

Title and Approval Page

TAHOE/TRUCKEE CITIZEN MONITORING QUALITY ASSURANCE PROJECT PLAN

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Sierra Watershed Education Partnership

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Adopt-a-Watershed

Signature: _____ Date: _____

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3. Distribution List

All group leaders, and technical advisors will receive copies of this Quality Assurance (QA) plan, and any approved revisions of this plan. Once approved, this QA plan will be available to any interested party by requesting a copy from the Lahontan Regional Water Quality Control Board (LRWQCB), South Lake Tahoe Office, contact Jill Wilson (530) 542-5449.

4. Project Organization

The Tahoe/Truckee Citizen Monitoring Project is a multi-organization project. Various citizen groups and independent citizen monitors will monitor and assess natural streams, storm drains and lakes in the Truckee River watershed and the Lake Tahoe Basin watershed. Current organizations involved in citizen monitoring include the Truckee River Watershed Council (TRWC), Truckee River Aquatic Monitors (TRAM), Marine Research and Education (MR&E), Incline Village General Improvement District Waste Not (IVGID Waste Not), Nevada Division of Environmental Protection (NDEP), Tahoe Regional Planning Agency (TRPA), and the Lake Tahoe Environmental Education Coalition (LTEEC). LTEEC further coordinates the activities of monitors associated with the following groups: citizens at Fallen Leaf Lake, Nevada Conservation Corps volunteers, Americorps volunteers, Lake Tahoe Community College Ecology Club, the League to Save Lake Tahoe, Tahoe Resource Conservation District, the Sierra Club, and other groups and schools.

Several resource agencies have assisted in the development of this project from its inception. Additional partnerships will be developed to ensure adequate technical support to all participating citizen monitoring groups. The QA plan reflects the diversity of monitoring and organizational support involved in this project. For the elements of this QA plan, we have addressed aspects that are shared with all groups as well as those aspects that are unique to individual groups. While the goals of monitoring may vary, the data quality objectives are consistent allowing us to compare data collected by different organizations.

Each of the participating organizations will identify in Appendix 1 the personnel whose responsibility it will be to perform the following functions,

- Project Managers (Leaders and Trainers)
- Equipment and Supply Management (including calibration)
- Data Management Coordinator
- Quality Assurance and Quality Control Officer

Technical Advisors

The Technical Advisors for the Tahoe/Truckee Citizen Monitoring Program are as follows:

Bill Ray, M.S. Chemistry, Quality Assurance Officer, California State Water Resources Control Board
Holly Sheradin, B.S. Agronomy, Statewide Citizen Monitoring Coordinator, California State Water Resources Control Board
Jill Wilson, M.S. Environmental Education, B.S. Environmental Biology, Environmental Specialist, Lahontan Regional Water Quality Control Board
Chris Rosamond, Ph.D. in progress, Benthic Macro-invertebrate Taxonomist, University of Nevada, Reno
John Kleppe, Ph.D. Electrical Engineering, Professor, University of Nevada, Reno
Rita Whitney, Water Quality Planner/Hydrologist, Tahoe Regional Planning Agency
Bob Richards, M.S. Zoology, Laboratory Manager, Tahoe Research Group
Betsy Julian, PhD Geology, Professor, Lake Tahoe Community College
Stephanie Heller, M.S. in Environmental Science, Hydrologist, U.S.D.A. Forest Service
Chuck Levitan, Ph.D. in Biology, Professor, Sierra Nevada College
Jason Kuchnicki, M.S. in Hydrology, Environmental Scientist III, Nevada Division of Environmental Protection
Beth Christman, Ph.D. in Ecology/Evolutionary Biology, Program Manager, Truckee River Watershed Council
Rick Susfalk, Ph.D. in Hydrology, Field Watershed Researcher, Desert Research Institute
Heather Segale, Environmental Education Coordinator, University of Nevada Cooperative Extension

5. Problem Definition/Background

5.1. Problem Statement

There is insufficient information to adequately assess the status of some of the aquatic resources in the Truckee River and Lake Tahoe Basin watersheds. Citizen monitoring organizations have been formed and are becoming active in local watersheds to address water quality concerns and to collect long-term data that is useful for assessing long-term trends and Total Maximum Daily Load (TMDL) implementation. If quality assurance is adequate, valuable information will be provided for watershed management and pollution prevention.

5.1.1. Regional Citizen Monitoring Mission and Goals

5.1.1.1. *Mission*

The mission of citizen monitoring is to produce environmental information that is needed to protect the Truckee River and Lake Tahoe Basin watersheds and aquatic resources. Citizen monitoring will also inform and engage the community in effective watershed stewardship.

5.1.1.2. *Watershed Goals*

The goals of citizen monitoring are:

- Identifying valued resources and watershed characteristics for setting management goals,
- Identifying physical watershed characteristics influencing pollutant inputs, transport and fate,
- Identifying the status and trends of chemical characteristics and biological resources in and around an aquatic environment,
- Screening for water quality problems,
- Identifying pollution sources and illegal activities (spills, wetland fill, diversions, discharges),
- Establishing trends in water quality for waters that would otherwise be un-monitored,
- Evaluating the effectiveness of restoration or management practices,
- Evaluating the effect of a particular activity or structure,
- Evaluating the quality of water compared to specific water quality criteria,
- Providing data that can be used to identify potential restoration projects, and
- Identifying “hot spots” (locations requiring further investigation)

In addition, citizen monitors build awareness of water quality issues, aquatic resources and pollution prevention.

This project will supplement existing agency information by monitoring streams in the Truckee River and Lake Tahoe Basin watersheds. The focus of the project is on habitat, chemical, physical and biological water quality measures that will identify the status of these aquatic resources. This information will be provided to the regulatory agencies. It is the agencies' responsibility to ensure that adequate and valid data are collected to meet their regulatory requirements.

5.2. *Intended Usage of Data*

Data will be collected and reported in a common format and used for general watershed assessment purposes. This assessment of this data will be useful in providing information for watershed management and pollution prevention. The data will be made available to the public for purposes of watershed education. It will also be made available to the regulatory and resource management agencies to supplement their existing data collection efforts. One potential application of the data will be to provide information to the Regional and State Boards for their potential use in Section 305(b) reporting and 303(d) listing or de-listing, and the development or implementation of TMDL's.

