Quartz Valley Indian Reservation

Quality Assurance Project Plan
2016 Revision
Water Quality Sampling and Analysis

CWA 106 grant identification # I-96927206-0

Prepared by

Tribal Environmental Protection Department

Quartz Valley Indian Reservation

13601 Quartz Valley Road

Fort Jones, CA 96032

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Approval Page

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For EPA use:

Approved by EPA Project Manager:

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Expedited Review? ___ Yes ___ No

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Approved: Date:

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Distribution List

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The Quartz Valley Indian Reservation's Environmental Department (QVIRED) is completing this *QAPP* to define how quality control (QC) procedures are implemented and to define how the QVIRED and its staff will work together on quality assurance (QA) to insure that data are properly collected and analyzed, managed and stored for on-going use, and results published in a timely fashion. Because of the systematic planning process documented in this *QAPP*, the QVIRED Water Quality Monitoring Program will supply quality assured data for management decisions related to the aquatic environment within QVIR jurisdiction and the Scott River watershed.

The QVIR Water Quality Monitoring Program is organized as shown in Figure 1. The QVIR Environmental Director has ultimate control over and responsibility for the WQ program. The QVIR Environmental Director is responsible for program coordination, schedule and budget management, technical oversight, report preparation, and overall program quality.

The QA Manager will have responsibility and authority for:

- ❖ Ongoing review of monitoring methods and equipment calibration,
- ❖ Auditing field notebooks, databases, chain of custody forms, and
- ❖ Insuring adherence to field and laboratory QA/QC programs.
- ❖ Assist with report preparation
- ❖ Run preliminary analysis of data, and provide charts for reports

In short, the QA Manager will insure that QC procedures developed in this QAPP are carried out.

The Field Technicians will work under the supervision of the QA Manager and follow procedures as defined in this *QAPP*. The Field Technicians will:

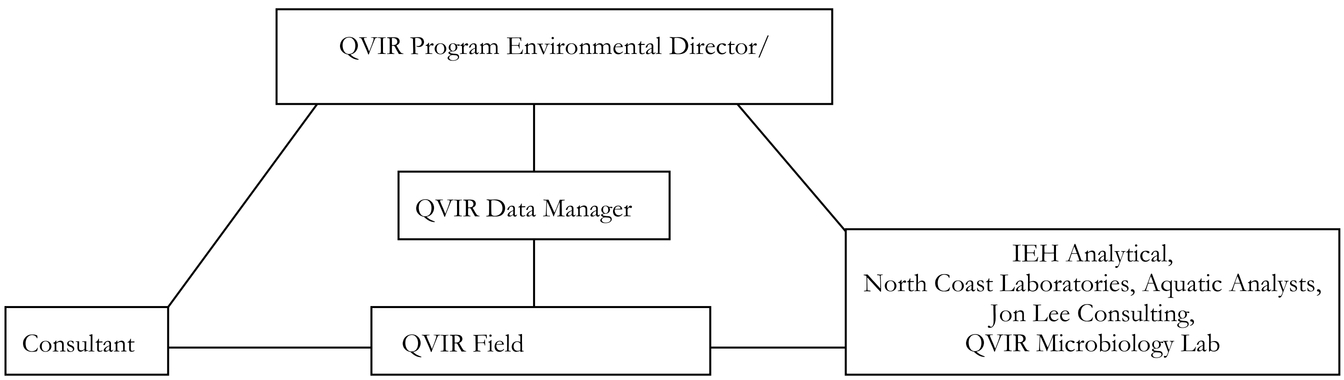
- ❖ Collect field samples
- ❖ Fill out forms to record results and field conditions,
- ❖ Care for and calibrate equipment,
- ❖ Properly fix and ship samples needing laboratory analysis,
- ❖ Transfer results from the field or laboratory into databases,
- ❖ Properly store data and archive to insure against loss,

Any time there are problems perceived by the Data Manager or the WQ Technician with any part of the WQ Monitoring Program, they are to notify the QVIR Project Manager so they can work collaboratively on resolving them. The QA Manager will also periodically conduct audits to detect QA/QC problems or deficiencies.

If any tests of surface or groundwater exceed action levels, the QVIR Environmental Director will be notified so that she can inform the QVIR Tribal Council. Following notification of the Tribal Council, the QVIR EPD would then inform the North Coast Regional Water Quality Control Board staff and work cooperatively with that agency for abatement of problems.

The QVIR EPD will send water quality samples for nutrient analysis to IEH Analytical. Water samples tested for pesticides will be sent to North Coast Laboratories, Ltd. A benthic macro-invertebrate consulting firm, Jon Lee Consulting, will provide technical assistance in the sampling and identification of aquatic macro-invertebrates. Phytoplankton and algae samples will be sent to Jim Sweet Aquatic Analyst, to be processed and analyzed. Bacteria samples will be analyzed for E. coli, fecal, and total coliforms in house by QVIR's Environmental Lab Accredidation Program (ELAP) certified bacteria laboratory.

Figure 1 QVIR Water Quality Program Organizational Structure



Problem Definition/Background

The Quartz Valley Indian Reservation lies in a rural, sparsely populated area within the Scott River watershed in the Klamath Mountain Province. The Scott River is one of four major tributaries of the Klamath River (Figure 2), contributing about 5% of the entire Klamath's runoff (yearly average of 615,000 acre feet). The Scott River watershed is a large area with substantial variation in geology, geomorphology, and climatology. The watershed drains approximately 520,617 acres (812.2 mi^2 or 2,107 km^2). Major tributaries to the 58 mile long Scott River in the Scott Valley include: Shackleford, Kidder, Etna, French, and Moffett Creeks, and also the South and East Forks (SRWC SAP 2005).Quartz Valley Indian Reservation has several streams on tribal land. Shackleford, Mill, and Sniktaw Creeks all run through the original reservation boundaries.
The headwaters of the largest creeks, Shackleford and Mill lie in the Marble Mountain Wilderness Area. Campbell, Cliff, and Summit Lakes comprise the headwaters of

Shackleford Creek. The headwaters of Mill Creek consist of the two Mill Creek ponds. The size, elevation and depth of each lake are listed in Table 1.   The Tribe has interest in the health of these aquatic ecosystems because of their role in producing cold water fish and other culturally significant flora and fauna. Chinook and coho salmon as well as steelhead trout return to these creeks to spawn and rely on a healthy Scott River for juvenile rearing and adult migration.

Figure 2 Scott River Basin, Siskiyou County California

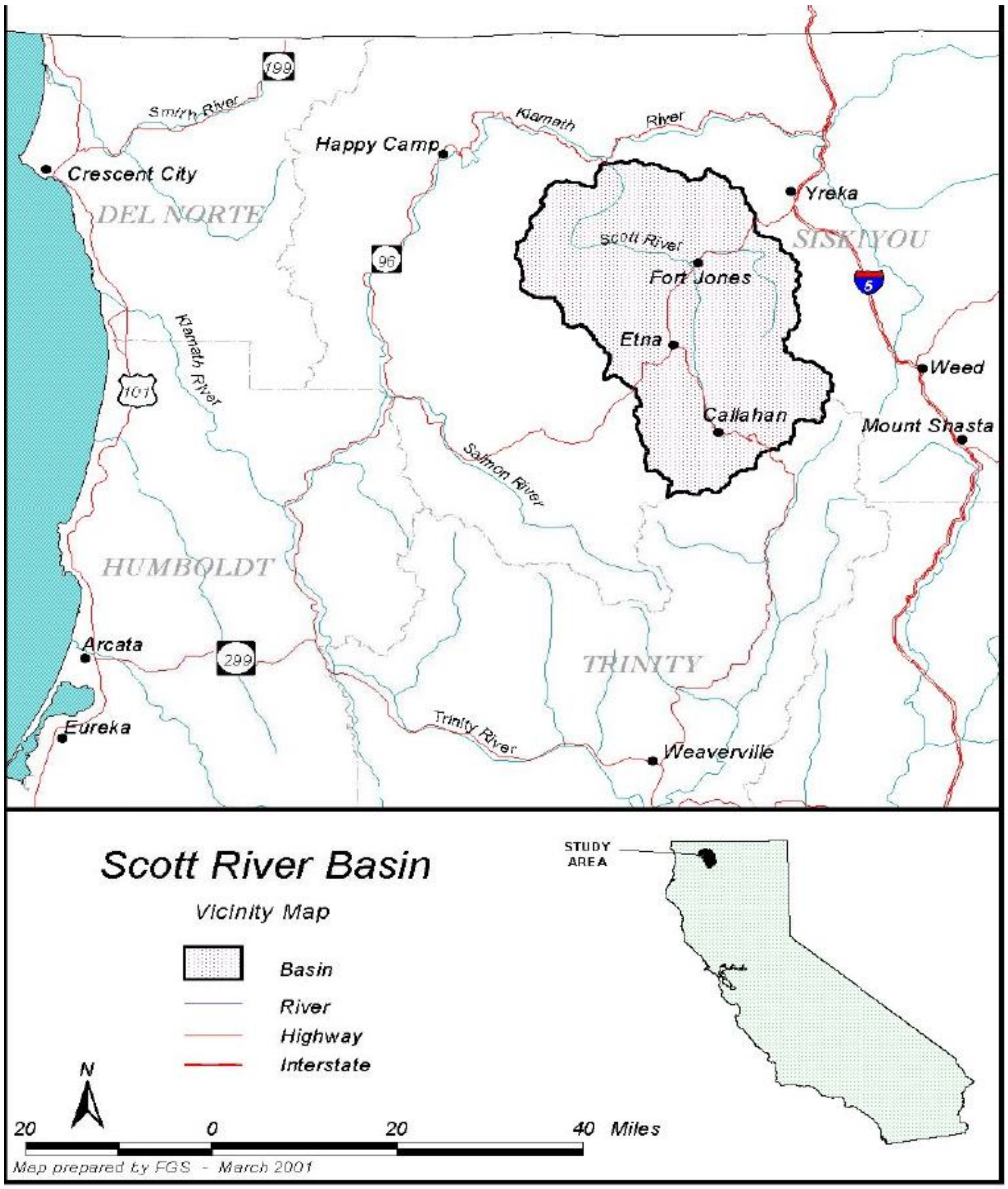


Table 1: Lakes at Headwaters of Shackleford-Mill Creeks (Data from Klamath Nation Forest)

Lake	Elevation	Acres	Depth
Campbell	5800’	33	3’
Cliff	6100’	52	175’
Summit	6050’	5	15’
Summit Meadow	6050’	1.3	4’
Mill Creek (West)	6450’	4.5	8’
Mill Creek (East)	6350’	1.5	15’

The Scott River was listed as sediment and temperature impaired under Section 303(d) of the Clean Water Act by the North Coast Regional Water Quality Control Board and the U.S. Environmental Protection Agency (EPA) in 1997. Total Maximum Daily Loads (TMDL’s) were approved by the Regional Water Board (December 2005), the State Water Board (June 2006) and the US EPA (September 2006). Water quality conditions (low flow, high temperatures, altered sediment supplies, and highly fluctuating water chemistry during summer months) are considered to have adversely affected the habitat of anadromous salmonid populations in the Scott River watershed. Coho salmon in the region were listed as threatened under the Federal Endangered Species Act (ESA) in 1997 by the National Marine Fisheries Service (NMFS) and by the California Fish and Game Commission in 2002. Additionally, the Klamath River in the section downstream of the confluence with the Scott is also listed for nutrients and organic enrichment/low dissolved oxygen; the Klamath TMDL was approved by the EPA in 2010.

Decline of the Fishery

All runs of anadromous fish have declined over time in the Scott basin. Historically, spring-run Chinook salmon were the most abundant salmon in the rivers of the Klamath Basin, and outnumbered the fall Chinook run (Hume in Snyder 1931). “Salmon ascend the river in large numbers, before the waters subside in the spring,” remarked Gibbs in 1851 (SRWC SAP 2005). Fall Chinook, winter steelhead, and summer steelhead were also widespread in the Scott River Basin (Maria, personal communication in SRWC SAP 2005). Today, the spring Chinook run and the summer steelhead run are virtually nonexistent in the Scott River (KRBFTF, 1991. p. 2-87, 2-99, and 4-15; USFS, 2000b, p.3-9; USFS, 2000a). The fall Chinook population of the Scott River basin is thought to have declined since at least the 1960’s (Hardy and Addley, 2001, p.12). The Scott River produces approximately 9.2 % of the natural fall Chinook salmon in the Klamath River basin (SRWC, 2004, p.6-1).

Historically, coho salmon would have flourished in the numerous ponds created by beavers throughout the valley and in both forks of the Scott River (SRWC SAP 2005 & Belchik, personal communication). Brown et al. (1994) state that California coho populations are probably less than 6 % of what they were in the 1940's, and there has been at least a 70 % decline since the 1960s. Coho salmon occupy only 61 % of the SONCC Coho ESU streams that were previously identified as historical coho salmon streams (CDFG, 2002, p.2)

Land Use Factors

Factors that limit salmon and steelhead production affect water quality and constrain attainment of other beneficial uses in Shackleford and Mill Creeks are inter-related. There are some over-arching factors, such as flow depletion, that cause secondary water quality problems (e.g., transit time increases and stagnation of water can occur). Limiting factors are most often linked to land use activities, including logging, agriculture, rural urbanization, channelization, road building/use and mining.

Historically, gold was mined in the Quartz Valley area, both in the valley itself and in the nearby Scott and Oro Fino valleys. The prominent type of mining performed in Northern California during the late 1800's was hydraulic mining. Surface and groundwater in the Quartz Valley could potentially be contaminated with heavy metals that naturally occur in association with gold but are discarded in tailings, such as arsenic and mercury. Dredge tailings from hydraulic mining can also serve as a long-term source of sediment and can create long-term physical alterations to channels and substrate.

Much of the land in Siskiyou County was logged, beginning in the latter half of the 19^{th} century. Erosion due to land-slides associated with clear-cutting or failures of logging roads still used or abandoned are thought to be sources of sediment to the Shackleford Creek and Scott River system. Bank destabilization from agricultural practices also contributes to sediment deposits.

Beginning around 1850, ranching became the most prevalent use of land around the Quartz Valley. Grazing of cattle is still performed by many landowners on the valley floors in the Scott River watershed, which could contribute to accelerated bank erosion along streams and increased bacterial levels of surface waters when cattle are permitted uncontrolled access to streams. Land around the upper reaches of Shackleford Creek has historically been used for cattle grazing during the summers, which have been shown to be associated with increased levels of fecal coliforms to the surface water. Land in the Quartz Valley floor is also used for commercial agriculture, which includes use of pesticides, nitrates, and phosphates which can find their way to the surface water.

Private industrial timber lands border the Reservation and Shackleford Creek. Modern forestry practices often use herbicides, pesticides, and fertilizers and can be additional sources of chemical inputs to surface and ground waters. Fruit Growers Company, one of the largest owners of private land in Siskiyou County, has been unwilling to share data or studies they have conducted pertaining to Shackleford Creek. They have since sold their west side Scott River holdings to Timbervest. QVIR Environmental staff has been meeting with Timbervest representatives as of 2006 and have established a positive working relationship which includes data sharing and property access.

On Reservation trust land, no grazing or agriculture is performed, however agriculture and grazing does occur within the original Reservation boundary on lands no longer owned by the QVIR. The area around Shackleford Creek and the Reservation does contain paved roads and has vehicle traffic. Oils and other contaminants likely to come from automotive traffic are potential sources of chemicals to surface and ground waters.

No heavy industry is present in the area, and chemical inputs from such industrial applications do not currently occur. However, there are large scale agricultural operations in the larger Scott River watershed that use fertilizers and pesticides and pose a concern to the Tribe.

Logging and Roads: Upland areas within the Shackleford Creek watershed have been extensively logged and currently have high road densities (see Appendix A). Compaction of soils and changes in routing of storm water on logged areas and logging roads have been shown to have the following affects:

- increased peak stream discharge (Montgomery and Buffington, 1993; Jones and Grant, 1996),
- increased sediment yield (Hagans et al., 1986, de la Fuente and Elder, 1998), and
- reduced large wood for recruitment to streams (Reeves et al., 1993; Schuett-Hames et al., 1999).

These potential effects to aquatic conditions related to logging and road type disturbances are each described in greater detail below. Also the description of conditions in Shackleford Creek uplands based on GIS and other data is presented in Appendix A.

Increased peak stream flows can winnow out smaller sediment particles such as sand and gravels and leave the streambed with larger cobbles and boulders. This larger diameter distribution of the substrate can end up being greater than optimal for salmonid use such as spawning, or providing macro invertebrate habitat. The increased peak flows can wash out large wood and trigger bank failures and increased channel scour. Channel changes can include decreased pool frequency and depth (Buffington and Montgomery, 1993). Wider and shallower channels also are more subject to solar warming. Although less well studied, hydrologic changes associated with compaction of soil and loss of infiltration capacity over a watershed can also lead to decreased summer base flows.

Increased sediment yield is a problem in the Scott River watershed (NCRWQCB, 2003; 2005). Fine sediment comes primarily from surface or gully erosion. (Sommarstrom et al. (1990) identified erosion from road cuts and road fills on decomposed granitic soils as a major source of fines in the Scott River watershed.

Increased sediment yield can affect watershed in two ways. One is by creating elevated levels of sand and fine sediment in transport that can settle downstream and fill interstitial spaces in normally sorted stream gravels, and cause decreased salmonid egg and alevin survival and reduced quality of aquatic insect habitat. Decreased aquatic invertebrate production diminishes food resources for juvenile salmonids. Smaller sediment particles, being highly mobile, fill pools thus reducing salmonid juvenile carrying capacity and adult salmonid holding habitat. Another way increased sediment yield can affect watersheds is via elevated mass wasting. The coarse and fine sediment yielded to stream channels by increased rates of mass wasting typically cause channel aggradation, loss of pool habitat, changes in median particle size, decreased spawning gravel quality and channel adjustments that facilitate stream warming.

Large wood depletion and changes in riparian conditions can increase ambient air temperature over streams and reduce relative humidity, thus leading to stream warming (Bartholow, 1989; Pool and Berman, 2001). Pools are often formed by large wood debris and these have been shown to be extremely important nursery areas for coho salmon juveniles (Reeves et al., 1988) as they must rear for one year in fresh water before migrating to the ocean. Large wood depletion is associated with diminished aquatic habitat complexity, reduced pool frequency and lower carrying capacity for juvenile coho. Large coniferous trees in riparian zones take decades or centuries to grow to sufficient size to be useful in buffering air temperatures and providing wood of sufficient size to provide lasting habitat value (Shuett-Hames et al., 1999).

Agricultural Water Diversion: Flow depletion in Shackleford Creek caused by water extraction for agriculture contributes to stream warming.   Water volume is directly related to maintaining thermal mass and therefore reduced volumes will warm more readily. Also water cools itself via hyporheic exchange with ground water and loss of surface flow will reduce this rate of exchange. Decreasing flows also causes riffles to shallow and will contribute to the formation of isolated and disconnected pools. Shackleford Creek on the QVIR flows subsurface in sections in late summer until the fall rains restore the stream flow. This drying of the channel causes stranding of salmonids and other aquatic organisms. As flows decrease, the ability to scour substrate decreases allowing increased growth of periphyton. High rates of photosynthesis are often the result as a function of increased temperatures and slower flows. The photosynthesis and respiration of the algae in low-flow conditions can cause large nocturnal and diurnal fluctuations in pH and dissolved oxygen.

Pesticides: Many of the leading pesticides used in Scott Valley and the Shackleford Creek drainage are chemicals that have no recognized levels of exposure for human health risk as set by the U.S. Environmental Protection Agency or the State of California (EDW, 2005). However, two pesticides used in Scott Valley were acknowledged to be harmful to salmonids on July 2006, by the US EPA. Table 2 show the pesticides most used in the Shackleford and Scott River basins with those harmful to salmon and steelhead listed in bold text. Table 3 shows the top five sites for pesticide use and the most commonly used pesticides in Siskiyou County for 2010.

Table 2 Top-ten most commonly used pesticides in Shackleford and Scott BAsin during 1990-2004 (Data Source: CA Pesticide Use Reporting Database)

Use Rank	Shackleford	Scott River
1	Paraquat dichloride	Paraquat dichloride
2	**Trifluralin**	Hexazinone
3	Hexazinone	**Diuron**
4	Metribuzin	Glycophosphate
5	Glycophosphate	2,4-D Dimethylamine salt
6	2,4-D Dimethylamine salt	Metribuzin
7	2.4-D Butoxyethanol ester	2.4-D Butoxyethanol ester

Use Rank	Shackleford	Scott River
8	Norflurazon	**Trifluralin**
9	MCPA, Dimethylamine salt	2,4-D, Isooctyl ester
10	Atrazine	Chloropyrifos

Table 3 Top-five industrial practices for total pesticide use and the top five esticides used in Siskiyou County 2010 (Data Source: CA Pesticide Use Reporting Database)

Industrial practice	Pesticide	Pounds	Acres
Forest/Timberland Management	Hexazinone	6,419	3734
	Methylated soybean oil*	4784	2034
	Oleic acid, methyl ethyl l ester	3106	1163
	Fatty acids, methyl ester	2343	756
	Imazapyr, isoprpylamine salt	2055	4265
	All other AIS	25653	21968
Soil Fumigation/Preplanting	Methyl bromide	11882	49
	Chloropicrin	5950	50
	1,3-Dichloropropene	173	1
Alfalfa Cropping	Paraquat dichloride	1533	2710
	Metribuzin	1302	2638
	Hexazinone	1053	1974
	Glyphosate, isopropyl amine salt	675	552
	Alpha-(para-nonylphenyl)-omega hydroxypoly (ox ethylene) *	535	8975
	All other AIS	2220	11764
Rights of Way Maintenance	Dazomet	1171	
	Glyphosate, isopropylamine salt	1124	72
	Borax	647	
	Glyphosate, dimethyl amine salt	423	
	Copper naphthenate	290	
	All other AIS	1278	216
Water Area Maintenance	Acrolein	2105	
	Copper carbonate basic	711	
	Copper sulfate, (pent hydrate)	29	10
	Copper ethanolamine complexes, mixed	19	

Purpose of Water Quality Investigations

What was once a historically productive fishery in Scott Valley has declined to numbers precluding tribal members from utilizing their fishing rights on Reservation waters and limiting their take for sustenance throughout the Scott River Valley. The Indian people of Quartz Valley traditionally depended on the land and waters to provide for their physical and cultural needs. The state of the watershed today prevents this dependency. The Tribe's priority is a restored watershed that supports healthy populations of salmonids. This water quality study is a first step in understanding conditions in areas that have not been studied which may have contributed to population decreases of anadromous salmonids. It is also an opportunity to work collaboratively with other agencies and tribes to share information and to ultimately restore the watershed to historical conditions.

