (EPA, 1999)
- Numeric Criteria for Priority Toxic Pollutants for the State of California;Rule (CTR)

# APPENDIX E.

# EPA DATA QUALITY INDICATOR STANDARD OPERATING PROCEDURES

**Appendix E.**
**EPA Data Quality Indicator Standard Operating Procedures**

- EPA Data Quality Indicator Standard Operating Procedures (EPA, 1999)

# APPENDIX F.

# EPA SAMPLING AND ANALYSIS PLAN GUIDANCE AND TEMPLATE

## APPENDIX G.

## INDIAN ISLAND BROWNFIELDS ASSESSMENT PHASE I AND II REPORTS