Data will be compiled by the data manager for each of the participating organizations and stored at the location listed in Appendix 1. The information will be collated and shared with the State Water Resources Control Board, the LRWQCB, and upon request to other state, federal, and local agencies and organizations. The collated information, recorded in a common spreadsheet format with hard copies and photos, will be stored by:

- TRPA – Lake Tahoe data
- TRWC – Middle Truckee River data
- NDEP – Lower Truckee River data

Data will also be available through the Tahoe Integrated Information Management System (TIIMS); a bi-state, multi-agency system developed to house and disseminate wide-ranging information about Lake Tahoe Basin planning and restoration efforts via the World Wide Web, at <http://www.tiims.org>. The citizen monitoring section of TIIMS will provide a wide spectrum of information regarding Snapshot Day from the raw data in spreadsheet format and this QA plan to highly refined information such as the final report, press releases and newspaper/newsletter articles. TIIMS users will learn how to get involved in citizen monitoring events and learn about the benefits of becoming a citizen monitor.

6. Project/Task Description

The citizen monitoring organizations will be monitoring water quality in the Truckee River and Lake Tahoe Basin watersheds. Physical, chemical and biological parameters will be measured, although not all groups are measuring all parameters. Appendix 1 identifies the monitoring design of the participating groups.

This QA plan only addresses data quality objectives for the following parameters:

- Temperature
- Dissolved Oxygen
- pH
- Conductivity
- Turbidity
- Suspended Sediment Concentration
- Fecal Coliform
- BMI's (Level 1 and 2)
- Nutrients
- Secchi Depth
- Streamflow

These analyses will be performed according to the methods described in Table 13.1 and will use the procedures given in the SWRCB Clean Water Team Compendium for Water Quality Monitoring and Assessment (Compendium) and the U.S. EPA Volunteer Stream and Lake Monitoring Manuals (Monitoring Manuals). Generally, streamflow measurements are collected from available USGS stream gages. In certain low flow or laminar flow instances the flow measurements will be determined in consultation with a qualified technical advisor(s) (from list on Page 4). In addition to the above list of measurements, occasionally citizen monitors may also collect grab samples for other constituents as requested.

This program will have a systematic method for visual and other sensory observations. A Stream/Shore Walk Visual Assessment observation sheet (modified from the *California SWRCB Stream/Shore Walk Visual Assessment* form), with instructions, that is included in the Compendium is used. Observations using the Stream/Shore Walk Visual Assessment observation sheet will be made, at a minimum, annually. Observational data include color, odor, presence of oil or tar, trash, foam, and algae. Secchi Disk measurements will be made in Lake Tahoe, Fallen Leaf Lake, Donner Lake, and other lakes according to the procedures of the Great American Secchi Dip-In, coordinated by Kent State University.

Volunteers may collect samples for, Total Suspended Solids, Total Organic Carbon, Nutrients, Metals, Oil and Grease, PAH's, Pesticides or other synthetic organic compounds, Toxicity, BMI's for CSBP Level 3 Taxonomic Analysis, and other parameters that will be sent to an agency, commercial, or academic laboratory for analysis. Section 11 contains references and instructions for the collection of samples. It has been determined that there will be no project-specific quality assurance and data quality objectives developed for the data generated for the above described parameters. Samples may be sent to any laboratory capable of performing analysis. The project accepts the data generated within the analyzing laboratory's internal quality assurance program and the project will not comment on its quality relative to data from the same test generated by other laboratories.

Physical habitat conditions will be assessed by groups, such as TRAM, using the California Dept. of Fish and Game Physical Habitat Assessment Form at each bioassessment sampling site. Physical habitat data include epifaunal substrate/available cover, embeddedness, velocity/depth regimes, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetative protection, and riparian vegetative zone width.

Benthic macroinvertebrate (BMI) bioassessment samples will be collected seasonally, from June through September. A committee of monitors determines sample sites at the beginning of the sampling season. Chemical and physical measurements will be performed, at a minimum, annually at the time of the BMI sampling. All sampling locations will be within the Middle Truckee River watershed. GPS coordinates of sampling sites will be included in the database.

7. Data Quality Objectives

This section identifies how accurate, precise, complete, comparable, sensitive, and representative our measurements will be. Objectives for these data characteristics are summarized in Tables 7-1 & 7-2. Data quality objectives were derived by reviewing the QA plans and performance of other citizen monitoring organizations (e.g. Chesapeake Bay, Texas Watch, Coyote Creek Riparian Station, Southern California Citizen Monitoring Steering Committee, Heal the Bay Malibu StreamTeam), considering the specifications of the instruments and methods that we will employ, and considering the utility of the data. For purposes of this QAPP the data quality will be considered adequate for the determination of general water quality conditions with a potential application of the data to Section 305(b) and 303(d) reporting purposes and TMDL's.

Table 7.1. Data Quality Objectives for Conventional Water Quality Parameters

Parameter	Method/range	Units	Detection Limit	Sensitivity*	Precision	Accuracy	Completeness
Streamflow**	USGS Gage/ Area-Velocity Equation	CFS	0.5 to 2	NA	±20 %	±25%	NA
Temperature	Thermometer (-5 to 50)	° C	-5	0.5 ° C	± 0.5 ° C	± 0.5 ° C	80%
Dissolved oxygen	Electronic meter/probe	mg/l	0.1 mg/l	0.1 mg/l	± 10%	± 10%	80%
Dissolved oxygen	Micro-Winkler Titration	mg/l	0.2 mg/l	0.2 mg/l	± 10%	± 10%	80%
Dissolved oxygen	Vacuum ampoule Indigo carmine	mg/l	1.0 mg/l	1.0 (1.0-6.0) 2.0 (6.0-12.0)	± 1.0 mg/l	± 1.0 mg/l	80%
pH	pH meter	pH units	2.0	0.1 unit	± 0.2 unit	± 0.2 unit	80%
pH	Non-bleeding strips (0-14 or 5 – 10)	pH units	0 or 5	0.5 unit	± 0.5 unit	± 0.5 unit	80%
Conductivity	TDS specific conductivity meter	µS/cm	10 µS/cm	10 µS/cm	±10µS(<100) ±10%(>100)	±10µS(<100) ±10%(>100)	80%
Conductivity	TDS specific conductivity meter - low	µS/cm	1 µS/cm	1 µS/cm	±1µS(<100) ±10%(>100)	±1µS(<100) ±10%(>100)	80%
Transparency	Transparency Tube	centi-meters	1 cm	1 cm	± 20%	± 30%	NA
Transparency	Secchi Disk	meters	1 m	1 m	± 20%	± 30%	NA
Turbidity	Nephelometer	NTU's	0.1	0.1	± 10%	± 10%	80%
Nutrients	See SOP from High Sierra Lab & TMWRF in Appendix 5						