The goal of this QAPP is to provide the Quartz Valley Indian Community with a quantitative assessment of the water quality of the resources effecting the Reservation to further expand the Tribe's scientific knowledge for tribal members, fisheries, future planning, and watershed activities. Additionally, these analyses will help identify any surface water contamination problems that could affect fish habitat, since wild salmon are an important resource to the Tribe and a vital piece of the Tribe's cultural heritage.

This QAPP will be used to develop baseline information in order to document water quality changes over time, screen for potential water quality problems, and to provide a scientific foundation in order to actively participate in the management of the Shackleford-Mill Creek watershed and the broader Scott River Watershed.

Principal data users/decision makers who will use the data to make decision

Quality-assured water quality data collected by the QVIR ED will be used in management of the Shackleford Creek watershed. Data will be shared with the US EPA and NCRWQCB staff through timely reports on findings, including for use in TMDL updates. Other agencies and entities cooperating in Shackleford Creek watershed management, including the Klamath National Forest, and area Tribes may also receive QVIR ED data after it has undergone QA/QC and analysis. The QVIR EPD will also share data with tribal members through annual reports and with the public upon request.

Brief Summary of existing information and recent water quality data collection

Data collection began during the late spring of 2007 and continues into 2015.

YSI Sonde

A major collection effort is being performed by a multi-channel, data recorder (YSI Datasonde 6600). This datasonde records a range of parameters on programmable intervals and is deployed on the mainstem Scott River at the US Geologic Survey (USGS) flow gage site located about 11 miles downstream of the community of Fort Jones (USGS gage 11519500). The datasonde records temperature, specific conductivity, dissolved oxygen, pH and turbidity. The results are available for real-time viewing at the California Data Exchange Center (CDEC) website using the tab labeled "Query Tools" and requesting data for "SFJ" (Scott River at Fort Jones). An additional data recorder (YSI 6600 series Datasonde) will be installed in 2015 in the upper Shackleford watershed on USFS land and on Bureau of Land Management property in the Mill Creek watershed for continuous monitoring of the same parameters as USGS site on the Scott River. (Or click on this link: http://cdec.water.ca.gov/cgi-progs/plotReal2?staid=sfj).

Nutrient Sampling

In addition to the datasonde data, we collect bi-monthly grab samples of surface water at selected locations in the Scott River Watershed year-round. The grab samples collected at these sites are analyzed for the following water quality parameters: total nitrogen, nitrate+nitrite, total phosphorus, soluable reactive phosphorus (SRP), bacteria (*E. coli* and total coliform, fecal), pH, dissolved oxygen, and specific conductivity. Total Nitrogen, nitrate+nitrite, SRP, and phosphorus are sent out and analyzed by contracting labs such as IEH Analytical Seattle, WA. Bacteria analyses are done in-house. The remaining analyses are performed on site using a hand held YSI datasonde.

Bacteria Analysis

The Quartz Valley Indian Reservation operates its own bacteria lab, which is ELAP certified by the State of California since 2007. The QVIR lab is also certified and available to perform tests for the public on bacterial contamination of surface and drinking water samples from wells or other sources. Total coliforms, E. coli, and fecal coliform tests are routinely performed in the lab.

Temperature Monitoring

In addition to the above water chemistry efforts, QVIREPD collects continuous temperature data at many sites over the Scott River basin. Temperature is also taken at all grab samples of nutrient and chemical parameters. Temperature is measured and recorded at programmable intervals using HOBO continuous recording temperature devices (Onset Corp.).

Groundwater Monitoring

In addition to the surface water program, groundwater is also being monitored. QVIREPD performs biweekly sampling of drinking water wells and a newly establish set of ground water monitoring wells. Bacteria sampling, depths to water, and a handheld datasonde analysis is performed on the drinking water wells. Continuous monitoring of water level depths was initiated in early 2012 on a set of 13 monitoring wells on the QVIR land holdings.

Monthly and bimonthly monitoring of QVIR ground water wells for bacteria and water level has occurred for the past 8 years by QVIR ED. Staff followed the previous version of this QAPP (2007 QVIR QAPP) and SOPs for this ground water monitoring. Ground water has also been sampled for the QVIR residents in the past as a part of routine well installation and maintenance. Records of well water analysis for the wells are few, and lab analysis Quality Assurance information is not known. Prior groundwater tests and a summary of bacteria results are included in Appendix B1.

Fish Surveys

Annual spawning ground and carcass surveys are performed by a collaborative effort including QVIR, USFS, CDFW, and other agencies. Surveys confirm the presence of Chinook and coho salmon in the Scott River, and verify that the Scott River has the largest number of native coho of the Klamath River tributaries. These surveys are hoped to provide accurate trend information on local salmonids, and in recent years has included the use of an Alaskan style weir on the lower Scott above Indian Scotty Campground with a recorded video feed that is viewed for individual species counts.

GIS

In recent years, our Geographic Information Systems (GIS) technology and other remote sensing methods have contributed to the knowledge of the basin. Geologic and sediment study data are available for the greater Scott River basin, some of which is applicable to or includes specific information about the Quartz Valley. GIS datasets may also cover the Quartz Valley, but to date, few analyses performed with this data have focused on the Quartz Valley. The Scott River TMDL utilized the available GIS data for the watershed, but recent changes in land use, forestation, or roads may not be reflected in the data available. QVIREPD is working to increase our GIS expertise and is seeking collaboration with other partnering agencies such as USFWS and use of their LiDAR data sets.

Baseline Watershed Assessment

In February 2005, a preliminary assessment of the QVIR groundwater and surface water resources was conducted as part of a preliminary Baseline Watershed Assessment. The assessment had two components: chemical analysis, for both surface and groundwater, and an assessment of fish and wildlife habitat in the QVIR reach of Shackleford Creek. Funding for this assessment was obtained through the Bureau of Indian Affairs, by the QVIR Tribal EPD office. During these tests, 15 wells on QVIR land were tested and samples were taken from four stream sites.

Shackleford Creek was tested using hand-held field meters for dissolved oxygen, pH, turbidity and temperature. These parameters were chosen due to their importance to salmonid habitat. Samples of water were also taken and analyzed for phosphates, nitrates, organochloride pesticides, heavy metals, and some volatile organic chemicals. Test results are compiled in Table 4 through Table 6. The consultant's SAP and the Lab's SOP are included in the Appendix B.

Baseline Watershed Assessment: Groundwater Results

For groundwater, a suite of 12 metals was tested: mercury, antimony, barium, beryllium, cadmium, chromium, copper, iron, arsenic, lead, selenium and thallium. Copper, iron and barium were detected. In two wells, iron concentrations exceeded the proposed limit, found in the US EPA secondary drinking water standards. Copper was detected in samples from all the wells on the main reservation. Although it did not exceed the standard, it was the only analyte of note detected in the samples. Because it occurred in every well, it is likely the copper is naturally occurring in the water bearing rock.

The other analytes tested in groundwater during the preliminary sampling event were total coliforms, fecal coliforms, chlorine dioxide, chlorite, and chloramines. Field parameters were measured with the YSI Multiparameter, but many readings were of poor data quality. A calibration check after the sampling event showed the YSI unit to be out of calibration. As a result, the readings taken during this sampling event do not provide a good baseline for temperature, conductivity, TDS and pH in addition to the analytes listed above, an abandoned well was tested for hexane extractable materials (HEM), which result from contamination with petroleum products such as oil or gasoline. Empty 55-gallon drums found near the abandoned well were thought to have previously contained petroleum products. No HEMs were detected.

Two wells had a total coliform count out of compliance with the standards of the Siskiyou County Health office. These two wells tested positive for total coliforms, though neither tested positive for fecal coliforms. No other wells were found to have either total coliforms or fecal coliforms.

Table 4: Groundwater Analysis Results

Sampling Site	**Coliforms**	**Metals**	**Concentration in micrograms/L**	**Nitrate mg/L**	**Nitrite**	**Chlorines**	**Oils and Grease**
Well #1	Total - /Fecal -	Copper	18	n/a	n/a	ND	n/a
Well #2	Total - /Fecal -	Copper	14	n/a	n/a	ND	n/a
Well #3	Total - /Fecal -	Copper	16	n/a	n/a	ND	n/a

Well #4	Total - /Fecal -	Copper	17		n/a	n/a	ND	n/a
Well #5	Total - /Fecal -	Copper	110		n/a	n/a	ND	n/a
Well #6	Total+ /Fecal -	Copper	62		n/a	n/a	ND	n/a
Well #7	Total - /Fecal -	Copper	40		n/a	n/a	ND	n/a
Well #8	Total - /Fecal -	Copper	34		n/a	n/a	ND	n/a
Well #9	Total - /Fecal -	Copper	27		n/a	n/a	ND	n/a
Well #10	Total+ /Fecal -	Copper	23		n/a	n/a	ND	n/a
Well #11	Total - /Fecal -	Copper	18		n/a	n/a	ND	n/a
Well #12	Total - /Fecal -	Iron	290		n/a	n/a	ND	n/a
Well #13 (Cram Gulch)	Total - /Fecal-	Barium	46		n/a	n/a	ND	n/a
		Iron		740				
Well #14 (Cram Gulch)	Total - /Fecal-	Barium	47		n/a	n/a	ND	n/a
		Iron		270				
Well #15	Total - /Fecal -	Iron	600		2.6	ND	ND	ND

* n/a -- samples from this site were not tested for this analyte
+ ND -- analyte not present/not detectable

Baseline Watershed Assessment: Surface Water Analysis

No information on surface water chemistry prior to 2005 is available for the upper reaches of Shackleford Creek. Some modern aerial photographs, including FLIR data, are available for the lower reaches of the stream. During the February 2005 preliminary assessment, surface water samples were analyzed for nitrates and nitrites, organophosphate pesticides, and heavy metals (see Table 5). Iron and copper were again the only metals detected. No organophosphates were detected. Two out of the four stream sample sites had very low nitrate concentrations; none of the sites tested positive for nitrite. High concentrations of nitrates can be indicative of runoff containing fertilizers or potential septic tank seepage.

At the time of sample collection, field parameters were also taken with a YSI Multiparameter meter. Temperature, total dissolved solids (TDS), pH, conductivity, and dissolved oxygen (DO) were recorded (see Table 6).

Table 5: Surface Water Analysis Results

Sampling Site	Metals	Concentration (micrograms/L)	Nitrate (mg/L)	Nitrite (mg/L)	Organophosphate Pesticides
Stream Site 1	Copper	29	0.52	ND	ND
	Iron	270			
Stream Site 2	Copper	16	0.5	ND	ND
	Iron	150			
Stream Site 3	Copper	16	ND	ND	ND
Stream Site 4	Copper	12	ND	ND	ND

n/a -- samples from this site were not tested for this analyte
+ ND -- analyte not present/not detectable

Table 6: Field Parameters at Surface Water Sample Locations

Sampling Site	DO (mg/L)	Conductivity (us/m)	TDS (ppm)	Salinity (psu)	pH	Temperature (C)
Stream Site 1	13	61	0.066		7.91	4
Stream Site 2	13	63	0.068	0.05	7.67	4.10
Stream Site 3	12.74	63	0.068	0.05	7.94	4.14
Stream Site 4	12.41	62	0.067	0.05	7.52	4.2

No analytes were found to be out of compliance with proposed water quality standards during this sampling event. In addition, all organophosphate pesticides were below the detection limit. All four stream sites tested positive for copper, in low concentrations. Two sites also tested positive for iron, in moderate concentrations, but were still under the level proposed for drinking water, based on the US EPA secondary drinking water standards.

Baseline Watershed Assessment: Habitat Assessment and Stream Condition Inventory

This description describes the condition of Shackleford Creek prior to flooding events that occurred during the winter of 2005-2006. Shackleford Creek appears to have undergone some changes since, but it has not been formally habitat typed since the assessment in 2005.

The section of Shackleford Creek that runs through QVIR property is wide, shallow, and braided with primarily gravel and cobble substrate. The channel divides into two major braids, and one minor braid. Most habitat units are low-gradient riffle (LGR) or high-gradient riffle (HGR) with one short glide (GLD) section and one root wad enhanced lateral scour pool. One secondary channel pool was also noted. In-stream cover is minimal in most portions of the stream, with few large trees situated near enough to the stream to provide cover. The depth in most of the stream was less than two feet during the stream survey, conducted during low- to moderate- flow conditions. The stream depth does not offer significant cover to aquatic species in most of the stream. This section of Shackleford Creek was typed as a Rosgen D3, a multiple channel system with a cobble and gravel substrate.

In the stream near the QVIR boundary, the main channel is slightly entrenched; at this location, the north bank is higher than the south, and the bank was slightly undercut. Further downstream, the banks were of more equal height and did not show the same erosion as the upper reaches. The width-to-depth ratio of the stream is very high, and the overflow channels around the stream are quite wide.

In several locations, the stream contained excellent gravels for salmonid spawning. Several redds had been found in this section of stream during surveys in prior years; several likely redds were also noted during this habitat assessment. Several of the reaches in the stream ranged from good to ideal spawning habitat. Silt depth in the channel was minimal; the banks of the stream showed slightly greater silt depth, but generally less than 0.2 feet.

At the time the habitat survey was conducted, a stonefly hatch was noted. Future surveys could include a benthic macro invertebrate component to evaluate the availability of larvae as a food source for coho fry. Appendix B4 contains the complete habitat unit characterization.

Flow measurements were also made at the endpoints of the QVIR reach of Shackleford Creek. The flow where Shackleford Creek enters QVIR land was

40.5 cubic feet per second (cfs) and the stream width was 27.0 feet. The flow just below the road crossing where Shackleford Creek leaves QVIR land was 39.6 cfs and the stream width was 42.5 feet. At the point in time when the flow measurements were taken, while the stream appeared to lose approximately one cfs over the QVIR reach; this calculated loss was within the margin of error of the discharge measures, and no conclusions about stream loss or base flow could be made. Flow measurement data are included as Appendix B5.

Project/Task Description and Schedule

The QVIR EPD has implemented a Water Quality Monitoring Program to collect quality-assured water quality data for management decisions related to the aquatic environment within the QVIR and the Scott River watershed. Ongoing monitoring will continue under the previously approved QAPP. Additional monitoring is scheduled to begin in spring 2016 upon US EPA approval of this QAPP. Water quality data collection will help establish baseline water quality conditions and quantitatively assess the quality of QVIR water resources and initiate long-term trend monitoring. Each year results will uploaded to WQX/Storet and included in the annual water quality report submitted to the EPA.   To the degree they are useful, these quality-assured data will be provided for to the North Coast Regional Water Quality Control Board for use in TMDL implementation.

The QVIR EPD will be sampling surface water for various parameters critical to fish health at numerous locations on Shackleford, Mill and Sniktaw Creeks in the Reservation's watershed. The headwater lakes of Shackleford and Mill Creeks will be sampled as well. These sites were selected to use as a comparison with the pre-agricultural conditions of Shackleford/Mill Creeks and to use as baselines for other Scott River sample results. Additional sample sites have been selected in the Scott River, one just downstream of the confluence of Shackleford Creek and Scott River, and sites upstream on both the East Fork and South Fork Scott River..

Water quality sampling will take place in the following water bodies with varying numbers of stations in each (Figure 3):

1. Scott River
2. Tributaries to the East Fork Scott River.
3. Headwaters of Shackleford Creek
4. Shackleford Creek
5. Headwaters of Mill Creek
6. Mill Creek
7. Sniktaw Creek

Water quality parameters to be sampled for each water body are listed in Table 7. These include hand held instrument readings, stage and flow gauges, and continuous automated probe sampling. The sampling frequency at each location by parameter can also be found in Table 7. Water quality sampling may not be feasible on the middle sections of Shackleford Creek because of loss of surface flow late in summer and before fall rains. The continuous data recorders in the Scott River downstream of the mouth of Shackleford Creek at the USGS Gage,Shackleford and Mill Creek will be fixed to a cable, protected by a metal pipe, which will suspend the probe to avoid damage to equipment posed by powerful Scott River flows during winter.

Monitoring will help identify water quality problems within or adjacent to the QVIR and the QVIR EPD will report any findings of action levels of contaminants and work to abate any identified problems as described above. Turbidity monitoring data will likely be useful for tracking recovery of water quality for the TMDL implementation.

Monitoring Locations, Methods and Timing of Samples

Monitoring methods described below have been selected to best determine whether beneficial uses of water are being attained on the QVIR and in the Scott River watershed and what trends for parameters are limiting attainment of beneficial uses over time.

Sample sites are located on public, private and tribal lands. Permission has been secured from the owners of private lands where sites are located. Some of the middle reaches of both Shackleford and Mill Creeks are under private ownership and are not accessible at this time. .

The QVIR monitoring locations (Table 7, 8 and Figures 3 - 5) are arrayed so as to allow a comprehensive assessment of Shackleford and Mill Creeks and to collect baseline data to facilitate participation in co-management of the watershed. Upper Shackleford Creek locations start at the headwaters within the U.S. Forest Service designated Marble Mountain Wilderness Area at the inlets, outlets, and in the center of Campbell Lake, Summit Lake, and Cliff Lake. Samples will also be collected at the junction of outlets from Summit Lake and Cliff/Campbell Lakes, at the confluence of the outlets of Log Lake, Long High Creek, and Back Meadows Creek and additionally at the Wilderness boundary. Middle and lower Shackleford Creek locations are ona private timber property, at the top of the QVIR ownership and on Indian trust land just below the confluence with Mill Creek and above the confluence with the Scott River.

Upper Mill Creek locations also begin at the headwaters in the USFS Marble Mountain Wilderness Area at the inlets, outlets, and in the center of the two Mill Creek Ponds and downstream at the Wilderness Boundary before the Creek crosses into private land. An additional sample site on Mill Creek is located approximately two miles outside of the Wilderness boundary on Bureau of Land Management property. A sample location on Lower Mill Creek is at the Quartz Valley Elementary School above the convergence of Shackleford and Mill Creeks

Sniktaw Creek will be sampled at two locations on the Reservation upstream and downstream of an area where excess solid waste has been stockpiled.

Scott River sampling locations are located just downstream of the mouth of Shackleford Creek, and sites upstream on both the East Fork and the South Fork. The following tributaries to the mainstem will be sampled at the lowest USFS boundary: Kelsey, Canyon, Boulder and Mill Creek at Scott Bar ("Scott Bar" Mill). Because land on the East Fork is all private and inaccessible at this time, the major tributaries flowing into the Scott River must be sampled instead. Samples will be taken on USFS land on Kangaroo, Grouse, Mule, and Mill Creeks. The South Fork main-stem will be sampled at the lowest USFS Boundary.

Ground water sampling locations will be on the Reservation at the thirteen monitoring wells and at the drinking water wells. Thirteen monitoring wells are arrayed throughout the Reservation, pressure transducers have been installed to monitor hourly changes in ground water levels over time. Data will be collected every hour year round. This information will provide the tribe with baseline information that will help the tribe plan for groundwater management and any future development. This data will be shared when requested.   Additionally, this information may help the tribe understand the bacterial exceedances found in the tribe's drinking water wells commonly in the winter and spring, and interactions between ground and surface waters.

Figure 3 Surface Water Sampling Loactions

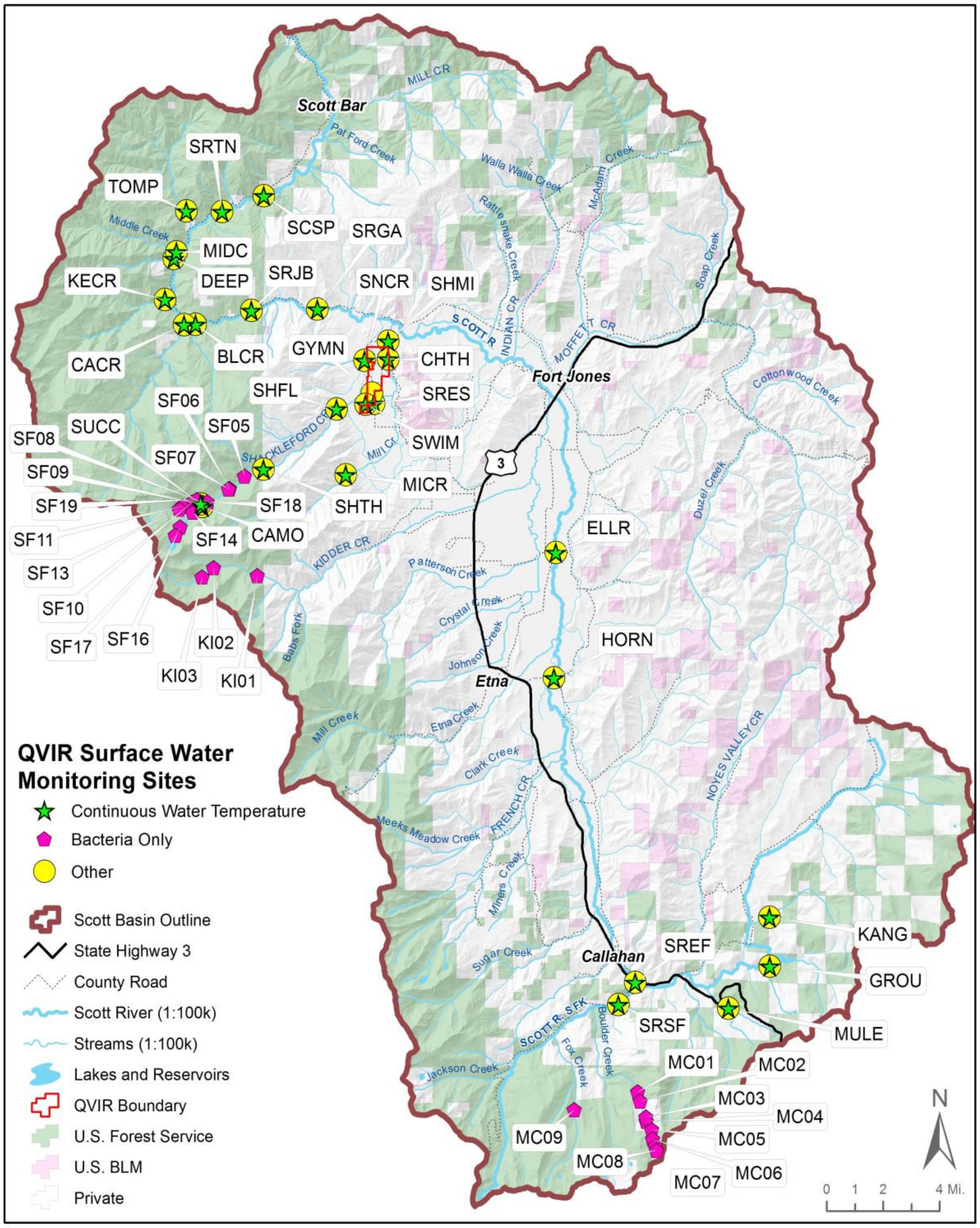


Figure 4 Static Groundwater Monitoring Locations

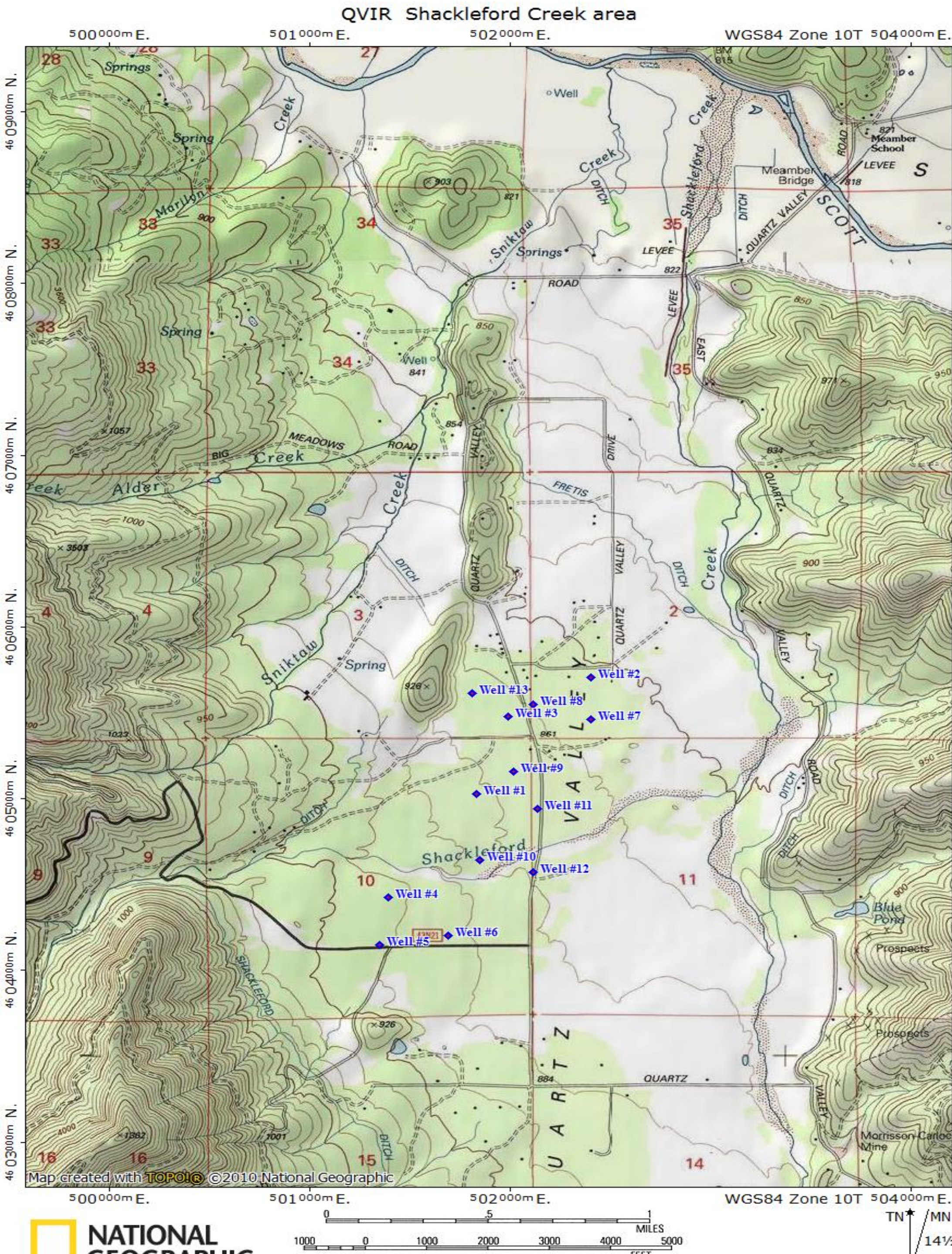
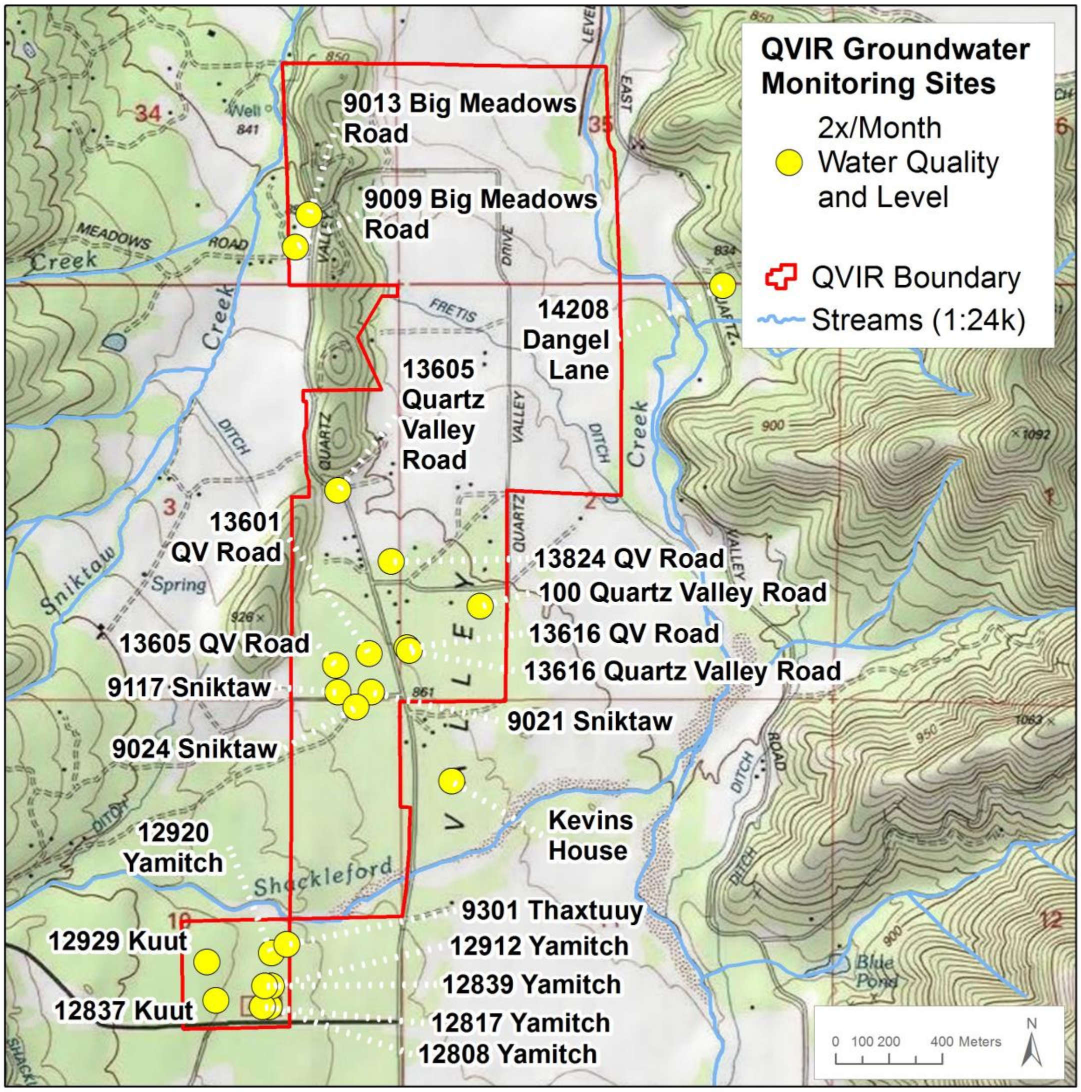


Figure 5 Domestic Groundwater Monitoring Locations



Sample Frequency and Parameters

Each location will be sampled on a regular basis at the locations listed on Table 7, 8 and shown on Figures 3 - 5 : flow; temperature; pH; conductivity; dissolved oxygen; macroinvertebrates; bacteria, and nutrients (grab sample)- phytoplankton, total phosphorus, dissolved phosphorus, total nitrogen, ammonium nitrogen, nitrate + nitrite, SRP, chlorophyll-a, and periphyton.

Temperature probes will be placed at each designated sample site for continuous monitoring recorded every half hour.

Stratified temperature monitoring and nutrient sampling will be conducted at all sampling locations in the lakes and ponds on a monthly basis between April 1 and October 31, only in years when funding is available.

Discharge will also be measured at each location as identified during each sampling event, Appendix F6 describes the protocol for collecting and calculating discharge measurements.

A YSI Sonde will monitor temperature, pH, specific conductivity, turbidity and dissolved oxygen in the Scott River downstream one mile from the mouth of Shackleford-Mill Creek, Mill Creek in Quartz Valley, and upper Shackleford Creek every half hour on a year round continuous basis. The Scott River, Mill Creek and Shackleford Creek sites will have real-time monitoring preliminary data available through the QVIR web page, accessible at California Data Exchange Center (cdec.gov). The Scott River site is at the USGS Gage, a recent MOU between the Tribe and USGS has been developed to formalize the usage of the gaging house for our equipment needs.

Groundwater wells will be monitored for depth, bacteria, temperature, pH, conductivity, turbidity and dissolved oxygen on a bimonthly basis year round. Past year's studies have found bacterial contamination of *E.coli*, fecal, and total coliforms during the winter and spring months when the water table is high. Due to the alluvial nature of the soils under the QVIR, it is possible that surface water is contaminating these wells.   There are thirteen monitoring wells that will log water depth (static water level) every hour on a continuous basis. This will provide more information about fluctuations of groundwater depths and the effects by surface waters on groundwater.

Most of the sample locations in this study are accessible by maintained paved or dirt roads, either County or Forest Service roads. The QVIR EPD's 4-wheel drive vehicle will be used when sampling these locations. The remaining sample locations will be accessed via hiking trails in the Marble Mountain Wilderness. Table 8 describes sample locations, rationale, and accessibility. Sampling technicians will hike in to wilderness locations using day packs to carry equipment. All samples will be collected from the shoreline except samples collected at the lakes. Lake samples will be obtained using an inflatable kayak to access the lake's center.

All sampling locations will be recorded using global positioning system (GPS) equipment following the procedures included in Appendix E1. Additionally, photo documentation will occur at each sampling location during every sampling event.

A parameter may be removed from the monitoring program if the sampling results indicate it is not of concern or added if new land uses develop after the monitoring program begins or the monitoring data indicates other potential parameters to include.

A sampling site may be removed from the monitoring program due to cost, access, or feasibility. Any changes will be updated in subsequent versions of this document.

Table 7 Sites and Parameters

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
	SURFACE																		
SNCR	Sniktaw Creek	41.6147	-122.9815	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SREF	Scott River @East Fork	41.3066	-122.7974	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SRSF	Scott River @South Fork	41.2956	-122.809	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
MICR	Mill Creek	41.5929	-122.9898	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SHMI	Shackleford/Mill confluence	41.6241	-122.9655	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SHTH	Shackleford Creek @Trailhead	41.5608	-123.0508	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SHFL	Shackleford Falls	41.5905	-123.0008	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SRES	Shackleford Creek @ QVIR	41.5933	-122.975	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
CHTH	Shackleford Creek@Charlie Thoms	41.6152	-122.9655	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SRGA	Scott River Gauge	41.64	-123.0138	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
CAMO	Campbell Lake Outlet	41.5422	-123.0925	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SUCC	Summitt Campbell Confluence	41.5436	-123.0936	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
GROU	Grouse Creek	41.3144	-122.7058	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
KANG	Kangaroo Creek	41.3386	-122.7058	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
MULE	Mule Creek	41.2936	-122.7341	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
DEEP	Deep Creek	41.665	-123.1122	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SCSP	Scott River@Sugar Pine	41.6961	-123.0505	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SRJB	Scott River @ Jones Beach	41.6394	-123.0591	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
GYMN	QVIR Gymnasium	41.5984	-122.9767	2/mth		X	X	X	X	X	X	X					X	X	X
TOMP	Tompkins Creek	41.6886	-123.1036	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
MIDC	Middle Creek	41.6683	-123.1105	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SRTN	Scott River @ Townsends Gulch	41.6883	-123.0791	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
BLCR	Boulder Creek	41.6324	-123.0972	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
CACR	Canyon Creek	41.6322	-123.105	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
KECR	Kelsey Creek	41.6447	-123.1183	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
ELLR	Scott River @ Eller Bridge	41.5192	-121.1483	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
UPSN	Upper Snicktaw	41.598	-121.0031	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
HORN	Scott River @ Horn Bridge	41.4574	-122.8524	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
SWIM	Reservation Swimming Hole	41.5929	-122.981	2/mth		X	X year-round, continuous	X	X	X	X	X	X	X	X	X	X	X	X
	Grazing Allotments																		
MC04	Unnamed tributary just above confluence with East Boulder Creek	41.2378	-122.79	weekly August through September			X						X	X	X	X	X		
MC05	Easr Boulder Creek below dam at East Boulder Lake	41.2327	-121.2138	weekly August through September			X						X	X	X	X	X		
MC06	East Boulder Creek above inlet for East Boulder Lake	41.2289	-122.7856	weekly August through September			X						X	X	X	X	X		
MC07	East Boulder Creek below outlet for Upper Lake	41.2254	-122.7839	weekly August through September			X						X	X	X	X	X		
MC08	East Boulder Creek above inlet for Upper Lake	41.2234	-122.7832	weekly August through September			X						X	X	X	X	X		

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
MC09	Fox Creek at road (no grazing in this drainage)	41.2435	-122.839	weekly August through September			X						X	X	X	X	X		
MC01	East Boulder Creek below trailhead parking and dispersed camping	41.2524	-122.7959	weekly August through September			X						X	X	X	X	X		
MC02	East Boulder Creek below first meadow at old cabin site	41.2478	-122.794	weekly August through September			X						X	X	X	X	X		
MC03	East Boulder Creek above confluence with unnamed tributary	41.2399	-122.7903	weekly August through September			X						X	X	X	X	X		
SF05	Shackleford Creek at gate below meadow complex, directly below rock wall	41.5573	-123.0635	weekly August through September			X						X	X	X	X	X		
SF06	Long High Creek above confluence with Shackleford Creek and above trail crossing	41.5511	-123.0739	weekly August through September			X						X	X	X	X	X		

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
SF07	Shackleford Creek above confluence with Long High Creek	41.5509	-123.0744	weekly August through September			X						X	X	X	X	X		
SF08	Shackleford Creek above Campbell Lake tributary (directly above log crossing)	41.5443	-123.0922	weekly August through September			X						X	X	X	X	X		
SF09	Campbell Lake tributary above Shackleford Creek- cross Shackleford Creek and go up trail to creek 300 feet to creek, before switchback starts	41.5434	-123.0924	weekly August through September			X						X	X	X	X	X		
SF10	Shackleford Creek below Log Lake Meadow complex and slightly above Lake	41.5443	-123.0996	weekly August through September			X						X	X	X	X	X		
SF11a	Shackleford Creek in Log Lake Meadow, below trail junction	41.5424	-123.106	weekly August through September			X						X	X	X	X	X		
SF12	Shackleford Creek above confluence with Bull Meadow tributary	41.5409	-123.1897	weekly August through September			X						X	X	X	X	X		

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
SF13	Bull Meadows tributary above confluence with Shackleford Creek	41.5409	-123.1082	weekly August through September			X						X	X	X	X	X		
SF14	Campbell Lake tributary below Campbell Lake and above unnamed tributary	41.5381	-123.0972	weekly August through September			X						X	X	X	X	X		
SF16	Campbell Lake tributary above inlet for Campbell Lake	41.532	-123.1075	weekly August through September			X						X	X	X	X	X		
SF17	Campbell Lake tributary below Cliff Lake	41.5277	-122.8887	weekly August through September			X						X	X	X	X	X		
SF18	Isolates Emerald Tributary, ungrazed without heavy recreation	41.5445	-123.0891	weekly August through September			X						X	X	X	X	X		
SF19	Isolates unnamed tributary above confluence with Shackleford Creek, near trail split for Calf Lake	41.5457	-123.0963	weekly August through September			X						X	X	X	X	X		
KI01	Kidder Creek above first unnamed tributary crossing Kidder Creek Trail from wilderness boundary	41.508	-123.0549	weekly August through September			X						X	X	X	X	X		

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
KI02	Kidder Creek above Kiddr Lake tributary	41.5119	-123.0846	weekly August through September			X						X	X	X	X	X		
KI03	Kidder Creek adjacent to Hays Meadow	41.5074	-123.0924	weekly August through September			X						X	X	X	X	X		
	STATIC WATER LEVEL MONITORING WELLS																		
Well1	By gymnasium	41.5969	-122.978	year round, continuous	X		X												
Well2	Off Quartz Valley Drive	41.603	-122.9711	year round, continuous	X		X												
Well3	QVIR Administration Building	41.601	-122.9761	year round, continuous	X		X												
Well4	Near Aaron's	41.6022	-122.9832	year round, continuous	X		X												
Well5	Across from Evette's	41.589	-122.9838	year round, continuous	X		X												
Well6	Shackleford Road	41.5895	-122.9797	year round, continuous	X		X												
Well7	QV Drive on Tribal Trust Land	41.6008	-122.9711	year round, continuous	X		X												
Well8	between Andrew and Lisa	41.6016	-122.9746	year round, continuous	X		X												
Well9	Near ANAV and Gym	41.5981	-122.9757	year round, continuous	X		X												
Well10	river left, Shackleford Creek	41.5935	-122.9778	year round, continuous	X		X												

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
Well11	River left, Shackleford Creek	41.5961	-122.9743	year round, continuous	X		X												
Well12	By bridge over Shackleford on QV Road	41.5928	-122.9764	year round, continuous	X		X												
Well 13	Culture Camp	41.6022	-122.9782	year round, continuous	X		X												
Well 8 Barometric Pressure	Between Andrew and Lisa	41.6016	-122.9746	year round, continuous	X		X												
	DRINKING WATER WELLS - GROUNDWATER																		
Cram Gulch		41.6125	-122.5784	2/mth	X		X	X	X	X	X						X		
12920 Yamitch		41.5913	-122.9805	2/mth	X		X	X	X	X	X						X		
12929 Kuut		41.591	-122.9834	2/mth	X		X	X	X	X	X						X		
13616 QV Road		41.6016	-122.9744	2/mth	X		X	X	X	X	X						X		
13601 QV Road		41.6014	-122.9761	2/mth	X		X	X	X	X	X						X		
13605 QV Road		41.601	-122.9776	2/mth	X		X	X	X	X	X						X		
12808 Yamitch		41.5895	-122.9806	2/mth	X		X	X	X	X	X						X		
12912 Yamitch		41.5902	-122.9805	2/mth	X		X	X	X	X	X						X		
12817 Yamitch		41.5895	-122.9809	2/mth	X		X	X	X	X	X						X		
12839 Yamitch		41.5902	-122.9808	2/mth	X		X	X	X	X	X						X		
12837 Kuut		41.5897	-122.983	2/mth	X		X	X	X	X	X						X		
9117 Sniktaw		41.6001	-122.9775	2/mth	X		X	X	X	X	X						X		
9021 Sniktaw		41.6001	-122.976	2/mth	X		X	X	X	X	X						X		

Site name	Description	decimal degrees		frequency	static evel	Flow	Temp	pH	Conductivity	Turbidity	DO	Macro-invertebrates	Total P	SRP	NO2+NO3	N	Bacteria	Chlorophyll a	Phytoplankton
9013 Big Meadows Road		41.6162	-122.9788	2/mth	X		X	X	X	X	X						X		
9024 Sniktaw		41.5996	-122.9767	2/mth	X		X	X	X	X	X						X		
13824 QV Road		41.6045	-122.9751	2/mth	X		X	X	X	X	X						X		
9009 Big Meadows Road		41.6151	-122.9794	2/mth	X		X	X	X	X	X						X		
9301 Thaxtuuy		41.5916	-122.9798	2/mth	X		X	X	X	X	X						X		
Kevins House		41.5971	-122.9724	2/mth	X		X	X	X	X	X						X		
14208 Dangel Lane		41.6138	-122.9602	2/mth	X		X	X	X	X	X						X		
13605 Quartz Valley Road		41.6069	-122.9775	2/mth	X		X	X	X	X	X						X		
13616 Quartz Valley Road		41.6015	-122.9743	2/mth	X		X	X	X	X	X						X		
100 Quartz Valley Road		41.603	-122.9711	2/mth	X		X	X	X	X	X						X		

Table 8 Locations and Rationale for Site Selection

Site Code & Name	*Description & Rationale*
SURFACE WATER	
SNCR Sniktaw Creek	*downstream of agricultural land use, Reservation land, only access location for sampling this tributary*
SREF Scott River @East Fork	*upstream of the valley floor, mixed forestry and agricultural uses*
SRSF Scott River @South Fork	*upstream of the valley floor, mixed forestry and agricultural uses*
MICR Mill Creek	*upstream of the valley floor, mixed forestry, pre-agriculture*
SHMI Shackleford/Mill confluence	*cummulative impacts reach, agriculture, forestry, residential*
SHTH Shackleford Creek @Trailhead	*captures water quality before Shackleford leaves the Wilderness area and the influence of the unnamed tributary upstream of the wilderness boundary. This is also the last site before Shackleford enters an industrial logging property*
SHFL Shackleford Falls	*captures water quality after Shackleford enters industrial logging property and will provide baseline to help identify water quality problems stemming from this type of land use. Public health monitoring since this location is a popular swimming area, also serves as a natural barrier forsalmonids.*
ESRC E. Fork Scott River- Crater	*coho bearing stream*
ESRH E. Fork Scott River- Houston	*coho bearing stream*
ESRR E. Fork Scott River- Rail	*coho bearing stream*
MSRM Mill Creek at Scott Bar	*samples at the first major thermal refugia for salmonids*
ESRM E. Fork Scott River- Mill	*coho bearing stream*
SRBF Scott River at Bridge Flat	*samples at popular recreation site – public health monitoring, thermal reach on mainsrtem canyon, high density of coho salmon over-summer here.*
SRES Shackleford Creek @ QVIR	*public health monitoring – popular swimming location, coho habitat*