NA: not applicable, some test methods will only be run on an as needed basis for specific purposes

* Some methods may vary in sensitivity over the range of detection. The specific range of readings is in parentheses.

** Streamflow is often acquired from USGS stream gages.

Table 7.2. Data Quality Objectives for Biological Parameters

Parameter	Method/range	Units	Detection Limit	Sensitivity	Precision	Accuracy	Completeness
Benthic Macro-invertebrates	Calif. Stream Bioassessment Protocol	N/A	Level 2 (Family level)	N/A	≤ 5% difference	≤ 5% difference	80%
Fecal Coliform Bacteria	Membrane Fecal Coliform (mFC)	CFU/100mL	1	1 CFU/100mL	Duplicates within 95% confidence limits	Positive standard within _ of an order of magnitude	80%

7.1. Accuracy

7.1.1. Chemical and Physical Parameters

Accuracy describes how close the measurement will be to its true value. Accuracy will be measured by comparing a known concentration against a measured value. The accuracy of chemical measurements will be checked by performing tests on standards at the quality control sessions held, at a minimum, annually or before every basin-wide Snapshot event. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner, e.g. a commercial or research laboratory. The concentration of the standards, known to the monitoring team leader, will be unknown to the monitors until after measurements are determined. The concentration of the standards will be within the mid-range of the equipment. The Data Quality Form: Accuracy, in Appendix 3, will be used to record accuracy.

7.1.2. Biological Parameters

Bacterial Analysis - Accuracy for bacteria will be determined by analyzing a positive control sample annually. A positive control is similar to a standard, except that a specific discrete value is not assigned to bacterial concentrations because bacteria are capable of mortality and reproduction. Instead of a specific value, an approximate target value of the bacterial concentration will be assigned to the sample by the laboratory preparing the positive control sample.

BMI Analysis - For BMI analysis, all samples identified to CSBP Level 2 by volunteers will be checked for taxonomic accuracy by the project QA/QC officer. Additionally, 20% of the samples identified to CSBP Level 2 by volunteers will be sent to an outside professional laboratory for validation. To ensure that samples are accurately identified, citizen macroinvertebrate analysts will have their taxonomic skills evaluated annually. Citizen analysts will have the option to become certified as Level One or Level Two taxonomists by passing identification tests of the common orders in the watershed or the common families of the major orders. The tests will be designed and administered by the project managers.

Macroinvertebrate taxonomists at the national level have called for formal taxonomic certification testing of all scientists performing taxonomy services in a professional setting to ensure accuracy of sample analysis. The State of California's Aquatic Bioassessment Lab (ABL) has noted that frequent quality assurance checks of samples, using interlaboratory QA testing are preferable to taxonomic certification. In a citizen monitoring setting, QA will be problematic because citizens do not have continuous access to a qualified mentor, as do trainees in a professional setting.

The groups conducting BMI sampling covered under this QAPP, primarily TRAM, will be comprised largely of non-professionals and will incorporate both taxonomic certification of citizens and interlaboratory QA checks to ensure the highest data quality possible from a citizen group.

Accuracy of BMI subsampling will be ensured by having each processed grid inspected by a project manager following completion of the subsampling procedure. If greater than 10% of the organisms in the grid are missed, retraining of the citizen monitors conducting the subsampling will occur. Taxonomic bias of missed organisms will also be recorded. If the taxonomic bias of missed organisms is determined to be significant by a project manager, the sample will be reconstituted and re-sampled, and the citizen monitors conducting the subsampling will be retrained.

7.2. Comparability

Comparability is the degree to which data can be compared directly to similar studies. Citizen monitoring groups will use the methods described in the following resource documents to ensure that their data can be compared to others:

- Monitoring Manuals,
- Compendium,
- California's Department of Fish and Game's (CDFG) California Stream Bioassessment Protocol (CSBP) for Citizen Monitors,
- Heal the Bay's Malibu Creek Stream Team Pilot Project, Shattering the Myths of Volunteer Monitoring, and
- San Francisco Estuary Institute's Volunteer Monitoring Protocols.

Before modifying these methods, or developing alternative or additional methods, technical advisors will evaluate and review the effects of the potential modification. It will be important to address their concerns about data quality before proceeding with the monitoring program.

7.3. Completeness

Completeness is the fraction of planned data that must be collected in order to fulfill the statistical criteria of the project. Volunteer data will not be used directly for legal or compliance uses. There will be no statistical criteria that require a certain percentage of data. However, it will be expected that 80% of all measurements will be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems.

We will determine completeness by comparing the number of measurements we planned to collect to the number of measurements we actually collected that were also deemed valid. An invalid measurement will be one that does not meet the sampling methods requirements and the data quality objectives. Completeness results will be checked quarterly for more routine monitoring and annually for Snapshot Day. This will allow us to identify and correct problems. The Data Quality Form: Completeness, in Appendix 3, will be used to record completeness.

7.4. Precision

7.4.1. Chemical and Physical Parameters

The precision objectives apply to duplicate and split samples taken as part of a QC session or as part of periodic in-field QC checks. Precision describes how well repeated measurements agree. The evaluation of precision described here relates to repeated measurements taken by either different volunteers on the same sample (at quality control sessions) or the same volunteer analyzing replicate samples (in the field). Sampling variability will not be covered in this section. The Data Quality Form: Precision, in Appendix 3, will be used to record precision.