CHTH Shackleford Crk @ C.Thom's	*Downstream from Shackleford/Mill Ck convergence, to monitor water quality after confluence. Associated with cumulative land uses – agricultural, forestry and residential*
SRGA Scott River Gage	*captures water quality of Scott River at the USGS Gaging Stationthis location splits the valley from the canyon reach of the river. Water quality impacts associated with agriculture, foresty and residential*
CAMO Campbell Lake Outlet	*captures water quality upon leaving lake and becoming Shackleford Creek. Captures existing flows exiting the lake, excellent climate change monitoring location.*
SUCC Summitt Campbell Confluen.	*captures water quality upon leaving lake and becoming Shackleford Creek. Captures existing flows exiting the lake, excellent climate change monitoring location*.
GROU Grouse Creek	*captures water quality due to forestry practices, coho spawning and rearing.*
KANG Kangaroo Creek	*captures water quality due to forestry practices, coho spawning and rearing*.
KLKI Kangaroo Lake Inlet	*capture water quality before entering popular recreational lake (fishing, swimming)*
KLKO Kangaroo Lake Outlet	*capture water quality upon leaving popular recreational lake (swimming, fishing) – public health monitoring*
MULE Mule Creek	*pre-agricultural- no property access on the Scott*
DEEP Deep Creek	*captures water quality associated with forestry practices*
SCSP Scott River @ Sugar Pine	*coho thermal refuge location in mainstem Scott*
SRJB Scott River @ Jones Beach	*public health monitoring - a popular swimming hole.*
TOMP Tompkins Creek	*captures water quality associated with forestry practices, also serves as a thermal refuge for coho salmon.*
MIDC Middle Creek	*captures water quality associated with forestry practices, also serves a thermal refuge for coho salmon.*
SRTN Scott @ Townsends Gulch	*capture water quality below the thermal reach of the mainstem Scott canyon*
BLCR Boulder Creek	*capture water quality of the tributary before entering the Scott River, serves as a high density thermal refuge for coho salmon*
CACR Canyon Creek	*capture water quality of the tributary before entering the Scott River serves as a high density thermal rege for coho salmon*

KECR	**Kelsey Creek**	*capture water quality of the tributary before entering the Scott River, serves as a high density thermal refuge for coho salmon*
ELLR	**Scott River @ Eller Bridge**	*captures water quality of the Scott River in middle Scott Valley, amidst agricultural practices*
UPSN	**Upper Sniktaw**	*upstream of the valley floor, mixed forestry water quality impacts*
HORN	**Scott River @ Horn Bridge**	*captures water quality in the middle of Scott Valley, in midst of agriculture practices*
SWIM	**Reservation Swimming Hole**	*captures water quality in popular reservation swim hole – public health monitoring*

<u>GRAZING ALOTTMENT SITES</u>

MC04	**Unnamed tributary just above confluence with East Boulder Creek**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
MC05	**East Boulder Creek below dam at East Boulder Lake**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
MC06	**East Boulder Creek above inlet for East Boulder Lake**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
MC07	**East Boulder Creek below outlet for Upper Lake**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
MC08	**East Boulder Creek above inlet for Upper Lake**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
MC09	**Fox Creek at road**	*(no grazing in this drainage) control site*
MC01	**East Boulder Creek**	*below trailhead parking and dispersed camping In grazing allotment. Exploring connection between grazing and bacterial exceedences*
MC02	**East Boulder Creek below first meadow at old cabin site**	*In grazing allotment. Exploring connection between grazing and bacterial exceedences*

MC03 East Boulder Creek above confluence with unnamed tributary	*In grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF05 Shackleford Creek at gate below meadow complex,	*directly below rock wall In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF06 Long High Creek above confluence with Shackleford Creek	*above trail crossing in wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF07 Shackleford Creek above confluence with Long High Creek	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF08 Shackleford Creek above Campbell Lake tributary	*(directly above log crossing) In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF09 Campbell Lake tributary above Shackleford Creek	*cross Shackleford Creek and go up trail to creek 300 feet to creek, before switchback starts In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF10 Shackleford Creek below Log Lake Meadow	*complex and slightly above lake, In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF11a Shackleford Creek in Log Lake Meadow	*below trail junction.In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF12 Shackleford Creek above confluence with Bull Meadow tributary	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF13 Bull Meadows tributary above confluence with Shackleford Creek	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*

SF14	**Campbell Lake tributary below Campbell Lake and above unnamed tributary**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF16	**Campbell Lake tributary above inlet for Campbell Lake**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF17	**Campbell Lake tributary below Cliff Lake**	*In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
SF18	**Isolates Emerald Tributary**	*ungrazed without heavy recreation, control site*
SF19	**Isolates unnamed tributary above confluence with Shackleford Creek**	*near trail split for Calf Lake In wilderness grazing allotment. Exploring connection between grazing and bacterial exceedences*
KI01	**Kidder Creek**	*above first unnamed tributary crossing Kidder Creek Trail from wilderness boundary Control Site, no grazing in Kidder Ck watershed*
KI02	**Kidder Creek above Kiddr Lake tributary**	*Control Site, no grazing in Kidder Ck watershed*
KI03	**Kidder Creek adjacent to Hays Meadow**	*Control Site, no grazing in Kidder Ck watershed*

MONITORING WELL SITES

Well1	By gymnasium	monitoring wells for ground water level monitoring
Well2	Off Quartz Valley Drive	monitoring wells for ground water level monitoring
Well3	QVIR Administration Building	monitoring wells for ground water level monitoring
Well4	Near Aaron's	monitoring wells for ground water level monitoring explore surface and groundwater interaction
Well5	Across from Evette's	monitoring wells for ground water level monitoring

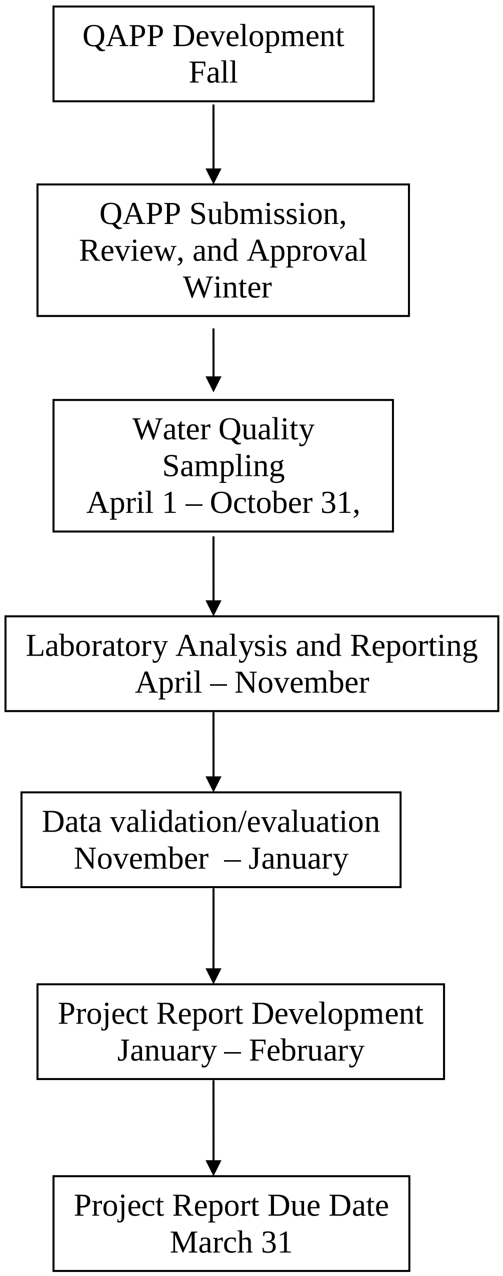
Well6	Shackleford Road	monitoring wells for ground water level monitoring
Well7	QV Drive on Tribal Trust Land	monitoring wells for ground water level monitoring
Well8	between Andrew and Lisa	monitoring wells for ground water level monitoring, also has a continuous air pressure probe
Well9	Near ANAV and Gym	monitoring wells for ground water level monitoring
Well10	river left, Shackleford Creek	monitoring wells for ground water level monitoring, explore surface and groundwater interaction
Well11	river left, Shackleford Creek	monitoring wells for ground water level monitoring, explore surface and groundwater interaction
Well12	By bridge over Shackleford on QV Road	monitoring wells for ground water level monitoring explore surface and groundwater interaction
Well 13	Culture Camp	monitoring wells for ground water level monitoring
Well 8	between Andrew and Lisa	monitoring wells for ground water level monitoring, also contains the continuous barometric pressure probe

<u>DOMESTIC WELL SITES</u>

Cram Gulch	monitoring bacteria and parameters for reservation home drinking wells
12920 Yamitch	monitoring bacteria and parameters for reservation home drinking wells
12929 Kuut	monitoring bacteria and parameters for reservation home drinking wells
13616 QV Road	monitoring bacteria and parameters for reservation home drinking wells
13601 QV Road	monitoring bacteria and parameters for reservation home drinking wells
13605 QV Road	monitoring bacteria and parameters for reservation home drinking wells
12808 Yamitch	monitoring bacteria and parameters for reservation home drinking wells
12912 Yamitch	monitoring bacteria and parameters for reservation home drinking wells
12817 Yamitch	monitoring bacteria and parameters for reservation home drinking wells

12839 Yamitch	monitoring bacteria and parameters for reservation home drinking wells
12837 Kuut	monitoring bacteria and parameters for reservation home drinking wells
9117 Sniktaw	monitoring bacteria and parameters for reservation home drinking wells
9021 Sniktaw	monitoring bacteria and parameters for reservation home drinking wells
9013 Big Meadows Road	monitoring bacteria and parameters for reservation home drinking wells
9024 Sniktaw	monitoring bacteria and parameters for reservation home drinking wells
13824 QV Road	monitoring bacteria and parameters for reservation home drinking wells
9009 Big Meadows Road	monitoring bacteria and parameters for reservation home drinking wells
9301 Thaxtuuy	monitoring bacteria and parameters for reservation home drinking wells
Kevins House	monitoring bacteria and parameters for reservation home drinking wells
14208 Dangel Lane	monitoring bacteria and parameters for reservation home drinking wells
13605 Quartz Valley Road	monitoring bacteria and parameters for reservation home drinking wells
13616 Quartz Valley Road	monitoring bacteria and parameters for reservation home drinking wells
100 Quartz Valley Road	monitoring bacteria and parameters for reservation home drinking wells
GYMN QVIR Gymnasium	monitoring bacteria and parameters for reservation drinking well

Figure 6 Schedule for Implementation



Quality Objectives and Criteria for Measurement Data

The primary goal of this *QAPP* is to ensure that high quality data be generated by the QVIR EPD Water Quality program that this data can be used to answer questions about the quality of waters within QVIRs watershed and to foster their protection or improvement over time. Specific questions to be answered through this study include:

- Do chemical and biological baseline levels in the Scott River watershed, including Shackleford and Mill Creek, support fish health and public health safety?
- What pollutants are present in the surface waters of the watershed that would be detrimental to the health of fish populations or the ecosystem?
- Do any of these pollutants exceed the national, state, and regional water quality objectives set for this basin?
- Do the lakes support current adjudicated water rights in the Shackleford and Mill sub basins and meeting public health standards?
- Are bacteria levels in surface and groundwater exceeding state and federal MCLs?

The Tribe's primary concern with surface water is to minimize the effects of human activity in the watershed, to bolster the health of the ecosystem, to preserve cultural resources, and to return fish populations to a sustainable level enabling tribal members to utilize their fishing rights on the Reservation. Current numbers of returning salmonids will not support a fishery on the Reservation as it once did.

Decisions to be made using the data

The surface water monitoring program is designed to continue gathering data to characterize the surface water resources of the Quartz Valley Indian Reservation. On-going monitoring allows the Tribe to continue to track changes in water quality over time and to assess potential future environmental impacts to the Reservation's surface waters. The long-term use of the surface water monitoring program is to provide information to help the Tribe establish water quality standards and other tribal regulations and ordinances for the Quartz Valley Indian Reservation. The tribe hopes to apply for Treatment As A State and begin the water quality standard establishment process during this five year period.

Decisions to be made with the data include:

- If data for any analyte or field parameter (from an individual location or single sampling event) are found to exceed the project action limits, then the Tribal Council will be notified.
- If data are found to exceed the project action limits and appear to be increasing with time, then the Tribal Council will be notified and a plan for future investigations of potential sources will be discussed.
- If waters flowing onto the reservation are impaired (i.e., exceed project action limits or the national water quality standards), the issue will be brought to the attention of the Tribal Council for possible discussion with the US EPA Project Officer and other responsible agency as applicable.

The Tribe will determine if any action is needed to reduce surface water pollution from tribal lands. Some examples of actions that could result from findings of poor water quality on the Reservation are:

- Remediation activities for point sources to stop contamination if a single point source is suspected
- Stream and watershed restoration activities (e.g. planting native flora for erosion control)
- Pollution prevention planning and establishment of educational programs on the Reservation to reduce anthropogenic sources of pollution
- Dedication of Tribes adjudicated water rights to bolster in-stream flows and improve water quality

The Tribe will also use this information to act as co-managers in the Scott River Watershed with federal, state, and local agencies. The information will be shared with these agencies in order to track changes over time and to ultimately improve the quality and quantity of fish populations in the watershed.

Table 9 Water Quality Parameters and Action Levels

Parameter	Units	Water Body	Data Uses	Action Level		Laboratory Detection Limit
Fecal Coliform		all	Baseline, long-term monitoring, TMDL, public health			1 MPN/100ml
SRP	Mg/L	all	Baseline, long-term monitoring,			.001 mg/L
Flow	cfs	All	Baseline Long-Term Monitoring, TMDL	Minimum instream flow requirements for salmonids has yet to be determined		Flow Tracker
Temp.	°C	All	Baseline Long-Term Monitoring, TMDL	MWMT [a]	24° C	HOBO YSI
E. coli		All	Baseline Long-Term Monitoring	Drinking water -1 MPN/100ml		1 MPN/100ml
Total Coliforms		All	Baseline Long-Term Monitoring			1 MPN/100ml
pH	pH	All	Baseline Long-Term Monitoring	Max 8.5 [b]	Min 7 [b]	YSI
Conductivity	µS/cm	All	Baseline Long-Term Monitoring	90% Upper Limit	50% Upper Limit	

[a] Maximum weekly maximum temperature (MWMT) or "7-day maximum" threshold for coho salmon from Welsh et al. (2001).

[b] Scott River Water Quality Objectives from the North Coast Regional Water Quality Control Board's Water Quality Control Plan (2001)

[c] Action levels adopted from U.S. EPA Ambient Water Quality Criteria Recommendations Rivers and Streams in Nutrient Ecoregion II (U.S. EPA 2000).

Parameter	Units	Water Body	Data Uses	Action Level			Laboratory Detection Limit
				400 [b]		275 [b]	YSI
Turbidity	NTU	All	Baseline Long-Term Monitoring, TMDL	5 NTU [e] above ambient turbidity levels			YSI WQ770
Dissolved Oxygen	mg/L	All	Baseline Long-Term Monitoring	Min	90% Upper Limit	50% Upper Limit	YSI
				7.0 [b]		9.0 [b]	
Macro-invertebrates	-	All	Baseline Long-Term Monitoring	N/A			N/A
Total Phosphorus	µg/L	All	Baseline Long-Term Monitoring	10.00 [c]			0.05 ppm
Dissolved Phosphorus	mg/L	All	Baseline Long-Term Monitoring	-			0.050 ppm
Total Nitrogen	mg/L	All	Baseline Long-Term Monitoring	0.12 [c]			0.40 ppm
Ammonium Nitrogen	µg/L	All	Baseline Long-Term Monitoring	-			0.10 ppm
Nitrate + Nitrite	mg/L	All	Baseline Long-Term Monitoring	10 [f]			400 ppb
Phytoplankton	-	All	Baseline Long-Term Monitoring TMDL	-			100 specimens
Chlorophyll	µg/L	All	Baseline Long-Term Monitoring	100-200 [g]			2 ppb
Pesticides-Trifluralin	µg/L	All except lakes	Baseline Long-Term Monitoring	0.08 [f]		1.0	1.0

Parameter	Units	Water Body	Data Uses	Action Level		Laboratory Detection Limit
Pesticides-Diuron	μg/L	All except lakes	Baseline Long-Term Monitoring	1.0 [f]		1.0

[d] California Department of Fish and Game: Aquatic Bio assessment Laboratory. December, 2003. California Stream Bio assessment Procedure: (Protocol Brief for Biological and Physical/Habitat Assessment in Wadeable Streams).

[e] Action Level adopted from Berg, L. 1982 The effect of short term pulses of suspended sediment on the behavior of juvenile salmonids. Pages 177-196 in G.F. Hartman et al. editors. Proceedings of the Carnation Creek Workshop: a ten year review. Department of Fisheries and Oceans, Nanaimo, B.C. same data results from: Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. North American Journal of Fisheries Management. 7:34–45. ***This will become a fixed number once year round data has been collected in the Scott River and its headwaters to establish ambient turbidity.

[f] EPA, 2006. 2006 Edition of the Drinking Water and Health Advisories Standards pg. 10. *Need a lab with a lower detection limit.

[g] National Nutrient Guidance for Rivers and Streams, US EPA 2000. Chapter 7 Nutrient and Algal Criteria Development

Identify Data Needs and Establish Acceptance Criteria

Data Quality Indicators

In order to support project decisions, data generated must be of known and acceptable quality. To define acceptable data quality for this project, data quality indicators (DQIs) were identified for each analytical parameter, and decisions were made regarding how each DQI would be assessed. The DQIs include: precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity.

The general approach to assessing each DQI is described below. Some DQIs will be assessed quantitatively, while others will be assessed qualitatively. For quantitative assessments, example calculations have been provided and the QC samples (to assess each DQI) have been identified.

The frequency of the QC samples and the measurement performance criteria for each QC sample for each type of analysis are provided in Tables 12 and 13. For quantitative assessment of laboratory methodology, the laboratory's QA Manual and analytical SOPs have been reviewed by the tribe's project team, and the associated laboratory QC (types & frequencies of QC samples and QC acceptance limits) have been determined to be adequate to meet the data quality needs of the project. As such, the laboratory QC has been accepted as the project's measurement performance criteria for the analytical component, while project-specific criteria have been defined to assess the field sampling component.

For field measurements, the DQIs to be assessed quantitatively include precision and accuracy alone. The associated acceptance criteria (types & frequencies of QC checks and acceptance limits) for the project are summarized in Table 13.

Data quality will be assured by:

- Proper study design,
- Following standard methods,
- Using well calibrated equipment,
- Taking and maintaining good field records,
- Following chain of custody procedures for laboratory analysis,
- Prompt data entry in standard programs and formats,
- Data archiving with back ups to insure against loss, and
- Proper oversight of QA/QC procedures.

Accuracy is the degree of agreement of a measurement with the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) that result from sampling and analytical operations. Accuracy of water quality and quantity measurements contained in this QAPP is a function of the equipment used during sampling, which are listed in Table 10.

Accuracy/bias will be assessed as related to recovery, as well as in regards to potential contamination sources. Both of these terms will be evaluated quantitatively.

Accuracy/bias related to recovery is an assessment of the laboratory analytical methods alone. For Laboratory Control Samples (LCS), it will be expressed as % Recovery by the following equation:

$$\% \text{ Recovery} = (X/T) * 100$$

where,

X = Measured concentration

T = True spiked concentration

or, for Matrix Spike (MS) samples, by the following equation:

$$\% \text{ Recovery} = \frac{(B - A) \times 100}{T}$$

where,

B = Measured concentration of spiked sample

A = Measured concentration of unspiked sample

T = True spiked concentration

The frequency of the LCS and/or MS samples associated with the analytical parameters will be one for every 20 samples or 5%. No LCS or MS samples will be analyzed as part of the field measurements.

Accuracy/bias as related to contamination involves both a field sampling and laboratory component. To assess all steps of the project (from sample collection through analysis), field blanks will be collected and analyzed. Field blanks are planned to be collected at a frequency of 5% (or 1 blank/20 field samples) for off-site analysis of metals and anions. To assess potential laboratory contaminant sources alone, laboratory blanks will be prepared and analyzed at a one per batch or 5% frequency. No blanks will be analyzed as part of the field measurements.

Precision is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions. The precision of the sampling equipment is listed as a percentage in Table 10.

Precision will be assessed quantitatively with duplicate samples and expressed as relative percent difference (RPD) by the following equation:

$$RPD (\%) = \frac{|X_1 - X_2| \times 100}{(X_1 + X_2)/2}$$

where,
RPD (%) = relative percent difference
X_1 = Original sample concentration
X_2 = Duplicate sample concentration
$|X_1 - X_2|$ = Absolute value of $X_1 - X_2$

To assess precision associated with all steps of the project (from sample collection through analysis) field duplicates will be collected and analyzed. Field duplicates will be collected at a frequency of 10% (1 duplicate/10 field samples) for each analytical parameter and 5% (1 duplicate each of 2 days/10 field samples) for each field measurement parameter. To assess laboratory precision alone, laboratory duplicates will be prepared and analyzed at a 5% frequency.

Completeness is a measure of the amount of valid data obtained, expressed as a percentage of the number of valid measurements that were planned to be collected. Lack of completeness may result in an inability to support Data Quality Objectives or to provide adequate data for assessment and decision support by the QVIR.

To assess the term quantitatively, % Completeness will be expressed by the following equation:

$$\% \text{ Completeness} = \frac{N}{T} \times 100$$

where,

N = Number of usable results

T = Total targeted number of samples planned to be collected

All data collected in this project will be used to determine the quality of water in the Scott River Watershed and the Shackleford/Mill Creek sub-basin. Due to a variety of circumstances, sometimes not all samples scheduled to be collected can be collected (e.g., a creek may be dry, etc.) or the data from the samples cannot be used (e.g., samples are or bottles are broken in transit, sample holding times are grossly exceeded, etc.). For this surface water sampling project, the overall completeness goal has been set at 90% for each analytical parameter and field measurement type. If the completeness goal is not met, re-sampling and/or re-analyzing will be conducted.

At this point in time, no sampling locations have been deemed more critical to the overall project goal than any other. As such, there will be no qualitative assessment of completeness to ensure that samples from critical locations have been collected and their associated data has been deemed usable to support the project objectives.

Representativeness is a qualitative measure of the degree to which data accurately and precisely represent a characteristic of the sampled population or environmental condition. Representativeness will be assessed both quantitatively and qualitatively.

To assess this term quantitatively, an overall evaluation will be made of how well the precision and accuracy/bias assessments met their associated measurement performance criteria. An additional assessment will involve ensuring that a temperature blank sample has accompanied each cooler of samples that has a temperature requirement associated with its preservation (see Table 11) and that the temperature of these temperature blank samples are 4°C ± 2°C when received at the laboratory.

To assess this term qualitatively, no actual QC samples are involved. Instead, the evaluation will involve verifying that documented sample collection and analytical methods (including sample handling and chain-of-custody procedures, sample preservation, and sample holding time protocols) were followed.

The procedures identified throughout this QA Project Plan were chosen to optimize the potential for obtaining samples that reflect the true state of the environment, within practical limits. Long-term monitoring will increase the representativeness of the project in that it would enable an assessment of changes over time.

Comparability qualitatively expresses the confidence with which one data set can be compared to another. The use of standard, published methods in this project allows data to be compared to data from other regional projects and using the same methods throughout allows for comparison of data collected by the QVIR EPD in the future. Sampling methodologies are described in Sections 2.1 and 2.2 below. Expressing data using consistent units of measure also addresses comparability. Units of measure for each water quality parameter are listed in Table 9.