7.4.2. Biological Parameters

Precision for bacterial parameters will be determined by having the same analyst complete the procedure for laboratory duplicates of the same sample. At a minimum this will be done once per day, or run duplicates on a minimum of 5% of the samples if there will be over 20 samples run per day. The results of the duplicates will be within the confidence limits supplied by the manufacturer.

By following the procedures outlined in Section 7.1.2, both accuracy and precision will be ensured for BMI samples.

7.5. Representativeness

Representativeness describes how relevant the data will be to the actual environmental condition. Problems can occur if:

- samples are taken in a stream reach that does not describe the area of interest (e.g. a headwaters sample for a large stream should not be taken downstream of a point source or in a smaller side tributary),
- samples are taken in an unusual habitat type (e.g. a stagnant backwater instead of in the flowing portion of the creek), and/or
- samples are not analyzed or processed appropriately, causing conditions in the sample to change (e.g. water chemistry measurements are not taken immediately or are not refrigerated properly).

Representativeness will be ensured by processing the samples in accordance with Section 10, 11 and 12, by following the established methods, and by obtaining approval of this document.

7.6. Method Detection Limit and Sensitivity

The Method Detection Limit is the lowest possible concentration the instrument or equipment can detect. This is important to record because we can never determine that a pollutant was not present, only that we could not detect it. Sensitivity is the ability of the instrument to detect one concentration from the next. Detection Limits and Sensitivities are noted in Tables 7.1. - 7.2.

8. Training Requirements

Snapshot Day: All Snapshot Day team leaders must participate in a minimum of two-hours of hands-on training on water quality monitoring conducted by the Clean Water Team of the SWRCB, the LRWQCB, the TRPA, and/or LTEEC.

Trained citizen monitoring leaders may then train their rank-and-file volunteers. Individual trainees will be evaluated by their performance of analytical and sampling techniques and by comparing their results to known values and results obtained by trainers and other trainees.

In addition to completion of the above described training course, the citizen monitoring leaders must participate in the Quality Control Sessions. The Quality Control Sessions will be supervised by Quality Control Trainers and will provide an opportunity for citizen monitors to check the accuracy and precision of their equipment and techniques. Quality Control Trainers are defined as water quality professionals from the Technical Advisory Committee (TAC) or approved participating partners such as, NDEP, SWRCB, or TRPA. Additional qualified trainers may be recruited and designated by the above agencies from experienced citizen monitoring organizations, universities and colleges, commercial analytical laboratories, and other federal, state, and local agencies.

The monitor will bring his/her equipment to the Quality Control Session. The monitor will conduct duplicate tests on all analyses and meet the data quality objectives described in Section 7. If a monitor does not meet the objectives, the trainers will re-train and re-test the monitor. If there is insufficient time at the QC session to re-train and re-test monitors, the monitor will be scheduled for an additional training session. The monitor will be encouraged to discontinue monitoring for the analysis of concern until training is completed.

The Quality Control Trainers will examine kits for completeness of components: date, condition, supply of reagents, and whether the equipment is in good repair. The Trainers will check data quality by testing equipment against blind standards. The trainers will also ensure that monitors are reading instruments and recording results correctly. Sampling and safety techniques will also be evaluated. The trainer will discuss corrective action with the monitors, and the date by which the action will be taken. The citizen monitoring leader is responsible for reporting back that the corrective action has been taken. Certificates of completion will be provided once all corrective action has been completed.

Macroinvertebrate Bioassessment: For macroinvertebrate bioassessment citizen monitoring leaders, experienced project managers who are proficient in following the CSBP protocol for citizen monitors will train new project managers. Formal three to five-hour field training sessions will be held at a minimum of once annually. Additional training will occur during subsequent field collection sessions. Laboratory training will occur during each three-hour lab session, held twice monthly between December and April. An individual will not be considered to be a project manager until it is determined by the existing project managers that their training is completed.

9. Documentation and Records

All field results will be recorded at the time of completion using the field data sheets in Appendix 4. Data sheets will be reviewed for outliers and omissions before leaving the sample site. The citizen monitoring leader will sign data sheets after review. Data sheets will be stored in hard copy form at the locations specified in Appendix 1. Field data sheets will be archived for at least three years from the time they were collected. If data entry is ever performed at another location, duplicate data sheets will be used, with the originals remaining at the locations specified in Appendix 1. Hard copies of all data as well as computer back-up disks will be maintained at the locations listed in Appendix 1.

All voucher collections, completed data quality control forms, and maintenance logs will also be kept at the locations specified in Appendix 1. The maintenance log details the dates of equipment inspection, battery replacement, and calibrations, as well as the dates reagents and standards are replaced.

10. Sampling Process Design

10.1. Rationale for Selection of Sampling Sites

Sampling sites are indicated on the maps in Appendix 2. The following criteria were evaluated when choosing sampling locations:

- access is safe,
- permission to cross private property is granted,
- sample can be taken in main river current or where homogeneous mixing of water occurs,
- sample is representative of the part of the water body of interest,
- location complements or supplements historical data, and
- location represents an area that possesses unique value for fish and wildlife or recreational use.

Any reference sites will be chosen upstream of any potential impact. A site chosen to reflect the impact of a particular discharge, tributary or land use will be located downstream of the impact where the impact will be completely integrated with the water, but upstream of any secondary discharge or disturbance.

Prior to final site selection, permission to access the stream will be obtained from all private property owners. If access to the site becomes a problem, the citizen monitoring leader will select a new site following the site selection criteria identified above. Safety issues are included in the Compendium.

The monitoring leader will review sample sites before sending volunteers out to the site. The leader will document permission and terms obtained from private landowners, and will file a Stream/Shore Walk form for the site, which will include a map, coordinates, and photographs.