Sensitivity- the ability of a method to detect and quantify an analytical parameter of concern at the concentration level of interest will be assessed semi quantitatively. No actual QC samples are involved. Instead, the laboratory to perform the analyses has provided their QLs and DLs and demonstrated that these are lower than the project action limits (as shown in Table 9) or the majority of the analytical parameters. For field measurements, the sensitivity is defined by the instrument manufacturer, see Table 10.

Table 10 Precision of Sampling Equipment by the QVIR EPD

Matrix	Parameter	Measurement Method	Precision	Accuracy	Measurement Range
Water	Depth	Keck Water Level Meter	± 1.0%	.01 ft	0 - 100 feet
Water	Discharge	Flow Tracker flow meter	0.001	n/a	Operating range: 0.1 - 18 fps Volume range: 999,999.99 CFS Temp range: -20°C to 70°C
Water	Temperature	Onset HOBO Water Temp Pro Loggers	±0.2°C at 0° to 50°C (±0.36°F at 32° to 120°	±0.2°C at 0° to 50°C (±0.36°F at 32° to 120°	0° to 50°C (32° to 122°F) in water (non-freezing)
Water	Temperature	YSI 556 & 6600 MPS Multi Probe System: YSI Precision ™ Thermistor	0.1°C	± 0.15°C	YSI 556= -5 to 45°C YSI 6600= -5 to 60°C

Matrix	Parameter	Measurement Method	Precision	Accuracy	Measurement Range
Water	pH	YSI 556 & 6600 MPS Multi Probe System: YSI Glass Combination electrode	0.01 units	±0.2 units	0 to 14 units
Water	Dissolved Oxygen	YSI 556 & 6600 MPS Multi Probe System Steady state polarographic	0.01 mg/L	±2% @ 0 to 20 mg/L ±6% @ 20 to 50 mg/L	0 to 50 mg/L
Water	Conductivity	YSI 556 & 6600 MPS Multi Probe System: YSI 4-electrode cell with auto ranging	0.001 mS/cm to 0.1 mS/cm range-dependent	± 0.5% + 0.001 mS/cm	YSI 556= 0 to 200 mS/cm YSI 6600= 0 to 100mS/cm
Water	Turbidity	YSI 6600 MPS Multi Probe System	0.01 NTU	± 2%	0-1000 NTU
Water	Turbidity	Model WQ770	n/a	+5 % of full scale	0-50 NTU and 0-1000 NTU

Special Training Requirements/Certificates

The field personnel will be trained in the use and calibration of all field equipment using standardized scientific technique.

The WQ Technician will keep clear records about how instructions from the Director were followed and make notes about any conditions that might cause anomalies in data. The QVIR EPD QA Officer will inspect the field and sampling equipment and periodically audit the WQ Technician to make sure that proper maintenance is taking place and is being documented.

The collection of all surface and ground water samples using hand held equipment will use standard field methods as described in this QAPP, which are derived from recognized U.S. EPA (1983; 2004) and U.S. Geologic Survey (USGS, 1998) protocols.

Documents and Records

QA Project Plan Distribution

It is the responsibility of the QVIR Environmental Director/QA Officer to prepare and maintain amended versions of the QA Project Plan and to distribute the amended QA Project Plan to the individuals listed in the *Distribution List* on page . This *QAPP*, once approved, will be kept in printed form for ease of reference of the WQ Technician, QA Officer and QVIR Environmental Director. When updated plans are approved, one copy of an older version will be retained in the QVIR EPD library, but clearly stamped to indicate that it is no longer current. In addition, each page of the *QAPP* will be clearly labeled as to the version and date of revision.

Field Documentation and Records

In the field, records will be documented in several ways, including field logbooks, photographs, pre-printed forms (such as labels and chain-of-custody forms), corrective action reports, and field audit checklists and reports. Field activities must be conducted according to this QAPP. All documentation generated by the sampling program will be kept on file in the office of the Quartz Valley Environmental Program.

Field Notebooks

Bound field logbooks will be used to record field observations, sampling site conditions, and on-site field measurements. These books will be kept in a permanent file in the QVIR EPD Office. At a minimum, information to be recorded in the field logbooks at each sample collection/measurement location includes:

- Sample location and description,
- Site or sampling area sketch showing sample location and measured distances,
- Sampler's names,
- Date and time of sample collection,
- Designation of sample as composite or grab (for this project, all are grab samples),
- Type (media or matrix) of sample (for this project, all are surface water samples),
- Type of sampling equipment used (for this project, only sample bottles will be used),
- Type of field measurement instruments used, along with equipment model and serial number,
- Field measurement instrument readings,
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, color),
- Preliminary sample descriptions (e.g., clear water with strong ammonia-like odor),
- Sample preservation,
- Lot numbers of the sample containers, sample identification numbers and any explanatory codes,
- Shipping arrangements (overnight air bill number), and
- Name(s) of recipient laboratory

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

- Team members and their responsibilities,
- Time of arrival/entry on site and time of site departure,
- Other personnel on site,
- Deviations from the QAPP or SOPs required in the field, and
- Summary of any meetings or discussions with tribal, contractor, or federal agency personnel.

Separate instrument/equipment notebooks or logbooks will be maintained for each piece of equipment or instrument. These logbooks will be used to record field instrument calibration and maintenance information. Each logbook with include the name, manufacturer, and serial number of the instrument/equipment, as well as dates and details of all maintenance and calibration activities.

Photographs

Digital photographs will be taken at each sampling location and at other areas of interest near the sampling area for every sampling event. The photographs will serve to verify information entered into the field logbook. Digital photographs will be archived in a permanent digital file to be kept in the QVIR EPD office.

For each photograph taken, the following information will be written in the field logbook or recorded in a separate field photography logbook:

- Time, date, location, and weather conditions,
- Description of the subject photographed,
- Direction in which the picture was taken, and
- Name and affiliation of the photographer.

Labels

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 Laboratory will provide sample labels (see Appendix C1) for this project. The samples will have preassigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information:

- Sampling location or name,
- Unique sample number,
- Sample description (e.g., grab, composite),
- Date and time of collection,
- Initials/signature of sampler,
- Analytical parameter(s), and
- Method of preservation.

Each sample location will have a unique sample identification number.

Field Quality Control Sample Records

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

Sample Chain-of-Custody Forms and Custody Seals

Chain-of-custody forms and custody seals (see Appendix C2) will be provided by the laboratory. The forms will be used to document collection and shipment of samples for off-site laboratory analysis, while the seals will serve to ensure the integrity of (i.e., there has been no tampering with) the individual samples.

All sample shipments will be accompanied by a chain-of-custody form. The forms will be completed and sent with each shipment of samples to the laboratory. If multiple coolers are sent to a laboratory on a single day, forms will be completed and sent with the samples for each cooler. The original form will be included with the samples and sent to the laboratory. Copies will be sent to the QVIR Environmental Director/QA Officer.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of the field personnel, who will sign the chain-of-custody form in the "relinquished by" box and note the date, time, and air bill number.

A self-adhesive custody seal will be placed across the lid of each sample container/bottle. The shipping containers in which samples are stored will also be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping, as well as during shipping. All custody seals will be signed and dated.

Laboratory Documentation and Records

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

The data generated by the laboratory for each sampling event will be compiled into individual data packages/reports. The data packages will include the following information:

- Project narrative including a discussion of problems or unusual events (including but not limited to the topics such as: receipt of samples in incorrect, broken, or leaking containers, with improperly or incompletely filled out chain-of-custody forms, with broken chain-of-custody seals, etc.; receipt and/or analysis of samples after the holding times have expired; summary of QC results exceeding acceptance criteria; etc.),

- Sample results and associated QLs,
- Copies of completed sample receiving logs and chain-of-custody forms, and,
- QC checks sample records and acceptance criteria (to be included for all QC samples listed in Tables 12 and 13, including the temperature blank check).

All data packages will be reviewed by the Laboratory QA Officer to ensure the accurate documentation of any deviations from sample preparation, analysis, and/or QA/QC procedures; highlights of any excursions from the QC acceptance limits; and pertinent sample data. Once finalized, the Laboratory QA Officer will provide the data packages/reports to the Laboratory Project Manager who will sign them and submit them to the QVIR Environmental Director/QA Officer. Any problems identified by the Laboratory QA Officer will be documented in the narrative part of the tribe's report. Information about the documentation to be provided by the analytical laboratory is also contained in the laboratory's QA Manual (Appendix C3).

Technical Reviews and Evaluations

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

Field Audit Reports

The QVIR Environmental Director/QA Officer will observe selected sampling events to ensure that sample collection and field measurements are going according to plan. The results of the observations will be documented in a designated QA Audit Logbook. Once back in the office, the QVIR QA Officer will formalize the audit in a Field Audit Report to be forwarded to the QVIR Environmental Director and the QVIR EPD Water Quality Technician/Field Sampler.

Corrective Action Reports (following Field Audits)

Corrective action reports will be prepared by the QVIR EPD Water Quality Technician/Field Sampler in response to findings identified by the QVIR Environmental Director/QA Officer during field visits and audits. The reports will focus on plans to resolve any identified deficiencies and non-compliance issues that relate to on-going activities and problems of a systematic nature, rather than on one time mistakes.

Corrective Action reports do not have a specific format, but will be handled as an internal memorandum.

Field Activities Review Checklist

At the end of each sampling event, a technical review will be conducted of field sampling and field measurement documentation to ensure that all information is complete and any deviations from planned methodologies are documented. The review, as well as comments associated with potential impacts on field samples and field measurement integrity, will be documented on a Field Activities Review Checklist (as provided in Appendix D1.)

Laboratory Data Review Checklist

Following receipt of the off-site laboratory's data package for each sampling event, The QVIR EPD QA Officer/Data Manager will conduct a technical review of the data to ensure all information is complete, as well as to determine if all planned methodologies were followed and QA/QC objectives were met. The results of this review, as well as comments associated with potential impacts on data integrity to support project decisions, will be documented on a Laboratory Data Review Checklist (as provided in Appendix D2).

Project Document Backup and Retention

Hardcopies of field notebooks, checklists, laboratory results and other paperwork will be maintained in the QVIR EPD office water quality file for six years. After six years, project files will be placed in long term storage. The Tribe's policy is to maintain records indefinitely.

Electronic data will be backed up on CDs at year end and placed into project files for storage. Additionally, an external hard-drive will be used to backup all project data from computer hard-drives. These drives will be stored in a fireproof safe nightly.

Biannual and Annual Reports

The QVIR Environmental Director/QA Officer is responsible for the preparation of annual reports (summarizing the year's activities) to be submitted to the US EPA Grants Project Officer.

The report should include, at a minimum:

- Final laboratory data package (including QC sample results),
- Discussion of any problems noted with the data, either from laboratory or field measurements,

- Description of the project,
- Table summarizing the results (of all project data collected to date, including both laboratory data and field measurements),
- Final laboratory data package (including QC sample results),
- Discussion of the field and laboratory activities, as well as any deviations or modifications to the plans,
- Trends observed as a result of the year's monitoring efforts,
- Copies of Field Audit Reports and any associated Corrective Action Reports (for the fourth quarter),
- Copies of Field Activities Review Checklists and Data Review Checklists (for the fourth quarter),
- Evaluation of the data in meeting the project objectives, including data exceeding Action Levels,
- Recommendations to the Tribal Council regarding exceedance which are occurring on an on-going basis, and
- Recommendations/changes for future project activities (e.g., adding/deleting sampling locations and/or analyses, modifications to SOPs, amendments to the QA Project Plans, etc.).

Data Generation

This section of the QA Project Plan describes how the samples will be collected, shipped, and analyzed.

Sampling Design

All locations sampled for this surface water monitoring program will be in the Scott River Watershed. Water quality sampling will take place in the following water bodies with varying numbers of stations in each (Table 7):

The sample locations, ID, parameters and frequency for each sampling location are included in Table 7. Sampling will occur twice a month, year-round at the locations listed on Table's 7 and 8, and shown on Figures 3 – 5. Analyses will include parameters identified in Table 7 including pesticides, chlorophyll, bacteria, phytoplankton, nutrients, and macro-invertebrates. Samples from each location will also be field tested for temperature, pH, dissolved oxygen, conductivity (as specific conductance), and turbidity. Discharge will also be measured at specific locations during each sampling event.

A parameter may be removed from the monitoring program if the sampling results indicate it is not of concern or added if new land uses develop after the monitoring program begins or the monitoring data indicates other potential parameters to include.

Water samples will be collected from the most upstream points along Shackleford and Mill Creeks and the Scott River to the most downstream points. Tributaries to the mainstem Scott River canyon will also be sampled. This rationale is that the most upstream sampling points in the Scott River watershed are assumed to be the least impacted by current land use activities while the most downstream points are assumed to be most impacted by current land use. However, the rationale could change depending on the results from subsequent sampling events. If the sample collection order changes, this will be noted in the reports to the US EPA Grants Project Manager and documented in an amendment to the QA Project Plan. The types and frequency of field QC samples to be collected are and listed in Tables 12 and 13. These locations offer a linear comparison of parameters with Karuk, Hoopa and Yurok water quality sampling, from the headwaters of the Scott River to the ocean.

Flow measurements will allow assessment of pollutant loading as well as relationships of sources due to climatic events. The Scott River and Mill Creek are perennial and can be sampled year-round. Shackleford Creek most years loses surface flow on the Reservation during late summer and fall. Consequently, sampling at QVIR will be dependent on flow, rainfall, and the water year.

Measurements in Scott River and its tributaries will represent conditions that are shaped by management of the Scott River watershed as a whole and are expected to reflect temperature and sediment impairment. Sediment and temperature pollution could stem from several sources such as forestry practices, agriculture and grazing and gravel mining. Sediment and temperature are the focus of the *Scott River TMDL*, monitoring will allow participation of QVIR EPD staff in analysis of watershed wide temperature and sediment problems. Subsequent updates of this QAPP may include additional data collection related to sediment and temperature impairment to assist in *TMDL Implementation* monitoring.

Continuous hourly temperature monitoring will take place at all stream and river sample locations using a Hobo Temp Data logger. Temperature data will provide QVIR EPD with long-term temperature trends in order to evaluate the habitat suitability for salmonids. Data may also be applicable in the Scott River TMDL Implementation. Field technicians will follow manufacturer's instructions on downloading data from the data loggers, found in Appendix E.

Continuous, year-round, hourly monitoring for temperature, turbidity, pH, dissolved oxygen, and conductivity will take place using a YSI 6600on the Scott River just below the mouth of Shackleford-Mill, Shackleford at Wilderness boundary and Mill Creek. Continuous monitoring will provide QVIRED with a holistic picture of water quality conditions of the Scott River and tributaries throughout seasonal changes. Adult and juvenile salmonids must navigate year round through the lower Scott on their way to and from the Reservation waters therefore the condition of this habitat is critical to their sustainability. Year round turbidity measurements have never been collected on the Scott River and/or tributaries.

Water quality and quantity parameters to be sampled for each water body are listed in Table 9, including action levels that were chosen to comply with NCRWQCB *Basin Plan Water Quality Objectives* (3/18/11) standards and those set by U.S. EPA for protection of beneficial uses under the Clean Water Act.

Sampling Methods

The YSI Handheld 556 MPS will be used to gather water quality data at each site. The probe will be calibrated and used according to procedures outlined in the units manual Appendix E5. At each site, measurements will be taken at a consistent depth from the surface of the water. For groundwater sites the measurement will be taken in a bucket with constant flowing water through the bucket.

Surface Water

The grab sampling method will be used to gather samples from the Scott River and all Creeks at each of the different locations. The sample will be taken from flowing, not stagnant water, and the sampler will be facing upstream in the middle of the stream. Samples will be collected by hand if the stream is at a safe stage or with a sample bottle holder during larger flows. The bottle will be uncapped and the cap protected from contamination. Water samples will be collected 6 - 12 inches below the water's surface. At each sampling location, all sample bottles/containers designated for a particular analysis will be filled sequentially before containers designated for another analysis are filled. High mountain lake samples will be taken at the lake's center, via an inflatable kayak. (See Appendix F5)

Stratified water sampling will be done in the lakes using a Van Dorn Alpha Vertical Water Sampling Bottle. Instructions for using the Van Dorn bottle sample collection are in Appendix E4. Stratified sampling will occur in the epilimnion and hypolimnion layers. The depth of the thermocline will be found with the handheld YSI probe. Based on the depth of the thermocline, samples will be taken at the proper depths to represent each layer. All sampling depths will be recorded along with the YSI information. The Van Dorn bottle will be rinsed with deionized water between stratified samples, see Appendix E4.

Continuously monitoring HOBO temperature loggers and the Multiprobe YSI sonde will be deployed in areas expected to retain water throughout the summer. Some site locations will require us to remove the temperature loggers once the creek disconnects. Loggers will be checked at each site location when grab samples are taken. Data will be downloaded once the temp loggers and sonde have been retrieved. HOBO temperature loggers will be calibrated, deployed and retrieved according to the Draft North Coast Regional Water Qulaity Control Board Stream Temperature Monitoring Protocol, Appendix F8.

Benthic Macro-invertebrates will be sampled at all sites except the open water lake and pond sites. Specific sampling locations at the sites will be located in a riffle typical of the stream. An ideal location will be at least 3 ft x 3 ft, have cobble-sized rocks, fast moving water, and a depth of 3 to 12 inches, Sampling will be done using a kick net. The kick net will be positioned at the downstream end of the sampling area and the sampler will slowly walk upstream. The net should be stretched out to its full 3-foot width with the bottom edge lying firmly against the stream bed. No water should wash under or over the net. If needed, small rocks can be used to weigh down the bottom edge of the net. A "kick" is a stationary sampling accomplished by using the toe or heel of a boot and dislodging the upper layer of the stream bed one meter at a time. If larger substrate is encountered, such as a large piece of wood, the object should be picked up and rubbed by hand or a small brush to dislodge the attached organisms. To avoid losing macroinvertebrates that should be part of the sample, the sampler should not stand in or disturb the sampling area before the kick seine is in place. The kick seine will be lifted out of the water with a forward scooping motion. The kick seine should be carried to the stream bank and spread it out flat on a piece of white plastic. Specimens will be placed in preserved sampling containers (500 ml) for identification by contracted consultant. This data will be evaluated using regional indices of biological integrity. (See Appendix F3)

Discharge will be measured using the Flow Tracker flow meter. A tape measure will be stretched across the channel perpendicular to water flow. A minimum of ten measurements will be taken at each site from river right wetted edge to river left wetted edge. The water depth, the velocity at 40% of the water column (from the streambed up) and the distance from the wetted edge will be recorded for each measurement, see Appendix F6.

Surface water samples will be analyzed at each sample collection location for the following field measurement parameters: pH, dissolved oxygen, conductivity (as specific conductance), turbidity, and temperature. Field measurements will be taken at each location prior to sample collection laboratory analysis. All field instruments will be calibrated (according to the manufacturer's instructions) at the beginning of each date of sampling and checked at the end of each day. Field instrument calibration and sample measurement data will be recorded in the field logbook.

Groundwater

Static water level will be taken before any groundwater purging occurs for sampling. Techinicans will place a hose onto the faucet head if sample is to be taken from well head faucet or outside faucet. The well will be purged into a five gallon bucket with holes drilled into the side. The water will fill the bucket, but will still drain at a reasonable rate to allow for water quality parameters to be taken. Techinicans will ensure that air is not being introduced into the sample and may turn water pressure down if this is a problem. The YSI 556 handheld probes will be placed into the bucket being sure that all probes are covered with water. The water should purge for 5 minutes and/or until all parameters have stabilized. Stabilization is shown by 3 to 5 consecutive readings where:

- Temperature is constant (varies by less than 1.0 ºC),
- pH measurements remain constant within 0.1 Standard Unit
- Conductivity varies no more than 10 % of average
- % DO remains constant within 1%

Results are then recorded for temperature, pH, conductivity, turbidity and dissolved oxygen onto ground water datasheet. (See Appendix F4)

Surface and Groundwater

If a QC sample is to be collected at a given location, all containers designated for a particular analysis for both the sample and QC sample will be filled sequentially before containers for another analysis are filled. For field duplicate samples, containers with two different sample designations will be filled alternately.

Preservatives will be added after sample collection, if required, to avoid losing the preservatives and dilution of preservatives during sampling. Once the samples are collected and preserved, they will be kept chilled (if appropriate) and processed for shipment to the laboratory. Care will be taken to not touch the lip of the sample bottle during sample collection and preservation, so as not to potentially contaminate the sample. Table 11 summarizes the sample bottle/containers, volumes, and preservation requirements for each analysis and field measurement.

For other contaminants that require a preservative, guidelines presented in the QA manuals from contracted laboratories will be used (see Appendix C). If the option is given of a shorter hold time with no preservative, or a longer hold time with a preservative added to the sample, the longer hold time with a preservative will be the method chosen. After samples are taken, the bottles will be properly labeled, and placed into the appropriate cooler. All samples will be double-checked for the proper sample level, any potential leakage, and proper labeling before being sealed and shipped to the lab. If the level of sample is different from the water level marked in the field at the time of sampling, the sample will be recorded as potentially tainted in the sampling log book.

Field Variances

As conditions in the field vary, it may become necessary to implement minor modifications to the sampling procedures and protocols described in this QA Project Plan. If/when this is necessary; the QVIR EPD Field Sampler will notify the QVIR Environmental Director/QA Officer of the situation to obtain a verbal approval prior to implementing any changes. The approval will be recorded in the field logbook. Modifications will be documented in the Quarterly Reports to the US EPA Grants Project Officer.

Quality Assurance for Sampling

Detailed instructions for collection of all field QC samples is discussed in the *Quality Control Requirements* section , beginning on pg. 83, and listed in Tables 12 and 13.

Documentation of deviations from this QA Project Plan is the responsibility of the QVIR EPD QA Officer. Deviations noted during the field audit will be documented in the QA Audit Logbook, recorded in the Field Audit Reports, and discussed in the biannual reports.

Additional deviations from the QA Project Plan may be implemented as field variances or modifications. These deviations will be communicated to the QVIR Environmental Director/QA Officer by the QVIR EPD Water Quality Technician/Field Sampler for approval. The approval will be recorded in the field logbook, and the modifications will be documented in the Quarterly Reports.

Field Health and Safety Procedures

A brief tail-gate safety meeting will be held the first day of each sampling event to discuss emergency procedures (e.g., location of the nearest hospital or medical treatment facility), local contact information (e.g., names and telephone numbers of local personnel, fire department, police department), as well as to review the tribe's contingency plan. All field sampling activities will be conducted with a buddy system (i.e., two field personnel will constitute the sampling team). This will allow for the presence of a second person to provide assistance and/or call in an emergency or accident for the other field person, if/when needed. Field personnel will be CPR and First Aid certified.

Level D personal protective equipment (PPE) will be used when collecting the surface water samples. At a minimum, safety glasses, plastic gloves, and steel-toed rain boots or waders will be worn. When wading, care will be taken to avoid slipping on rocks and algae. Also, due to weather conditions during the sampling events and the possibility of health concerns (e.g., heat stress) from working in high temperatures, field personnel will be advised to drink plenty of water and wear clothing (e.g., hat, long-sleeved shirt) that will cover and shade the body.