10.2. Sample Design Logistics

Volunteers will be instructed to work in teams of at least two people. If a scheduled team cannot conduct the sampling together, the team leader will be instructed to contact the citizen monitoring leader so that arrangements can be made for a substitute trained volunteer.

Safety measures will be discussed with all volunteers. No instream sampling will be conducted if there are small creek flood warnings or lightning advisories. It will be the responsibility of the citizen monitoring organization to ensure the safety of their volunteer monitors. Safety issues are included in the Compendium.

11. Sampling Method Requirements

The Compendium and the Monitoring Manuals describe the appropriate sampling procedure for collecting samples for water chemistry. Water sampling apparatus may include Van Dorn Samplers, Niskin Bottles, Kemmerer Tubes, LaMotte Oxygen Samplers, DH 48 Sediment Samplers, extension pole type sampling devices, and hand held plastic containers. Benthic invertebrates will be collected with a D shaped kick net (0.5 mm mesh) mounted on a pole. In cases where glass bottles are required, plastic samplers are allowed as long as the hold time in the sampling device is minimal before transfer to the glass sample bottle. Sampling devices and sample bottles that are not pre-sterilized and do not contain preservatives/fixing agents will be rinsed three times with sample water prior to collecting each sample. Sterile bottles, whirl-paks, and sample bottles that do contain preservatives/fixing agents (e.g., acids, etc.) will never be rinsed with sample water prior to collecting the sample. Sample bottles containing preservatives/fixing agents will never be used for sampling; in these cases always use a sampling device to collect the sample prior to transferring the sample into the bottle.

Whenever possible, the collector will sample from a bridge so that the water body is not disturbed from wading. All samples will be taken approximately in mid-stream, at least one inch below the surface. If it is necessary to wade into the water, the sample collector will stand downstream of the sample, taking the sample upstream. If the collector disturbs sediment when wading, the collector will wait until the effect of disturbance is no longer present before taking the sample.

The following table describes the sampling equipment, sample holding container, sample preservation method and maximum holding time for each parameter.

Table 11.1 Sampling Method Requirements

Parameter	Sample Bottle	Preferred / Maximum Holding Times
<i>Conventional Parameters</i>		
Temperature	clear plastic bottle or sample directly	immediately
Dissolved oxygen	plastic bottle or sample directly	immediately / for wet chemistry fix per protocol instructions, keep cool, continue analysis within 8 hr.
pH	plastic bottle or sample directly	immediately
conductivity	plastic bottle or sample directly	immediately / refrigerate up to 24 hours
turbidity	plastic bottle	immediately / store in dark for up to 24 hr.
<i>Nutrients</i>		

Ammonia N	plastic bottle	immediately / up to 8 hours if the sample is acidified with sulfuric acid to less than 3.0 pH / sample may be frozen (do not acidify if freezing), analyze within 30 days after completely thawing
Nitrate N	plastic bottle	immediately / refrigerate in dark for up to 48 hours / sample may be frozen, analyze within 30 days after completely thawing
Ortho-Phosphate	plastic bottle	immediately / refrigerate in dark for up to 8 hours / sample may be frozen, analyze within 30 days after completely thawing
<i>Urban Pollutants – Field Measurements</i>		
Total Residual Chlorine	glass bottle	immediately
Phenols	glass bottle	immediately
Total Copper	plastic bottle	immediately
Detergents	glass bottle	immediately
<i>Laboratory Analysis of Chemical Parameters</i>		
Total Organic Carbon	acid and d.i. water rinsed glass sampling bottle, Teflon liner in lid	refrigerate to 4 degrees C, send to lab immediately
Metals	acid and d.i. water rinsed plastic sampling bottle	fix with Ultrapure (or comparable) nitric acid, send to lab immediately
Oil and Grease	solvent rinsed and dried glass amber sampling bottle, Teflon liner in lid	refrigerate to 4 degrees C, send to lab immediately
PAH's	solvent rinsed and dried glass amber sampling bottle, Teflon liner in lid	Fill sample container gently and allow no bubbles (do not fuel car before sampling), refrigerate to 4 degrees C, send to lab immediately
Pesticides and other synthetic organic compounds	solvent rinsed and dried glass sampling bottle, Teflon liner in lid	refrigerate to 4 degrees C, send to lab immediately
Toxicity	acid and d.i. water rinsed glass sampling bottle, Teflon liner in lid	refrigerate to 4 degrees C, send to lab immediately
<i>Biological Samples</i>		
Bacteria	sterile plastic sampling bottle or whirl-pak	Refrigerate to 4 degrees C in the dark; delivered to the lab within 4 hours, start analysis within 6 hours
BMI's	wide mouth plastic bottles	Fixed with ethanol immediately
Nutrients	See SOP from High Sierra Lab & TMWRF in Appendix 5	

12. Sample Handling and Custody Procedures

12.1. Sample Handling

Identification information for each sample will be recorded on the field data sheets, in Appendix 4, when the sample is collected. Samples that are not processed immediately in the field will be labeled with the water body name, sample location, sample number, date and time of collection, sampler's name, and method used to preserve the sample (if any).

12.2. Custody Procedures

The conventional water quality monitoring tests do not require specific custody procedures since they will, in most cases, be conducted immediately by the same person performing the sampling. In certain circumstances, such as driving rain or extreme cold, samples will be taken to a nearby residence for analysis. Samples requiring chemical preservation will be fixed prior to transport.

When samples are transferred from one volunteer to another member of the same organization for analysis or from the citizen monitoring group to an outside professional laboratory, a Chain of Custody form will be used. This form identifies the water body name, sample location, sample number, date and time of collection, sampler's name, and method used to preserve sample (if any). It also indicates the date and time of transfer and the names and signatures of both the sampler and the sample recipient. In cases where the sample remains in the custody of the monitoring organization, the field data sheet may be allowed to double as the Chain of Custody form. It is recommended that when a sample leaves the custody of the monitoring group, the Chain of Custody form used will be provided by the outside professional laboratory. Similarly, when a professional lab performs quality control checks, their samples will be processed under their chain of custody procedures with their labels and documentation procedures.

For BMI samples, the California Department of Fish and Game Aquatic Bioassessment Laboratory Chain of Custody form will be used.