Potential routes of exposure related to field sampling and measurement activities are through the skin (e.g., from direct contact from the surface water) and/or by ingestion (e.g., from not washing up prior to eating). The use of Level D PPE, good hygiene, and following proper sampling procedures will minimize these potential exposures.

Decontamination Procedures

For the currently planned sample collection activities, samples will be collected directly into sample bottles/containers provided from the laboratory. As such, no field decontamination of these bottles (used as the sampling equipment) is necessary. The bottles will be provided and certified clean by the laboratory according to procedures described in the laboratory's QA Manual provided in Appendix C3.

In the case that there is a need to collect surface water samples by an alternative method decontamination of reusable sampling equipment coming in direct contact with the samples will be necessary. Decontamination will occur prior to each use of a piece of equipment and after use at each sampling location. Disposable equipment (intended for one-time use) will not be decontaminated but will be packaged for appropriate disposal.

All reusable/non-disposable sampling devices will be decontaminated according to US EPA Region 9 recommended procedures using the following washing fluids in sequence:

- Non-phosphate detergent and tap water wash (using a brush, if necessary),
- Tap-water rinse, and
- Deionized/distilled water rinse (twice).

Equipment will be decontaminated in a predesignated area on plastic sheeting. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

Disposal of Residual Materials

In the process of collecting water samples for this project, various types of potentially contaminated wastes will be generated which may include the following:

- Used PPE,
- Disposable sampling bottles/containers or equipment,
- Decontamination fluids, and
- Excess water collected for sample container filling.

The USEPA's National Contingency Plan requires that management of the wastes generated during sampling comply with all applicable or relevant and appropriate requirements to the extent practicable. Residuals generated for this project will be handled in a manner consistent with the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides the guidance for the management of wastes. In addition, other legal and practical considerations that may affect the handling of the wastes will be considered, as follows:

- Used personal protective equipment (PPE) and disposable containers/equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any used PPE and disposable containers or equipment (even if it appears to be reusable) will be rendered inoperable before disposal in the refuse dumpster.
- Decontamination fluids generated in the sampling event could consist of deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the sampling area. The water (and water with detergent) will be poured onto the ground.
- Excess water collected for sample container filling will be poured onto the ground.

Table 11 Required Sample Containers, Volumes, Preservation Methods, Analysis Method and Holding Times for Water Samples Requiring Lab Analysis

Analysis	Container Type	Sample Volume	Preservation Method	Maximum Holding Time	Laboratory Detection Limit	Analysis Method	Inorganics No. of:[1] Dup	MS
Macro-invertebrates	Plastic Bottle	500 ml	95% denatured CH_3CH_2OH (ethanol)	15 days	N/A	Level 1 CSBP[2]	N/A	
Total Phosphorous (TPO_4)	Poly	250 ml	H_2SO_4	28 DAYS	0.050 ppm	EPA 365.2	1 Dup and MS per analytical batch 500 ml	
Dissolved Phosphorus	Same Bottle As T-P	250 ml	H_2SO_4	28 DAYS	0.050 ppm	EPA 365.2	Same as bottle as T-P Dup and MS	
Total Nitrogen	Poly	125 ml	None	28 DAYS	0.40 ppm	EPA 351.3	N/A	
Ammonium Nitrogen	Poly	500 ml	H_2SO_4	28 Days	.10 ppm	EPA 350.2	1 Dup and MS per analytical batch 1liter	

[1] Include number of associated analytical QC samples if collection of additional sample volume and/or bottles is necessary. If the QC samples listed are part of the analysis but no additional sample volume and/or bottles are needed, include "NAS" (for "no additional sample") in the column. (Note: MS=matrix spike, MSD=matrix spike duplicate, dup=laboratory duplicate/replicate.)

Analysis	Container Type	Sample Volume	Preservation Method	Maximum Holding Time	Laboratory Detection Limit	Analysis Method	Inorganic5 No. of:[1]	
							Dup	MS
Nitrate + Nitrite	Same Bottle As T-P	125 ml	4 DEG C,	48 HRS	400 ppb	EPA 300.0	1 Dup and MS per analytical batch	
E.coli, fecal and Total Coliform	Poly	100 ml	15 deg C	6 hours	1>MPN 100 ml	SM9223B	10% of samples for duplication	
Phytoplankton	Poly	250 ml	1% Lugol solution	1 year or more	0.45 micrometer membrane filter	Standard Methods, 1992,10200.F.2.c	10% of samples for duplication	
Chlorophyll a	Amber Glass	1 liter	None	24 Hrs To Filtration	2 ppb	SM10200H2B	1 Dup and MS per analytical batch 2 liters	
Pesticides-Trifluralin	Amber Glass	1 liter	None	7 days	1.0 ug/l	EAP 8141A	Extra Liter for Duplicate	
Pesticides-Diuron	Amber Glass	1 liter	None	7 days	1.0 ug/l	EPA 632	Extra Liter for Duplicate	

Sample Handling and Custody

This section describes the sample handling and custody procedures from sample collection through transport and laboratory analysis. It also includes procedures for the ultimate disposal of the samples.

Containers & Preservatives

The QVIR Environmental Director has worked directly with the Laboratory Project Manager to determine the number of sample containers, and associated sizes/volumes and materials, needed for this monitoring project. The containers will be provided precleaned from the laboratory directly and require no washing or rinsing by the field samplers prior to sample collection.

Preservatives will also be provided by the laboratory. Sample bottles will not be pre-preserved. Instead, the preservative will be added to the sample containers by the field team immediately following sample collection.

Container and preservative information will be documented in the field logbook.

Packaging and Shipping

All sample containers will be placed in a sturdy shipping container (e.g., a steel-belted cooler). The following outlines the packaging procedures that will be followed for this project:

1. Line the bottom of the cooler with a large trash bag to minimize leakage of water.
2. Place bubble wrap around the inside edge of the cooler to prevent breakage during shipment, and/or wrap bottles individually.
3. Seal the drain plug of the cooler with fiberglass tape to prevent potential leakage from the cooler (should sample bottles or bagged ice leak.)
4. Prepare bags of ice to be used to keep the samples cool during transport. Ice will be used. Pack the ice in doubled, zip-locked plastic bags.
5. Check the sample bottle screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.

6. Secure sample bottle/container tops and place a custody seal over the container's top.
7. Ensure sample labels are affixed to each sample container and protected by a cover of clear tape.
8. Wrap all glass sample containers in bubble wrap to prevent breakage.
9. Seal all sample containers in heavy duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.
10. Place sample containers (wrapped and sealed) into the cooler. Place the bagged ice on top and around the samples to chill them to the correct temperature.
11. Fill the empty space in the cooler with bubble wrap, Styrofoam peanuts, or any other available inert material to prevent movement and breakage during shipment.
12. Enclose the appropriate chain-of-custody(s) in a zip-lock plastic bag and affix to the underside of the cooler lid.
13. Close the lid of the cooler. Tape the cooler shut with fiberglass strapping tape.
14. Affix custody seals across the openings of the cooler both front and back to ensure that samples are not tampered with during transport. Include sample packer's initials and date on the custody seals.

Daily, the QVIR Field Samplers will notify the Laboratory Project Manager of the sample shipment schedule. The laboratory will be provided with the following information:

- Sampler's name,
- Name and location of the site or sampling area,
- Names of the tribe and project,
- Total number(s) and matrix of samples shipped to the laboratory,
- Carrier, air bill number(s), method of shipment (e.g., priority next day),
- Shipment date and when it should be received by the laboratory,
- Irregularities or anticipated problems associated with the samples, and
- Whether additional samples will be shipped or if this is the last shipment.

Sample Custody

The field sampler is responsible for custody of the samples until they are delivered to the laboratory or picked up for shipping. (Note: As few people as possible will handle the samples to ensure sample custody.) Chain-of-custody forms must be completed in the field. Each time one person relinquishes control of the samples to another person, both individuals must complete the appropriate portions of the chain-of-custody form (see Appendix C2) by filling in their signature as well as the appropriate date and time of the custody transfer.

During transport by a commercial carrier, the air bill will serve as the associated chain-of-custody. Once at the laboratory, the sample receipt coordinator will open the coolers and sign and date the chain-of-custody form. The laboratory personnel are then responsible for the care and custody of samples. The analytical laboratory will track sample custody through their facility using a separate sample tracking form, as discussed in the laboratory QA Manual included in Appendix C3.

A sample is considered to be in one's custody if:

- The sample is in the sampler's physical possession,
- The sample has been in the sampler's physical possession and is within sight of the sampler,
- The sample is in a designated, secure area, and/or
- The sample has been in the sampler's physical possession and is locked up.

Sample Disposal

Following sample analysis, each laboratory will store the unused portions for an established length of time (see lab QA/QC Manual's in Appendix C3). At that time, the laboratory will properly dispose of all the samples (if applicable). Sample disposal procedures at the laboratory are discussed in the laboratory's QA Manual included in Appendix C3.

Analytical Methods

The field measurement and off-site laboratory analytical methods are listed in Table 11 and discussed below.

Laboratory Analyses Methods (Off-Site)

Surface water samples will be analyzed at IEH Analytical, QVIR Microbiology Lab, North Coast Laboratories, Ltd., and Aquatic Analysts. Analyses will be performed following either EPA-approved methods or methods from *Standard Methods for the Examination of Water and Wastewater, 20th Edition,* as summarized in Table 11. SOPs for the analytical methods are included in Appendix C. The Laboratory QA/QC Officer must notify the Laboratory Project Manager if there is any knowledge of the SOPs not being followed.

Benthic Macro invertebrates will be analyzed by Jon Lee Consulting. Macro invertebrates are determined to the genus level. The California Stream Bioassessment Procedure Taxonomic Level 1, as outlined in the CAMLnet Short List of Taxonomic Effort, is followed. Samples are subsampled to a 300, 500, or higher specimen count - protocol dependent. Each sample is placed into a 500 micron sieve. Larger debris is carefully inspected for clinging organisms, thoroughly rinsed, and returned to the original container. The sample is placed in water for approximately five minutes and strained. The sample is moved to a gridded pan (25 $cm.^2$ grids) and evenly spread among the grids. The number of grids covered by the sample is recorded. At least five grid numbers are randomly selected. Macroinvertebrates are systematically removed from the selected grids and placed into vials containing 70% ethanol until the targeted number of specimens have been removed. The number removed from each grid is recorded. All specimens are removed from the last grid processed and this number is recorded. The number of specimens removed from each grid provide an estimate of sample relative abundance. The processed sample debris from each grid is placed into a container labeled remnant. The remaining sample is returned to the original sample container and labeled original.

Both the laboratory and consultant will summarize the data and associated QC results in a data report, and provide this report to the QVIR Environmental Director within 21 days of receipt. The QVIR Environmental Director/QA Officer will review the data reports and associated QC results to make decisions on data quality and usability in addressing the project objectives.

Quality Control Requirements

This section identifies the QC checks that are in place for the sample collection, field measurement, and laboratory analysis activities that will be used to access the quality of the data generated from this project.

Field Sampling Quality Control

Field sampling QC consists of collecting field QC samples to help evaluate conditions resulting from field activities. Field QC is intended to support a number of data quality goals:

- Combined contamination from field sampling through sample receipt at the laboratory (to assess potential contamination from field sampling equipment, ambient conditions, sample containers, sample transport, and laboratory analysis) - assessed using field blanks;
- Sample shipment temperature (to ensure sample integrity and representativeness that the sample arriving at the laboratory has not degraded during transport) - assessed using temperature blanks; and
- Combined sampling and analysis technique variability, as well as sample heterogeneity - assessed using field duplicates.

For the current project, the types and frequencies of field QC samples to be collected for each field measurement and off-site laboratory analysis are listed in Table 11 and 12. These include field blanks, temperature blanks (as included in a footnote to the table), and field duplicates.

<u>Field Blanks </u>- Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sample collection due to exposure from ambient conditions or from the sample containers themselves. Field blank samples will be obtained by pouring deionized water into a sample container at the sampling location. Field blanks will not be collected if equipment blanks have been collected during the sampling event. If no equipment blanks are collected (and none are planned because samples will be collected directly into sample containers), one field blank will be collected for every 10 samples or a frequency of 10%.

Field blanks will be preserved, packaged, and sealed in the same manner described for surface water samples. A separate sample number and station number will be assigned to each blank. Field blanks will be submitted blind to the laboratory for invalidation of results, greater attention to detail during the next sampling event, or analysis of metals, hardness, and anions. No field blanks are planned for the other analytical parameters or field measurements as it is not expected that it would yield information critical to project data needs.

If target analytes are found in field blanks, sampling and handling procedures will be reevaluated and corrective actions taken. These may consist of, but are not limited to, obtaining sampling containers from new sources, training of personnel, discussions with the laboratory other procedures felt appropriate.

<u>Temperature Blanks </u>-For each cooler of samples that is transported to the analytical

laboratory, a 40-ml VOA vial (prepared by the laboratory) will be included that is marked "temperature blank." This blank will be used by the laboratory's sample custodian to check the temperature of samples upon receipt to ensure that samples were maintained at the temperature appropriate for the particular analysis. For the current project, temperature blanks will be included in all coolers containing samples requiring temperature preservation, as identified in Table 11.

Field Duplicate Samples - Field duplicate samples will be collected to evaluate the precision of sample collection through analysis. Field duplicates will be collected at designated sample locations by alternately filling two distinct sample containers for each analysis. Field duplicate samples will be preserved, packaged, and sealed in the same manner described for the surface water samples. A separate sample number and station number will be assigned to each duplicate. The samples will be submitted as "blind" (i.e., not identified as field duplicates) samples to the laboratory for analysis.

For the current project, field duplicates will be collected for each analytical parameter, and field measurement parameter, at the frequencies shown in Table 12. The duplicates samples will be collected at random locations for each sampling event. Criteria for field duplicates for the analytical and field measurement parameters are provided in Tables 11-12 and 13, respectively. If criteria are exceeded, field sampling and handling procedures will be evaluated, and problems corrected through greater attention to detail, additional training, revised sampling techniques, or whatever appears to be appropriate to correct the problems.

Field Measurement Quality Control

Quality control requirements for field measurements are provided in Table 13.

Laboratory Analyses Quality Control (Off-Site)

Laboratory QC is the responsibility of the personnel and QA/QC department of the contracted analytical laboratories. Each laboratory's Quality Assurance Manuals detail the QA/QC procedures it follows. The following elements are part of standard laboratory quality control practices:

- Analysis of method blanks,
- Analysis of laboratory control samples,
- Instrument calibration (including initial calibration, calibration blanks, and calibration verification),
- Analysis of matrix spikes, and
- Analysis of duplicates.

The data quality objectives for Aquatic Analysts, Jon Lee Consulting, QVIR Microbiology Lab, IEH Analysts, and North Coast Laboratories (including frequency, QC acceptance limits, and corrective actions if the acceptance limits are exceeded) are detailed in the QA Manuals and SOPs (as in Appendix C3). Any excursions from these objectives must be documented by the laboratory and reported to Quartz Valley Indian Reservation Project Manager/QA Officer.

The Tribe has reviewed each laboratory's control limits and corrective action procedures and feels that these will satisfactorily meet tribal project data quality needs. A summary of this information is included in Table 11. These include laboratory (or method) blanks, laboratory control samples, matrix spikes, and laboratory duplicates.

Method Blanks - A method blank is an analyte-free matrix, analyzed as a normal sample by the laboratory using normal sample preparation and analytical procedures. A method blank is used for monitoring and documenting background contamination in the analytical environment. Method blanks will be analyzed at a frequency of one per sample batch (or group of up to 20 samples analyzed in sequence using the same method).

Corrective actions associated with exceeding acceptable method blank concentrations include isolating the source of contamination and re-digesting and/or re-analyzing the associated samples. Sample results will not be corrected for blank contamination, as this is not required by the specific analytical methods. Corrective actions will be documented in the laboratory report's narrative statement.

Laboratory Control Samples - Laboratory control samples (LCS) are laboratory-generated samples analyzed as a normal sample and by the laboratory using normal sample preparation and analytical procedures. An LCS is used to monitor the day-to-day performance (accuracy) of routine analytical methods. An LCS is an aliquot of clean water spiked with the analytes of known concentrations corresponding to the analytical method. LCS are used to verify that the laboratory can perform the analysis on a clean matrix within QC acceptance limits. Results are expressed as percent recovery of the known amount of the spiked analytical parameter.

One LCS is analyzed per sample batch. Acceptance criteria (control limits) for the LCS are defined by the laboratory and summarized in each of the lab manuals, see Appendix C3. In general, the LCS acceptance criteria recovery range is 70 to 130 percent of the known amount of the spiked analytical parameter. Corrective action, consisting of a rerunning of all samples in the affected batch, will be performed if LCS recoveries fall outside of control limits. Such problems will be documented in the laboratory report's narrative statement.

Matrix Spikes - Matrix spikes (MS) are prepared by adding a known amount of the analyte of interest to a sample. MS are used as a similar function as the LCS, except that the sample matrix is a real-time sample rather than a clean matrix. Results are expressed as percent recovery of the known amount of the spiked analytical parameter. Matrix spikes are used to verify that the laboratory can determine if the matrix is causing either a positive or negative influence on sample results.

One matrix spike is analyzed per sample batch. Acceptance criteria of the MS are defined by each laboratory in Appendix C3 lab manuals. In general, the MS acceptance criteria recovery range is of 70 to 130 percent of the known amount of the spiked analytical parameter. Generally, no corrective action is taken for matrix spike results exceeding the control limits, as long as the LCS recoveries are acceptable. However, the matrix effect will be noted in laboratory report's narrative statement and documented in the Tribe's reports for each sampling event.

Laboratory Duplicates - A laboratory duplicate is a laboratory-generated split sample used to document the precision of the analytical method. Results are expressed as relative percent difference between the laboratory duplicate pair.

One laboratory duplicate will be run for each laboratory batch or every 10 samples, whichever is more frequent. Acceptance criteria (control limits) for laboratory duplicates are specified in the laboratory QA Manuals, Appendix C3. If laboratory duplicates exceed criteria, the corrective action will be to repeat the analyses. If results remain unacceptable, the batch will be rerun. The discrepancy will be noted in the laboratory report's narrative statement and documented in the Tribe's reports for each sampling event.

Background Samples

Background samples are collected because there is a possibility that there are native or ambient levels of one or more target analytes present, and because one objective of the sampling event is to differentiate between on-site and off-site contributions to a parameter's concentration. The background location for this monitoring program will be the most upstream (and thus assumed to be least impacted) sample collected at the following locations: Summit, Cliff, Campbell inlet and lake samples, West and East Mill Creek ponds inlet and lake samples, upstream of the Case property on Sniktaw, Crater, Houston, Rail, Kangaroo, Grouse, Mill, Mule, S. Fork Scott, Kelsey, Canyon and Boulder Creeks. The analyses to be conducted on the background samples will be the same as that for the other surface water samples.

Table 12 Summary of Field and QC Samples

Matrix/ Media	Analytical Parameter[i]	No. of Sampling Locations	Depth (surface, mid, or deep)[ii]	No. of Field Duplicates[iii]	Inorganics No. of:[iv]		No. of Field Blanks[v]	Total No. of Samples[vi]
					Dup	MS		
Analyses:								
Surface Water	Total Phosphorus	42	Surface (grab)	4	1	1	1	49
Surface Water	Dissolved Phosphorus	42	Surface (grab)	4	1	1	1	49
Surface Water	Total Nitrogen	42	Surface (grab)	4	0	0	1	47
Surface Water	Ammonium Nitrogen	42	Surface (grab)	4	1	1	1	49
Surface Water	Nitrate + Nitrite	42	Surface (grab)	4	1	1	1	49
Surface Water	Phytoplankton	42	Surface (grab)	4	10% of samples		1	51
Surface Water	Chlorophyll	42	Surface (grab)	4	1	1	1	49
Surface Water	Pesticides-Trifluralin	10	Surface (grab)	1	1 liter extra		1	13
Surface Water	Pesticides-Diuron	10	Surface (grab)	1	1 liter extra		1	13
Surface Water	Macro-invertebrates	42	Surface (grab)	4	NAS		1	47
Field Measurements:								
Surface Water	Temp.	42	Surface (grab)	4			0	46
Surface Water	pH	42	Surface (grab)	4			0	46
Surface Water	Conductivity	42	Surface (grab)	4			0	46
Surface Water	Turbidity	42	Surface (grab)	4			0	46
Surface Water	Dissolved Oxygen	42	Surface (grab)	4			0	46

[1] All analyses will be performed at an off-site laboratory. There will be no field screening analyses. Field measurements will be performed at each sample collection location.

[2] Samples will be collected at depth of 6-12 inches. If depth of water is less than 12 inches, sample will be collected at mid depth and noted in the field logbook

[3] Field duplicates will be collected at a frequency of 10% of the samples collected for laboratory analysis. Field duplicates will be collected at a frequency of 10% or one per day, whichever is more frequent, for samples collected for field measurements.

Table 13 Quality Control Samples, Data Quality Indicators, Frequency, Methods, Acceptance Criteria and Corrective Actions

Field Parameters: Temperature, pH, Dissolved Oxygen, Turbidity, Conductivity

QC Sample	**Data Quality Indicator** (DQI)[2]	**Frequency/ Number**	**Methods/SOP** QC Acceptance Limits[3]	Acceptance Criteria/ Measurement Performance criteria[4]	**Corrective Action**
Temperature- YSI 556 & 6600 MPS Multi Probe System: YSI Precision ™ Thermistor					
Field Duplicate	Precision (S & A)	1/5 field samples	N/A	± 0.15°C	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample[5]	Accuracy	N/A	N/A	N/A	None. Sensor not used if it didn't meet annual calibration criteria.
Temperature- Onset HOBO Water Temp Pro Loggers					

Field Duplicate	Precision (S & A)	1/5 field samples	N/A	±0.2°C	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample[6]	Accuracy	N/A	N/A	N/A	None. Sensor not used if it didn't meet annual calibration criteria.
pH- YSI 556 & 6600 MPS Multi Probe System: YSI Glass Combination electrode					
Field Duplicate	Precision (S & A)	1/5 field samples	N/A	±0.2 units	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample6	Accuracy	1/batch each day	±0.5 units of true value for both calibration check standards	±0.5 units of true value	Qualify associated field data
Dissolved Oxygen- YSI 556 & 6600 MPS Multi Probe System Steady state polarographic					

Field Duplicate	Precision (S & A)	1/5 field samples	N/A	±20% RPD	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample6	Accuracy	1/batch each day	±0.5 mg/L of true value of full saturation standard	±0.5 mg/L of true value	Qualify associated field data
Conductivity- YSI 556 & 6600 MPS Multi Probe System: YSI 4-electrode cell with autoranging					
Field Duplicate	Precision (S & A)	1/5 field samples	N/A	±20% RPD	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample6	Accuracy	1/batch each day	±10% of true value or ±20 µS/cm (whichever is greater) for both calibration check standards	±10% of true value	Qualify associated field data
Turbidity- YSI 6600 MPS Multi Probe System					

Field Duplicate	Precision (S & A)	1/5 field samples	N/A	±20% RPD	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample6	Accuracy	1/batch each day	±20% or ±2 NTU of 20 NTU standard (whichever is greater) and ±1 NTU for 0 NTU standard	±20% of true value	Qualify associated field data
Turbidity- Model WQ770 Turbidity Meter					
Field Duplicate	Precision (S & A)	1/5 field samples	N/A	±20% RPD	Collect & analyze 3rd sample. Qualify data if still exceeding criteria
QC Check Sample6	Accuracy	1/batch each day	±20% or ±2 NTU of 20 NTU standard (whichever is greater) and ±1 NTU for 0 NTU standard	±20% of true value	Qualify associated field data

[2] Data Quality Indicators may be related to sampling (S) and/or analysis (A) activities.