12.3. Disposal

All analyzed samples, including used reagents, buffers, or standards will be collected in a plastic bottle clearly marked "Waste" or "Poison." The waste material will be disposed of according to appropriate state and local regulations. This usually means disposal into a drain connected to a sewage treatment plant.

13. Analytical Methods Requirements

Water chemistry will be monitored using protocols outlined in the Compendium and the Monitoring Manuals. The methods were chosen based on the following criteria:

- capability of volunteers to use methods,
- provide data of known quality, and
- methods can be compared to professional methods in *Standard Methods*.

If modifications of methods are needed, comparability will be determined by side-by-side comparisons with a US EPA or APHA Standard Method on no less than 50 samples. If the results meet the same precision and accuracy requirements as the approved method, the new method will be accepted.

Table 13.1 outlines the methods, any modifications to those methods, and the appropriate reference to a standard method.

Table 13.1 Analytical Methods for Water Quality Parameters

Parameter	Method	Modification	Reference (a)
Temperature	Thermometric	Alcohol-filled thermometer marked in 0.5°C increments	2550 B.
Dissolved Oxygen	Winkler Method, Azide Modification	Prepackaged reagents, 20 ml sample size	4500-O C.
Dissolved Oxygen	Membrane Electrode	none	4500-O G.
Dissolved Oxygen	Colorimetric indigo carmine	Vacuum ampoules	ASTM D 888-87
pH	Electrometric	none	4500-H B.
pH	Litmus indicator strips	Non-bleeding	Whatman Co.
Conductivity	Electrometric	none	2520 B.
Turbidity	Nephelometric	none	
Nutrients	See SOP from High Sierra Lab & TMWRF in Appendix 5		
Total Residual Chlorine	DPD Colorimetric	none	4500 - Cl G.
Fecal Coliform Bacteria	Membrane Fecal Coliform (mFC)	none	SM 9222 D
BMIs	California Stream Bioassessment Protocol	Level 2 (to family only)	Harrington, Jim, CDFG, 1997

(a) All of the above methods, with the exception of dissolved oxygen via indigo carmine, pH via non-bleeding indicator strips, turbidity via dual tube (JTUs), enterococcus bacteria, and BMIs are described in Standard Methods for the Examination of Water and Wastewater 20th Edition. American Public Health Association et al, 1998.

14. Quality Control Requirements

Quality control samples will be taken to ensure valid data are collected. Depending on the parameter, quality control samples will consist of blanks, replicate samples, and split samples. In addition, quality control sessions (a.k.a. intercalibration exercises) will be held to verify the proper working order of equipment, refresh volunteers in monitoring techniques, and determine whether the data quality objectives are being met.

14.1. Cautions Regarding Test Procedures (Winkler Titration)

The Winkler method is not appropriate for testing dissolved oxygen (DO) in highly alkaline waters. Other citizen monitoring groups have noted problems with a short shelf-life of the sodium thiosulfate reagent. To maximize shelf-life, keep the sodium thiosulfate in a cool, dark place and prevent contact with air when not in use. Field measurements of DO should be evaluated immediately to determine whether they are reasonable.

The validity of the DO test will also be assured by taking these steps:

- Care is taken not to aerate water samples during collection,
- Water is added gently to the DO bottle,
- No air bubbles are present in the sample,
- The titration sample will be measured carefully with a graduated cylinder, and
- The sample is swirled thoroughly after each drop of titrant,
- If the endpoint is overrun, another 20 ml. of the sample will be titrated.

14.2. Blanks, Replicates, Split Samples, and Standardization

Field/Laboratory Blanks: For all conventional water quality analyses, except temperature, dissolved oxygen and pH, field blanks will be analyzed once daily. For urban pollutants field blanks will be run daily. For bacterial analysis performed at a group's facility, a laboratory blank will be performed for each sampling/analysis event (see Table 14.1). Blanks, replicates, and split samples do not apply to BMI sampling. Instead, data quality objectives will be met using the procedures outlined in Section 7 of this document. Additionally, all samples will be stored in a safe location and are available for re-analysis by an outside lab at any time.

Instructions for Field and Lab Blanks: Distilled water will be taken into the field or used in the laboratory and handled just like a sample. It will be poured into the sample container and then analyzed. When reagents are used in a test method, the reagents will be added to the distilled water and these blanks will be referred to as reagent blanks. Field blanks will be recorded on the field data sheet. For bacterial analysis, the reagents are added to distilled water (in the same manner as a field sample) and that blank will be sealed in a quantitray and incubated along with the field samples. The blank should be below detection limits (i.e., no positive wells) at the end of the incubation period.

Field Confirmations: When a second method for measuring temperature, dissolved oxygen, and pH is available in the field, the monitors will be encouraged to perform both measurements on a split sample at least once daily. Examples of this sort of redundant measurement will be:

- for temperature, the use of an electronic thermometer (such as those that are built into dissolved oxygen meters) and an armored thermometer;
- for dissolved oxygen, the use of an oxygen meter and an indigo carmine colorimetric kit; and
- for pH, a meter and a non-bleeding indicator strip.

Field confirmations serve to provide backup if the more sensitive electronic meters fail and provide additional confidence to the quality of the data. The results of both measurements will be recorded along with the procedure used on the field data sheet. If both results are comparable then the result produced using the method of greater sensitivity will be the one entered into the final data set by the data manager in consultation with the monitoring leader. If the two results are inconsistent the monitoring leader will note on the data sheet which of the results will be entered on the final data set by the data manager.

Replicate Samples: Replicate samples are two or more samples collected at the same time and place. When there are only two replicates, they are referred to as duplicates. For conventional water quality analyses duplicate field samples will be taken once every 20 samples or quarterly, whichever comes first. Duplicate samples will be collected as soon as possible after the initial sample has been collected and will be subjected to identical handling and analysis. For bacterial analysis, lab

duplicates will be run at least once per sampling day. When there are more than 20 samples run per day, there will be a minimum 5% of the samples analyzed in duplicate.