[3] For field duplicate samples, there are no method-specific QC acceptance limits. (NA - Not applicable.)

[4] The information in this column supports acceptance criteria/measurement performance criteria introduced on page 52. For this study, the field measurement's QC acceptance limits (as determined from a calibration check sample analyzed half-way through the field day) were reviewed and found acceptable to meet the current data quality needs. As such, the field measurement's QC acceptance limits and the project's measurement performance criteria are equivalent.

[5] Accuracy is not ensured through the analysis of a QC check. If the temperature sensor meets the annual calibration procedures and criteria presented in Table 14, the measurements are considered accurate enough to meet the needs of the current project.

[6] Accuracy is ensured through the calibration and calibration check process presented in Table 14. The post calibration check sample(s) will be considered as QC check samples for the field measurements.

ALL SAMPLES ARE SURFACE WATER MATRIX. ALL SAMPLES ARE COLLECTED BY THE SAME PROCEDURE, AS PRESENTED IN APPENDIX F. NO ADDITIONAL QC CHECKS ARE PLANNED BEYOND THOSE IDENTIFIED ABOVE FOR ACCURACY AND PRECISION.

Instrument/Equipment Testing, Inspection, and Maintenance

Field Measurement Instruments/Equipment

Sampling equipment under the care of the QVIR Environmental Program will be maintained according to the manufacturer's instructions. Maintenance logs will be kept in the office of the QVIR Environmental Director/QA Officer. Each piece of equipment will have its own maintenance log. The log will document any maintenance and service of the equipment. A log entry will include the following information:

- Name of person maintaining the instrument/equipment,
- Date and description of the maintenance procedure,
- Date and description of any instrument/equipment problem(s),
- Date and description of action to correct problem(s),
- List of follow-up activities after maintenance (i.e., system checks), and
- Date the next maintenance will be needed.

Laboratory Analysis Instruments/Equipment (Off-Site)

Inspection and maintenance of laboratory equipment is the responsibility of the Aquatic Analysts, QVIR Micorbiology Lab, IEH Analytical, Jon Lee Consulting, and North Coast Laboratories and is described in each laboratory's QA Manual included as Appendix C3.

Instrument/Equipment Calibration and Frequency

Field Measurement Instrument/Equipment

Calibration and maintenance of field equipment/instruments will be performed according to the manufacturer's instructions (see Appendix E) and recorded in an instrument/equipment logbook. Each piece of equipment/instrument will have its own logbook.

The project-specific criteria for calibration (frequency, acceptance criteria, and corrective actions associated with exceeding the acceptance criteria) are provided in Table 14.

Laboratory Analysis Instruments/Equipment

Laboratory instruments will be calibrated according to the appropriate analytical methods. Acceptance criteria for calibrations are found Aquatic Analysts, QVIR Micorbiology Lab, IEH Analytical, Jon Lee Consulting and North Coast Laboratories calibrations procedures are contained in each of their QA Manuals included as Appendix C3.

Table 14 Field Equipment Calibration, Maintenance, Testing and Inspection						
Analytical Parameter	Instrument	Calibration Activity	Maintenance & Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action
Temperature (sensor)	YSI 556 & 6600 MPS Multi Probe System: YSI Precision ™ Thermistor		See Manufacturer's manual	Initial Post: Once a week check and calibrate as needed	± 0.15°C of true value at both endpoints	Remove from use if doesn't pass calibration criteria
Well level/barometric pressure	Onset HOBO U20 Water Level Logger	Individually calibrated	See Manufacturer's manual	Checked monthly		
Temperature (sensor)	Onset HOBO Water Temp Pro Loggers	Initial: Water bath calibration against NIST thermometer (US Fish and Wildlife Protocol)	See Manufacturer's manual	Checked monthly	±0.2°C of true value at both endpoints	Remove from use if doesn't pass calibration criteria
pH (electrode)	YSI 556 & 6600 MPS Multi Probe System: YSI Glass Combination electrode	Initial: two-point calibration bracketing expected field sample range (using 7.0 and either 4.0 or 10.0 pH buffer, depending on field conditions); followed by one-point check with 7.0 pH buffer Post: single-point check with 7.0 pH buffer	See Manufacturer's manual	Initial Post: Once a week check and calibrate as needed	Initial: Two point calibration done electronically; one-point check (using 7.0 pH buffer) ±0.1 pH units of true value Post: ±0.5 pH units of true value with both 7.0 pH and either 4.0 or 10.0 pH buffer	Recalibrate Qualify data

Dissolved oxygen (membrane electrode)	*YSI 556 & 6600 MPS Multi Probe System Steady state polarographic*	Initial: One-point calibration with saturated air (need temp, barometric pressure); followed by two-point check with saturated air and zero Post: single-point check at full saturation	See Manufacturer's manual	Initial Post: Once a week check and calibrate as needed	Initial: one-point calibration done electronically; two-point check with high (saturated) standard ± 0.2 mg/L of true value and low (zero) standard <0.5 mg/L Post: ±0.5 mg/L of true saturated value	Recalibrate; change membrane and recalibrate Qualify data
Turbidity (sensor)	*YSI 6600 MPS Multi Probe System*	Initial: two point calibration using 0 NTU (or deionized water) and 20 NTU standards to bracket expected sample range; follow by one point check with 20 NTU standard Post: two point check with high (20 NTU) and low ()NTU standards)	See Manufacturer's manual	Initial Post: Once a week check and calibrate as needed	Initial: two-point calibration done electronically; one-point check (using 20 NTU standard) ±10% of true value Post: two-point check with high (20 NTU) standard ±20% or ±2 NTU (whichever is greater) of true value and low (0 NTU) standard ±1 NTU of true value	See Manufacturer's manual
Turbidity	*Model WQ770*	Initial: two point	See Manufacturer	Initial: beginnin	Initial: two-point	See Manufacturer

(sensor)	*Turbidity Meter*	calibration using 0 NTU (or deionized water) and 20 NTU standards to bracket expected sample range; follow by one point check with 20 NTU standard Post: two point check with high (20 NTU) and low ()NTU standards)	's manual	g of each day Post: end of each day	calibration done electronically; one-point check (using 20 NTU standard) ±10% of true value Post: two-point check with high (20 NTU) standard ±20% or ±2 NTU (whichever is greater) of true value and low (0 NTU) standard ±1 NTU of true value	's manual
Conductivity (sensor)	*YSI 556 & 6600 MPS Multi Probe System: YSI 4-electrode cell with autoranging*	Initial: one point calibration at high (using 500 mS/cm standard) end of expected field sample range; followed by two-point check with High (500 mS/cm) and low (100 mS/cm) standards	See Manufacturer's manual	Initial Post: Once a week check and calibrate as needed	Initial: one point calibration done electronically; two point check with high standard ±5% of true value and low standard ±10% of true value Post: two point check with high and low standards ±10% of true value or ±20 mS/cm whichever is greater	Recalibrate Qualify data
Velocity	*Flow Tracker*	N/A Standard ratings are built into	See Manufacturer's manual			

		the Flow Tracker**See Manual				

Inspection and Acceptance of Supplies and Consumables

Field Sampling Supplies and Consumables
Sample containers and preservatives will be provided by the analytical laboratory. Containers will be inspected for breakage and proper sealing of caps. Other equipment such as sample coolers and safety equipment will be acquired by the Tribe. If reusable sampling equipment is acquired in the future, materials/supplies necessary for equipment decontamination will be purchased by the Tribe; however, this is not necessary for the present study. Any equipment deemed to be in unacceptable condition will be replaced.

Field Measurement Supplies and Consumables
Field measurement supplies, such as calibration solutions, will be acquired from standard sources, such as the instrument manufacturer or reputable suppliers. Chemical supplies will be American Chemical Society reagent grade or higher. The lot number and expiration date on standards and reagents will be checked prior to use. Expired solutions will be discarded and replaced. The source, lot number, and expiration dates of all standards and reagents will be recorded in the field log books.

Laboratory Analyses (Off-Site) Supplies and Consumables
Each of the laboratory's requirements for supplies and consumables are described in its QA Manual which is provided in Appendix C3.

Data Acquisition Requirements (Non-Direct Measurements)
To supplement field measurements and laboratory analytical activities conducted under this project, other potential "external" data sources will be researched. These sources include, but are not limited to, the U.S. Geological Survey, the California Department of Water Resources, the U.S. Environmental Protection Agency, the United States Forest Service, the Karuk Tribe of California, the Hoopa Tribe, and the Yurok Tribe. The primary use of this external data will be to help focus the Tribe's data collection efforts (for example, the information may be used to identify new sites in the Scott Valley River watershed for future sampling).

If it appears that the "external" data might facilitate water body evaluation, the data will first be reviewed to verify that they are of sufficient quality to meet the needs of the project by examining:

(1) the sample collection and location information;

(2) the data to see whether they are consistent with known tribally-collected data from the same general vicinity; and
(3) the QA/QC information associated with the data.

If the data are of insufficient or unknown quality, limitations will be placed on its use in supporting project decisions. In general, it is anticipated that decisions for the current project will be based on data collected by the Tribe following this current QA Project Plan.

Data Management

All data collected by the QVIR Environmental Program will be maintained in appropriate bound notebooks and electronic databases. Data from the laboratory will be requested in both hard copy and electronic form. The electronic and hard copy results will be compared to ensure that no errors occurred in either format. If discrepancies are noted, the laboratory will be contacted to resolve the issues.

ASSESSMENT AND OVERSIGHT

This section describes how activities will be checked to ensure that they are completed correctly and according to procedures outlined in this QA Project Plan.

Assessment/Oversight and Response Actions

During the course of the project, it is important to assess the project's activities to ensure that the QA Project Plan is being implemented as planned. This helps to ensure that everything is on track and serves to minimize learning about critical deviations toward the end of the project when it may be too late to remedy the situation. For the current project, the ongoing assessments will include:

- Field Oversight
- Readiness review of the field team prior to starting field efforts,
- Field activity audits, and
- Review of field sampling and measurement activities methodologies and documentation at the end of each event, and
- Laboratory Oversight - evaluation of laboratory data generated for each quarterly sampling event.

Details regarding these assessments are included below.

Field Oversight

Readiness Reviews

Sampling personnel will be properly trained by qualified personnel before any sampling begins and will be given a brief review of sampling procedures and equipment operation by the QVIR Environmental Director/QA Officer before each sampling event. Equipment maintenance records will be checked to ensure all field instruments are in proper working order. Adequate supplies of all preservatives and bottles will be obtained and stored appropriately before heading to the field. Sampling devices will be checked to ensure that they have been properly cleaned (for devices which might be reused) or are available in sufficient quantity (for devices which are disposable). Proper paperwork, logbooks, chain of custody forms, etc. will be assembled by the sampling technician. The QVIR Environmental Director/QA Officer will review all field equipment, instruments, containers, and paperwork to ensure that all is in readiness prior to the first day of each sampling event. Any problems that are noted will be corrected before the sampling team is permitted to depart the Tribe's facilities.

Field Activity Audits

Once a month, the QVIR Environmental Director/QA Officer will assess the sample collection methodologies, field measurement procedures, and record keeping of the field team to ensure activities are being conducted as planned (and as documented in this QA Project Plan). Any deviations that are noted will be corrected immediately to ensure all subsequent samples and field measurements collected are valid. (Note: If the deviations are associated with technical changes and/or improvements made to the procedures, the QVIR EPD QA Officer will verify that the changes have been documented by the QVIR EPD Water Quality Technicians in the Field Log Book and addressed in an amendment to this QA Project Plan.) The QVIR EPD QA Officer may stop any sampling activity that could potentially compromise data quality.

The QVIR EPD QA Officer will document any noted issues or concerns in a QA Audit Logbook and discuss these items informally and openly with the QVIR EPD Water Quality Technicians while on site. Once back in the office, she will formalize the audit findings (for each event) in a Field Audit Report which will be submitted to the QVIR Environmental Director and the QVIR EPD Water Quality Technicians.

The QVIR EPD Water Quality Technician will prepare a Corrective Action Report to address any audit findings discussed in the Field Audit Report. The Corrective Action Report will be issued as an internal memorandum the QVIR Environmental Director/QA

Officer in response to problems noted during on-site audits and will document steps taken to reduce future problems prior to the next sampling event.

Post Sampling Event Review
Following each sampling event, the QVIR EPD Data Manager will complete the Field Activities Review Checklist (Appendix D1). This review of field sampling and field measurement documentation will help ensure that all information is complete and any deviations from planned methodologies are documented. This review will be conducted in the office, not in the field. The results of this review, as well as comments associated with potential impacts on field samples and field measurement integrity will be forwarded to the QVIR Environmental Director to be used in preparing the reports for each event and also to be used as a guide to identify areas requiring improvement prior to the next sampling event.

Laboratory Oversight
Following receipt of the off-site laboratory's data package for each sampling event, the QVIR EPD QA Officer will review the data package for completeness, as well as to ensure that all planned methodologies were followed and that QA/QC objectives were met. The results of the review will be documented on the Laboratory Data Review Checklist (Appendix D2). (Note: The QVIR Environmental Director/QA Officer has the authority to request re-testing or other corrective measures if the laboratory has not met the project's QA/QC objectives and/or has not provided a complete data package.)

Due to the scope and objectives of the current project, the Tribe is not planning any laboratory audits at this time. However, the Tribe will check periodically with the state of California certification agency to make sure that the laboratory remains in good standing for those methods that the tribe is requesting.

The laboratories' QA Manuals describe the policies and procedures for assessment and response in the laboratory, see Appendix C3.

Reports to Management
Biannually, the QVIR Environmental Director will prepare and submit a report on that quarter's sampling activities. Contents of this report have been described previously in *Documents and Records*, pg. 63. This report will be submitted to the Tribal Council for approval. After approval, the report will be submitted to the US EPA Grants Project Officer.

Once a year a report summarizing the year's reports will be prepared which will show any data trends that have occurred. The report will also discuss how any actions taken during the year may have affected the trends. This report will also be submitted to the Tribal Council for approval. After approval, the report will be submitted to the US EPA Grants Project Officer.

DATA REVIEW AND USABILITY

Prior to utilizing data to make project decisions, the quality of the data needs to be reviewed and evaluated to determine whether the data satisfy the project's objectives. This process involves technical evaluation of the off-site laboratory data, as well as review of the data in conjunction with the information collected during the field sampling and field measurement activities. This latter, more qualitative review provides for a clearer understanding of the overall usability of the project's data and potential limitations on their use. This section describes the criteria and procedures for conducting these reviews and interpreting the project's data.

Data Review, Verification, and Validation Requirements

Setting data review, verification, and validation requirements helps to ensure that project data are evaluated in an objective and consistent manner. For the current project, such requirements have been defined for information gathered and documented as part of field sampling and field measurement activities, as well as for data generated by the off-site laboratory.

Field Sampling and Measurement Data

Any information collected during sample collection and field measurements is considered field "data." This includes field sampling and measurement information documented in field logbooks, photographs, and chain of custody forms.

Once the QVIR EPD Water Quality Technician returns to the office following a sampling event, she turns in the field data to the QVIR EPD Data Manager who is responsible for conducting a technical review of the field data to ensure that all information is complete and any deviations from the planned methodologies are documented. For the purpose of this project, the review will be documented using the Field Activities Review Checklist provided in Appendix D1. This checklist comprehensively covers the items to be reviewed and leaves room to capture any comments associated with potential impacts on field samples and field measurement integrity based on the items listed.

Laboratory Data

For the data generated by an off-site laboratory, the laboratory is responsible for its own internal data review and verification prior to submitting the associated data results package to the QVIR EPD QA Officer. The details of the review (including checking calculations, reviewing for transcription errors, ensuring the data package is complete, etc.) are discussed in the laboratory's QA Manual included as Appendix C. Details of the information that will be included in each data package is listed in the *Documents and Records* section of this QA Project Plan, pg.63.

Once the laboratory data are received by the Tribe, the QVIR EPD QA Officer is responsible for further review and validation of each data package. For the purpose of this project, data review and validation will be conducted using the Data Review Checklist provided in Appendix D2 in conjunction with the QC criteria (i.e., frequency, acceptance limits, and corrective actions) defined in Tables 13 and 14. This review will include evaluation of the field and laboratory duplicate results, field and laboratory blank data, matrix spike recovery data, and laboratory control sample data pertinent to each analysis. The review will also include ensuring data are reported in compliance with the project action limits and quantitation limits defined in Table 9; the sample preparation/analytical procedures were performed by the methods listed in Table 11; sample container, preservation, and holding times met the requirements listed in Table 11; the integrity of the sample (ensuring proper chain of custody and correct sample storage temperatures) is documented from sample collection through shipment and ultimate analysis, and the data packages. The Data Review Checklist comprehensively covers the review of all these items. (Note: Calibration data will not be requested for the project at this time.)

The QVIR EPD QA Officer will further evaluate each data package's narrative report and summary tables to see whether the laboratory "flagged" any sample results based on poor or questionable data quality and to ensure that any exceedances of the laboratory's QC criteria are documented. If a problem was noted by the laboratory, the QVIR EPD QA Officer will evaluate whether the appropriate prescribed corrective action was taken by the laboratory, the action successfully resolved the problem, and the process and its resolution were accurately documented.

An effort will be made to identify whether any data quality problem is the result of laboratory issues and/or if it may be traced to some field sampling activity. If the laboratory is determined to be responsible, the QVIR EPD QA Officer will request information from the laboratory documenting that the problem has been resolved prior to submitting future samples. If some aspect of the field operation (e.g., sample collection, sample containers and/or preservation, chain-of-custody, sample shipment, paperwork, etc.) is identified as the possible problem, efforts will be made to retrain the Tribe's field staff to minimize the potential of the problem recurring. If the problem is believed to be due to the sample matrix, the QVIR Environmental Director/QA Officer will discuss the use of alternative analytical methods with the laboratory; and, if an alternative method is available that might minimize the problem, the QA Project Plan will be modified and/or amended accordingly.

If any of the QC criteria and/or the project requirements (as discussed above) are exceeded, the associated data will be qualified as estimated and flagged with a "J". If grossly exceeded, the associated data will be rejected and the need for re-sampling will be considered. However, since the data are being generated for a baseline assessment, it is generally felt that paying special attention to some troublesome sample collection or analytical concern during the next sampling event will be sufficient and re-sampling will not be necessary.

Reconciliation with User Requirements

The purpose of the continued monitoring of the Scott River Watershed is to assess the surface water resources and determine whether analytes of concern exceed national water quality standards. This also provides the Tribe with the opportunity to begin efforts of co-management in the Scott River watershed. Data must fulfill the requirements of this QA Project Plan to be useful for the overall project. Information needed to support decision making under the surface water monitoring program is contained in this QA Project Plan, field documentation, the laboratory "data package" report, the Field Activities Review Checklist, the Laboratory Data Review Checklist, and the Field Audit Report and associated Corrective Action Report. This section describes the steps to be taken to ensure data usability (after all the data have been assembled, reviewed, verified, and validated) prior to summarizing the information in the Biannual and Annual Reports.

Once all the data from the field and laboratory have been evaluated, the QVIR Environmental Director/QA Officer will make an overall assessment concerning the final usability of the data (and any limitations on its use) in meeting the project's needs. The initial steps of this assessment will include, but not necessarily be limited to:

- Discussions with the QVIR EPD Water Quality Technician,
- Review of deviations from the QA Project Plan or associated SOPs to determine whether these deviations may have impacted data quality (and determining whether any impacts are widespread or single incidents, related to a few random samples or a batch of samples, and/or affecting a single or multiple analyses),
- Evaluation of the field and laboratory results and QC information,
- Review of any other external information which might influence the results, such as off-reservation activities up stream, meteorological conditions (such as storm

events proceeding sampling that might contribute to high turbidity readings), and data from other sources,

- Evaluation of whether the completeness goals defined in this QA Project Plan have been met,
- Examination of any assumptions made when the study was planned, if those assumptions were met, and, if not, how the project's conclusions are affected.

After all this information has been reviewed, the QVIR Environmental Director/QA Officer will incorporate her perspective on the critical nature of any problems noted and, ultimately, identify data usability and/or limitations in supporting project objectives and decision making. All usable data will then be compared to the Project Action Limits (as listed in Table 9) to identify whether these limits have been exceeded. Decisions made regarding exceeding the Project Action Limits will follow the "...if...then..." statements included above.

In addition, the QVIR Environmental Director/QA Officer will assess the effectiveness of the monitoring program and data collection at the end of each calendar year. Sampling locations, frequency, list of analytical parameters, field measurement protocols, choice of the analytical laboratory, etc. will be modified as needed to reflect the changing needs and project objectives of the Quartz Valley Indian Community. This QA Project Plan will be revised and/or amended accordingly.

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Appendix

Appendix A: Shackleford Creek
Limiting Factors Background Information: QVIR Monitoring Plan

This Appendix provides Shackleford Creek specific information on upland conditions based on GIS data and likely relationships of disturbance and resultant aquatic conditions based on local and regional scientific literature.

Increased Peak Flows: The rain-on-snow or transient snow zone is where logging and road building create the highest risk for elevating peak flows (Jones and Grant, 1996). This area of greater risk generally ranges between 3,500-5,000 feet in northern California (Armentrout et al., 1999). The rain-on-snow zone in the Shackleford Creek watershed almost directly overlaps with the private timber lands that have been actively managed and have high road densities (Figure 2). De la Fuente and Elder (1998) described effects of a rain-on-snow event as a result of the January 1, 1997 storm on U.S. Forest Service lands. Road failures tended to occur at the upper limit of the rain-on-snow zone, where debris torrents were initiated and often triggered channel scour for long reaches downstream.