Split Samples: Split spiked samples (standards) will be analyzed annually as part of a Quality Control Session. The split standard will be one sample, containing a known concentration of an analyte, which is divided equally into two or more sample containers. Split standards will be analyzed by the volunteers, and analyzed by the Quality Control Trainers or a professional laboratory (except for dissolved oxygen, temperature, and pH), before the maximum sample handling time is exceeded. Volunteers will analyze the split standard normally and will perform at least three analyses on that same sample. From these results accuracy and precision will be determined. The professional laboratory will analyze the sample using the method referenced in Table 13.1

For bacteria, split field samples or split positive controls will be analyzed by the citizen monitoring group and an outside professional laboratory twice annually. In addition, at the quality control session different analysts from the citizen monitoring group(s) will each read a minimum of the three quantitrays and compare their results. These results should be within \pm one well for concentrations of less than 1,000 MPN/100 ml, and within \pm two wells for concentrations of greater than 1,000 MPN/100ml.

Standardization of Instruments and Procedures: At the Quality Assurance Sessions the temperature measurements will be standardized by comparing our thermometers to a NIST-certified or calibrated thermometer in ice water and ambient temperature water. All meters (pH, conductivity, oxygen) will be evaluated at the Quality Assurance Session using standards provided with the assistance of a professional laboratory and/or the technical advisors. For oxygen meters the standard will be distilled water saturated with oxygen (zero DO). The Winkler kits for dissolved oxygen will be checked by standardizing the sodium thiosulfate solution in the test kit and/or by comparing the entire kit to a saturated oxygen standard (zero DO). Instructions for checking the sodium thiosulfate are included in the test kit. (Additional reagents and glassware must be purchased separately). If the result is unsatisfactory, as indicated in the instructions, the sodium thiosulfate and/or other reagent will be discarded and replaced with new reagents.

Continuous Monitoring Devices: Continuous monitoring devices must be calibrated and deployed according to the manufacturer's specifications and field confirmation will be performed using replicate sampling (for laboratory analysis) or standardized instruments. For example, there is the possibility of using in-situ continuous monitoring devices for flow or temperature measurements. Confirmations using a flow meter or a standardized field thermometer will be performed at the time of deploying and retrieving the device. This will serve to determine the accuracy of the continuous monitoring device.

Table 14.1 summarizes the quality control regimen.

Table 14.1 Summary of Quality Control Requirements

Parameter	Blank	Duplicate Sample	Split Sample to lab	QC session
<i>Water quality</i>				
Temperature	none	5% or a minimum of once a year	none	Annually*
Dissolved oxygen	none	5% or a minimum of once a year	none	Annually*
pH	none	5% or a minimum of once a year	none	Annually*
conductivity	daily	5% or a minimum of once a year	Annually	Annually*
turbidity	daily	5% or a minimum of once a year	Annually	Annually*
<i>Biological Parameters</i>				
Fecal Coliform Bacteria	daily	5% or a minimum of once per day	Annually	Annually*
Enterococcus Bacteria	daily	5% or a minimum of once per day	Annually	Annually*
BMIs	none	20% identified samples validated by outside laboratory		Annually*

*QC Sessions will be held annually at a minimum or before each Snapshot event.

15. Instrument/Equipment Testing, Inspection and Maintenance

The monitoring group leader will keep a maintenance log. The log details the dates of instrument and sampling gear inspection, calibrations performed in the laboratory, battery replacement, the dates reagents and standards are replaced, and any problems noted with instruments, samplers, or reagents.

15.1. Temperature

Before each use, thermometers will be checked for breaks in the column. If a break is observed, the alcohol thermometer will be placed in nearly boiling water so that the alcohol expands into the expansion chamber and forms a continuous column. Accuracy will be verified by comparing measurement with a calibrated or certified thermometer.

15.2. Dissolved oxygen

Dissolved Oxygen Winkler Titration: Before each use, bottles, droppers, and color comparators will be checked to see if they are clean and in good working order. Reagents will be replaced annually according to manufacturer's recommendation.

Dissolved Oxygen Meters: Membranes and solutions will be replaced at least quarterly and according to manufacturer's specifications. Membranes will be checked for bubbles after replacement. Before each use, DO meters will be checked to see if they are clean and in good working order. ___

15.3. Conductivity and pH

Before each use, conductivity will be pH meters are checked to see if they are clean and in good working order. Conductivity and pH meters will be calibrated before each use. Conductivity standards and pH buffers will be replaced at least annually. Conductivity standards will be stored with the cap firmly in place and in a dry place kept away from extreme heat. pH or conductivity standards will not be re-used.

Standards for conductivity for the Lake Tahoe Basin will be no higher than 1500 uS.

15.4. Turbidity

Nephelometers: Meters and tubes will be checked for cleanliness and proper operation. The tubes should not be smudged or scratched.

Due to the extremely low turbidity in the Lake Tahoe Basin, turbidimeters used in the Lake Tahoe Basin will be able to detect to 0.01-10 NTU for the lake, 1-50 NTU for streams (except stormwater).

16. Instrument Calibration / Standardization and Frequency

Instruments will be calibrated and reagents checked against standards accordingly to the following schedule. Standards will be purchased from a chemical supply company or prepared by (or with the assistance of) a professional laboratory. Calibration records will be kept in the maintenance log at the headquarters location (described in Section 5.2.) where it can be easily accessed before and after equipment use. Calibrations that are performed by monitors in the field will be recorded on the field data sheets, also archived at the location specified in Appendix 1. The frequency of calibration is described in Table 16.1.

Table 16.1 Instrument Calibration and Frequency

Conventional Water Quality Parameters		
Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used
Temperature	annually	NIST calibrated or certified thermometer
Dissolved Oxygen (Winkler)	Every 3 months	Check sodium thiosulfate and/or the entire kit against a saturated oxygen standard every 3 months.
Dissolved Oxygen meter	Every sampling day	At a minimum, water saturated air, according to manufacturer's instructions.
pH	Every sampling day	pH 7.0 buffer and one other standard (4 or 10)
conductivity	Every sampling day	Conductivity standard and distilled water
Turbidity meter (nephelometer)	Every sampling day	For clear ambient conditions use an 1.0 NTU standard, for turbid conditions use an 10.0 NTU standard
Dual Tube Turbidity	Every sampling day	Distilled water

17. Inspection/Acceptance Requirements

Upon receipt, buffer solutions, standards, and reagents used in the field kits will be inspected by the citizen monitoring leader for leaks or broken seals and to compare the age of each reagent to the manufacturer's recommended shelf-life. All other sampling equipment will be inspected for broken or missing parts and will be tested to ensure proper operation.