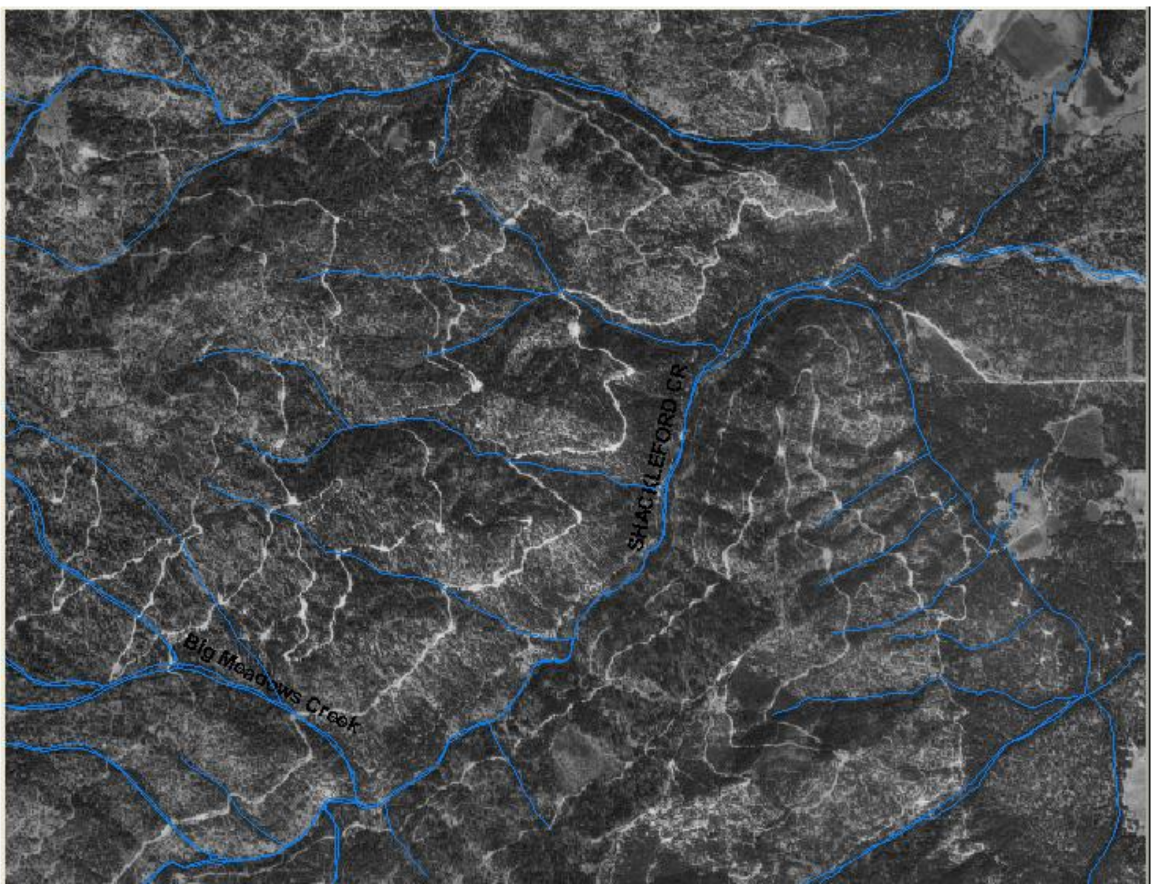

Figure 1. U.S. Geologic Survey orthophoto showing extensive logging and network of logging roads on private lands within the Shackleford Creek watershed.

Appendix B: ECORP WQ Study Documents

Appendix B1: Prior groundwater test results before ECORP BWA

FILE No.800 03/02 '05 10:16 ID:QUARTZ VALLEY INDIAN RCS FAX:530 468 5908 PAGE 3/ 5

well 10

SHASTA COUNTY HEALTH DEPARTMENT

2650 Breslauer Way, Redding, CA 96001 - (530) 225-5072

WATER SAMPLE FOR MICROBIOLOGICAL EXAMINATION

Bottle #: 04-1390 | Date and Time Collected: 2/7/05 12:00 pm | Sampler: R Musso

Mail Report To: Rebekah Musso | Phone #: 530-468-5907 | Fax #: 530-468-5908

Address: 13601 Quartz Valley Rd Fort Jones CA 96032

City: | State: | Zip Code:

Address Sample Taken: 12817 Yamitch Fort Jones, CA 96032

Sample Point (faucet, Well head, etc.): Well Water | Chlorine Residual: | Remarks: re-sample

TYPE OF SAMPLE

- [x] Drinking Water
- [ ] Public Water Supply
- [ ] Raw Surface Water
- [ ] Other

SELECT ONE TEST

- [x] Colisure P/A
- [ ] Quantitray 51 (MPN)
- [ ] Quantitray 2000 (MPN for Surface Waters)

LABORATORY USE ONLY — LABORATORY #: 05-140

Date Received: 2/8/05	Initials: BM	Comments:
Time Received: 1130	Initials: BM	
Time Set Up: 1135	Initials: BM	
Date Reported: 2/9/05	Initials: BM	
Time Reported: 1200	Initials: BM	
de 2-11-05		

Notations:
- [ ] Sample warm
- [ ] Leaked in transit
- [ ] QNS

Laboratory Contact Information Regarding Results: Left message for call back 2-9-05 @ 1200 BM

RESULTS GIVEN ON 2/11/05 @ 1430 de

COLISURE RESULTS

- [ ] Negative for Coliforms
- [x] Total Coliform (+), E. Coli (-)
- [ ] Total Coliform (+), E. Coli (+)

QUANTITRAY RESULTS

QT 51:	TC	EC
# Wells (+)		
MPN/100ml		
QT 2000:		
# Large Wells (+)		
# Small Wells (+)		
MPN/100ml		

Check Ned. BM

Check #: 3927 | Amount: 20.00

PAYMENT TERMS: Net 30 Days

Please remit payment in full to address listed above. Thank you

SCHD 5004 (Rev 6/2003)

building a healthier community

APPENDIX B2: Sampling and Analysis Plan Quality Assurance Technical Appendix ECORP WQ Study on QVIR

1.0 INTRODUCTION

The goal of this sampling plan is to provide the Quartz Valley Indian Community (QVIC) with a quantitative assessment of the water quality of the resources on Reservation land. The portion of Shackleford Creek that runs through the Quartz Valley Indian Reservation will be sampled, as will all groundwater wells, which provide Reservation residents with household water. Results from the analyses presented in this sampling plan will inform the Community about the quality of the groundwater, which is used by tribe members for drinking water. Additionally, these analyses will help identify any surface water contamination problems in Shackleford Creek that could affect fish habitat, since wild salmon is an important resource to the tribe and a vital piece of the Tribe's cultural heritage.

Surface water sampling will be performed at four locations in the approximately 1-mile stretch of Shackleford Creek on the Reservation. Chemical and biological analyses will be performed on samples taken from the stream, and will include analysis of phosphates, nitrates, and fecal coliforms among other contaminants. Field tests will be performed using portable water quality meters to analyze the pH, dissolved oxygen, conductivity, and temperature of the stream.

Ground water sampling will be performed at each of the wells on tribal land. Chemical and biological analyses to be performed will include heavy metals, total dissolved solids, phosphates, nitrates, and fecal coliforms among other contaminants addressed in the EPA primary drinking water standards. Depth to groundwater in each well will be sounded at the time of each sampling effort, and may be sounded seasonally, to provide information on annual fluctuations in the water table.

The surface water resources of the Reservation have not previously been tested for EPA-listed drinking water contaminants, and no comprehensive testing program has been established to test the Tribal drinking water resources. Required tests for coliform bacteria and E. coli have been conducted at the wells after drilling; results from these tests are included in Attachment XX of the QVIR Water Quality Control Plan and Baseline Watershed Assessment. This baseline watershed assessment may form the basis for a Tribal 305(b) and other activities involving water resources of the Quartz Valley Indian Community in the future.

1.1 Site Name or Sampling Area

Quartz Valley Indian Reservation and Shackleford Creek

1.2 Site or Sampling Area Location

The sampling locations are within the bounds of the Quartz Valley Indian Reservation, which comprises approximately 140 acres of land in Siskiyou County, California. Surface water samples will be taken from the reach of Shackleford Creek on the Reservation, which flows into the Scott River, a tributary of the Klamath River. Groundwater samples will be taken from each of the wells on the Reservation land.

The Quartz Valley Indian Reservation lies at approximately latitude 41° 35' 45"N, longitude 122° 58' 18"W, Township 43N, Range 10W, in portions of Sections 2, 3, 10, and 11, of the Greenview, California USGS 7.5-minute quadrangle.

Appendix B3: CLS Lab QA Information from ECORP Water Quality Study on QVIR

Appendix B3: CLS Labs QA Manual from ECORP Water Quality Study on QVIR

1.0 INTRODUCTION

The purpose of CLS Labs (CLS) Quality Assurance Manual is to document the minimum quality assurance requirements for the laboratory. This Quality Assurance Manual provides ready reference for analysts and clients on CLS's policy pertaining to the accuracy and reliability of analytical tests performed in the laboratory.

The policies contained within this CLS Quality Assurance Manual are intended to be generally applied to all laboratory operations. The manual is reviewed annually and updated as needed to provide for the addition of new methods and procedures as they are developed.

1.1 CLS ANALYTICAL SERVICES

CLS Labs (CLS) is an environmental testing laboratory providing a wide range of analytical services to both the public and private sectors. CLS laboratories are located in Rancho Cordova, California and features modern facilities and equipment. The staff is comprised of chemists, scientists, and technicians from a broad range of academic and environmental disciplines. The staff recognizes the need for high quality and legally defensible data, and the impact that this data has on the decisions of our clientele. It is our company mission to provide our customers with high quality and cost effective laboratory services that will meet and/or exceed our customers' expectations.

1.2 LABORATORY ORGANIZATION AND RESPONSIBILITY

Since the demands on an environmental testing laboratory can be great and diverse in nature, the CLS laboratories are structured into distinct and effective departments. These departments have clearly defined objectives and responsibilities that are directly involved in the analytical testing process. The structure of the CLS laboratories provides a method for high quality analytical operations while providing routes for Quality Assurance efforts to function unimpeded by the operational analysis of samples. The minimum responsibilities of laboratory personnel are defined as follows, with the laboratory organization outlined in Figure 1-1.

- **President, CEO**

  The President is responsible for the management of the entire laboratory, both financial and technical. It is the President's job to implement corporate goals, objectives, and policies. The President or Vice President is in direct communication with the Quality Assurance Manager.

- **Laboratory Director**

  Ultimate responsibility for laboratory operations and Quality Assurance is that of the Laboratory Director. The Laboratory Director communicates with the Quality Assurance Manager and General Manager to ensure that the CLS Quality Assurance Manual and SOPs

Appendix B4: Habitat Unit Characterization from ECORP Study of QVIR Feb 2004

					Stream Depth (inches)		Substrate							Cover		Instream Silt depth (inches)			Bank silt width/depth (feet)	
No.	Type	Characteristics	Unit Length	Average Width (ft)	Max	Avg	Silt	Sand	Gravel	Cobble	Boulder	Bedrock	Concrete	Canopy	Instream	L	C	R	L	R
1	HGR	HGR 2 major braids 1 minor	64.08	51	15	8	1	12	25	45	17	--	--	5	35	< .5	< .5	< .5	.2 / .2	.2 / .2
2	Shallow LGR	Pre-braid (2) SCP on river-right	82.95	87	10	8	3	5	35	32	25	--	--	5	5	< .2	< .2	< .2	.2 / .2	.2 / .2
3	LGR	Entire stream	150.6	30	15	10	1	4	45	25	20	--	--	0	5	< .2	< .2	< .2	.2 / .2	.2 / .2
4a	LGR	Mid-braid ideal spawn habitat	181.35	15	11	7	10	10	60	5	5	--	--	10	5	0.2	0	0.2	.2 / .2	1' / .2
4b	HGR	river-left braid above bridge	99.96	30	14	8	3	7	20	25	45	--	--	10	25	0.2	0	0.2	.2 / .2	2' / .2
4c	LGR	river-right braid	150.45	6	10	4	5	8	27	25	35	--	--	0	5	0.2	0	0.3	.2 / .2	1' / .2
5	HGR	Mid-braid	117.39	36	15	7	4	4	12	30	50	--	--	5	10	0.2	0.2	0	.2 / .2	1' / .2
6	LGR	right braid good spawn habitat	123.18	27	12	8	6	24	30	25	15	--	--	1	5	0.2	0	0.2	.5 / .2	1' / .2
7	HGR	swift	120.07	18	10	6	3	2	15	15	65	--	--	0	40	0.2	0	0.2	.2 / .2	.4 / .2
8	LGR	coho redd @ upstream end of site	69	17	14	7	2	10	45	25	18	--	--	0	20	< .2	0.3	< .2	.2 / .2	1' / .3
9	LGR	good spawn habitat	161	30	11	7	5	15	65	10	5	--	--	0	15	0.2	0.2	0.2	.4 / .2	.2 / .2
10	LSR	willow instream	50	35	24	11	10	15	55	15	5	--	--	30	20	0.8	0.2	0.2	.5 / .2	.2 / .2
11	HGR	small	15	17	9	6	2	3	43	37	15	--	--	0	20	0.2	0.2	0.2	.2 / .2	.2 / .2
12a	LGR	wide + long river-right braid	166.8	35	18	6	5	25	35	30	10	--	--	5	10	0.2	0.2	0.2	.2 / .2	.2 / .2
12b	LGR	river-left braid	560	15	11	6	2	3	5	25	65	--	--	2	3	0.2	0.2	0.2	.2 / .2	.2 / .2
13	HGR	swift	82.5	30	17	11	2	3	20	25	40	--	--	5	15	0.2	0.2	0.2	.2 / .2	.2 / .2
14	GLD	bush - river-right	45.72	28	28	12	1	9	25	35	30	--	--	10	5	0.2	0.2	0.2	.2 / .2	.2 / .2
15	LGR	uniform	135.5	38	12	7	1	4	20	55	20	--	--	0	3	0.2	0.2	0.2	.2 / .2	.2 / .2
16	HGR	wide last site - sign on tree	121.5	42	13	7	1	15	14	22	48	--	--	5	35	0.2	0.2	0.2	.2 / .2	.2 / .2
		Notes: stonefly hatch at time of survey entries that do not specify braid are where all braids have the same habitat type, or where all braids converge to form one channel																		

Appendix B5: Flow Measurement Data from ECORP Water Quality Study on QVIR

Site #1

	Stream Width =		**42.5**	**ft.**
Cell Width		**Cell Depth**	**Velocity**	**Q**
(ft)		**(ft)**	**(ft/s)**	**(cfs)**
13.5	16	1.00	0.14	0.35
16	18	1.00	0.22	0.44
18	20	0.80	0.72	1.15
20	22	0.80	0.90	1.44
22	24	0.75	0.87	1.31
24	26	0.60	1.08	1.30
26	28	0.70	1.22	1.71
28	30	0.85	0.75	1.28
30	32	1.10	0.64	1.41
32	34	1.15	0.73	1.68
34	36	1.35	1.03	2.78
36	38	1.30	0.94	2.44
38	40	1.40	1.56	4.37
40	42	1.40	1.45	4.06
42	44	0.90	1.83	3.29
44	46	1.10	1.49	3.28
46	48	0.95	1.47	2.79
48	50	0.85	1.25	2.13
50	52	0.60	1.35	1.62
52	54	0.40	0.97	0.78
54	56	0.15	0.00	0.00
Total Q =				**39.6**

Flow measurement Site #1 was located at the downstream end of Shackleford Creek, approximately 25 feet downstream of the Quartz Valley Road bridge, at the same location as surface water sample site #1: Northing 3072717.15, Easting 6294992.58.

Flow measurement Site #2 was located at the upstream end of Shackleford Creek, approximately 200 feet downstream of the QVIR property boundary, near surface water sample site #3: Northing 3072126.99, Easting 6293632.67.

Site #2

		Stream Width =	27.0	ft.
Cell Width		**Cell Depth**	**Velocity**	**Q**
(ft)		**(ft)**	**(ft/s)**	**(cfs)**
3.0	4.5	0.20	0.14	0.04
4.5	6.0	0.45	0.15	0.10
6.0	7.5	0.90	0.45	0.61
7.5	9.0	1.20	0.70	1.26
9.0	10.5	1.45	1.26	2.74
10.5	12.0	1.40	1.60	3.36
12.0	13.5	1.40	1.49	3.13
13.5	15.0	1.30	2.80	5.46
15.0	16.5	1.20	2.12	3.82
16.5	18.0	1.60	1.94	4.66
18.0	19.5	1.45	1.07	2.33
19.5	21.0	1.40	2.15	4.52
21.0	22.5	1.40	1.62	3.40
22.5	24.0	1.20	1.22	2.20
24.0	25.5	1.05	1.13	1.78
25.5	27.0	0.85	0.88	1.12
27.0	28.5	0.60	0.00	0.00
28.5	30.0	0.20	0.00	0.00
Total Q =				**40.5**

Appendix C: Laboratory Documents

Appendix C1: Sample Labels from Labs - CD

Appendix C2: Sample Chain of Custody and Custody Seals - CD

Appendix C3: Labs' & Consultant QA information - CD

Appendix C3-1: Jon Lee Consulting
Appendix C3-2: North Coast Laboratories
Appendix C3-3: Aquatic Analysts
Appendix C3-4: IEH Analytical Lab Certification
Appendix C3-5: QVIR Microbiology Lab
Appendix C3-6: IEH Analytical Lab QA Manual

Appendix D1: QVIR Field Activities Review Checklist

Sampling Location(s): Date(s) of Sampling: _________

Mark each topic "Yes," "No," or "NA" (not applicable), and comment as appropriate.

_______ All required information was entered into field logbooks in ink, and logbook pages were signed & dated. Comment:

_______ Deviations from SOPs , along with any pertinent verbal approval authorizations and dates, were documented in field logbooks. Comment:

_______ Samples that may be affected by deviations from SOPs were flagged appropriately. Comment:

_______ Field measurement calibration standards were not expired and were in the correct concentrations. Comment:

_______ Field calibrations were performed and results were within QAPP-specified limits for all parameters (Temperature, pH, Dissolved Oxygen, Conductivity, and Turbidity). Comment:

_______ Field measurement QC samples were within the QAPP-specified limits for all parameters. Comment:

_______ Field measurement data were recorded in the appropriate logbooks(s). Comment:

_______ Samples were collected at the correct sites. Comment:

_______ The correct number of samples for each type of analysis and the correct volume was collected. Comment:

_______ Certified clean sample containers, appropriate for the intended analysis, were used. Comment:

_______ Requested/required field quality control (QC) samples (Field blanks and field duplicates) were collected, and at the correct frequency. Comment:

_______ Samples were preserved with the correct chemicals, if required. Comment:

_______ Samples were stored and/or shipped at the proper temperature. Comment:

_______ Chain-of-custody documents were completed properly. Comment:

_______ Custody seals were applied and intact when relinquishing custody of the samples. Comment:

_______ Sample holding times were not exceeded during field operations. Comment:

Reviewer's Name (print):

Reviewer's Signature: ____
Reviewer's Title: ____
Quartz Valley Indian Reservation Tribal EPD Department
Date of Review: ___/___/_____

Appendix D2: QVIR Laboratory Data Review Checklist

Sampling Project:____

Date of Sampling:____

Analytical Laboratory:____

Mark each topic "Yes," "No," or "NA" (not applicable), and comment as appropriate.

______ Final data package includes chain-of-custody forms.
Comment:

______ Chain-of-custody forms were properly completed and signed by everyone involved in transporting the samples. Comment:

______ Laboratory records indicate sample custody seals were intact upon receipt.
Comment:

_____ Samples arrived at the laboratory at the proper temperature.
Comment:

_____ All requested analyses were performed and were documented in the analytical report. Comment:

_____ Analyses were performed according to the methods specified in the approved QA Project Plan.
Comment:

_____ Holding times for extraction and analysis were not exceeded.
Comment:

_____ Method detection and/or quantitation limits were included in the report.
Comment:

_____ A Narrative summarizing the analyses and describing any analysis problems was included in the final report. Comment:

_____ Data qualifiers and flags were explained in the analytical report.
Comment:

____ Method (laboratory) blank results were included for all analyses, at the appropriate frequency, and showed no laboratory contamination. Comment:

_____ Initial calibration data (if requested from the laboratory) were within QAPP, method, or laboratory SOP defined acceptance criteria for all analyses. Comment:

_____ Continuing calibration data (if requested from the laboratory) were within QAPP, method, or laboratory SOP defined acceptance criteria for all analyses. Comment:

_____ Matrix spike data were included for all pertinent analyses for every 20 samples.
Comment:

_____ Laboratory Control Sample data were included for all analyses for every 20 samples. Comment:

_____ Laboratory Duplicate data were included for all analyses for every 20 samples.
Comment:

_____ Field blanks do not contain analytes of interest or interfering compounds and included for all pertinent analyses for every 20 samples. Comment:

_____ Field Duplicates are within QAPP-defined acceptance criteria and included for all analyses for every 10 samples. Comment:

_____ Matrix spike results were listed and within QAPP or laboratory defined acceptance criteria. Comment:

_____ Matrix interferences were definitively identified either through a second analysis or use of Laboratory Control Sample Results. Comment:

_____ Laboratory Control Sample results were within QAPP or laboratory defined acceptance criteria.

Comment:

______ Laboratory Duplicate results were within QAPP or laboratory defined acceptance criteria.
Comment:

______ Reported results were within method detection or quantitation limits.
Comment:

Reviewer's Name (print):

Reviewer's Signature: ____

Reviewer's Title: ____

Quartz Valley Indian Reservation Tribal EPD Department:

Date of Data Review: __/___ /_____

Appendix D3: Field Water Quality Datasheets - CD

Appendix E: Field Equipment Manuals and Instructions - CD

- **Appendix E1: Garmin Rhino 650 GPS**
- **Appendix E2: SonTek Flow Tracker**
- **Appendix E3: HOBO Water Temp Pro Loggers**
- **Appendix E4: Van Dorn Sample Bottle Instructions**
- **Appendix E5: YSI 556 MultiProbe System Manual**
- **Appendix E6: YSI 6600 EDS MultiProbe System Manual**
- **Appendix E7: Model WQ770 Turbidity Meter**
- **Appendix E8: HOBO U20 Water Level Logger Manual**

Appendix F: Sampling Protocols - CD

- **Appendix F1: Rapid Bioassessment Protocol**
- **Appendix F2: NCWAP Methods Manual**
- **Appendix F3: SWAMP Protocol**
- **Appendix F4: Ground Water SOP**
- **Appendix F5: Surface Water SOP**
- **Appendix F6: Discharge Measurements SOP**
- **Appendix F7: Grazing Allottment SOP**
- **Appendix F8: HOBO Temperature Protocol**

Appendix G: Water Quality Standards - CD

- **Appendix G1: Basin Plan MCL Tables**
- **Appendix G2: EPA National Guidance WQ Standards**