Before use, thermometers will be inspected for breaks. Eliminate breaks by heating (see Section 15.1). If not, they will be returned to the manufacturer.

Reagents will be replaced before they exceed manufacturer's recommended shelf-life. Shelf-lives are typically one to two years. Specific replacement dates can be determined by providing the reagent lot number to the manufacturer. Reagent replacement dates will be noted in the maintenance log.

18. Data Acquisition Requirements

18.1. Professional Analytical Data

Only certified analytical laboratories or academic laboratories (with approval of State and/or Regional Board staff) will be used for quality assurance checks and analysis of field samples. The TAC or technical advisors will review these laboratories' data as well as the volunteers. They may also review the lab's own quality control data to ensure data validity.

18.2. Geographical Information/ Mapping

USGS maps will be used to verify watershed boundaries and river courses. NOAA navigation charts can be used for mapping marine sampling sites. Additional information on distribution of natural resources will be obtained from the National Park Service and the CDFG's Biodiversity database. Land use information will be obtained from local planning offices. When information is requested, the agency will be asked to provide appropriate metadata and any information on data limitations. This information will be maintained with the data files and on TIIMS. If possible, sites will be selected from previously documented sample sites.

19. Data Management

Field data sheets will be checked and signed in the field by the citizen monitoring team leader. The project manager will check in with each citizen monitoring team leader to identify any results where holding times have been exceeded, sample identification information is incorrect, samples were inappropriately handled, or calibration information is missing or inadequate. Such data will be flagged by the monitoring leader and further reviewed to determine if it is acceptable for entrance into the electronic database.

Independent laboratories will report their results to the citizen monitoring leader. The leader will verify sample identification information, review the chain-of-custody forms, and identify the data appropriately in the database. The technical advisors also review these data quarterly.

The data management coordinator will review the field sheets and enter the data deemed acceptable by the citizen monitoring leader and the technical advisors. Upon entering the data the data management coordinator will sign and archive the field data sheets. Data will be entered into a spreadsheet (MS Excel) or a database (MS Access) in a way that will be compatible with EPA's STORET and the Regional WQCB's database guidelines. Following initial data entry the data coordinator will review electronic data, compare to the original data sheets, and correct entry errors. After performing data checks, and ensuring that data quality objectives have been met, data analysis will be performed.

Data will be provided to the State and Regional WQCB in electronic form at least once every two years so that it can be included in the 305(b) report. Appropriate quality assurance information may be provided upon request.

BMI data is currently stored as electronic files and as hard copies. The data are entered into spreadsheets (MS Excel) and 16 standard metrics are computed for each stream. The analyzed data are currently presented annually to the Regional WQCB.

20. Assessment and Response Actions

Review of all field and data activities is the responsibility of the citizen monitoring leader with the assistance of the technical advisory committee. Volunteers will be accompanied by the citizen monitoring leader or a technical advisor on at least one of their first five sampling trips. If possible, volunteers in need of performance improvement will be retrained on-site. All volunteers must attend a refresher course offered by the citizen monitoring group. If errors in sampling technique are consistently identified, retraining may be scheduled more frequently.

Within the first three months of the monitoring project, the State or Regional WQCB staff, or its designee, will evaluate field and laboratory performance and provide a report to the citizen monitoring group. All field and laboratory activities, and records may be reviewed by State and EPA quality assurance officers as requested.

21. Reports

The technical advisors will review draft reports to ensure the accuracy of data analysis and data interpretation. Raw data will be made available to data users per their request. The citizen monitoring organization(s) will report their data to its (their) constituents after quality assurance has been reviewed and approved by their technical advisors. Every effort will be made to submit data and/or a report to the State and/or Regional WQCB staff in a fashion timely for their data uses, e.g. 305(b) reports.

22. Data Review, Validation and Verification

Data sheets or data files will be reviewed quarterly by the technical advisors to determine if the data meet the Quality Assurance Project Plan objectives. They will identify outliers, spurious results or omissions to the citizen monitoring leader. They will also evaluate compliance with the data quality objectives. They will suggest corrective action that will be implemented by the citizen monitoring leader. Problems with data quality and corrective action will be reported in final reports.

23. Validation and Verification Methods

As part of standard field protocols, any sample readings out of the expected range will be reported to the citizen monitoring leader. A second sample will be taken as soon as possible to verify the condition. If the data is invalid, then the data will be flagged on the data sheet. Further actions will be taken to trace the sources of error and to correct those problems. If the error is a result of improper monitoring procedures, monitors may be re-trained until their performance is acceptable. It will be the responsibility of the citizen monitoring leader to re-train volunteers until performance is acceptable.

24. Reconciliation with DQOs

The TAC working with the monitoring leader(s) will review data quarterly to determine if the data quality objectives (DQOs) have been met. A quorum of 1/2+1 of the TAC will be required for committee decisions. If a quorum is not met at the meeting, work will still proceed. The work product (e.g., review and comments on data or reports) will then be sent out to the whole TAC for approval with a 30-day review period.

If data do not meet the project's specifications, the following actions will be taken. First, the technical advisors working with the monitoring leader(s) will review the errors and determine if the problem is equipment failure, calibration/maintenance techniques, or monitoring/sampling techniques. They will suggest corrective action. If the problem cannot be corrected by training, revision of techniques, or replacement of supplies/equipment, the technical advisors and the TAC will review the DQOs and determine if the DQOs are feasible. If the specific DQOs are not achievable, they will determine whether the specific DQO can be relaxed, or if the parameter will be eliminated from the monitoring program. Any revisions to DQOs will be appended to this QA plan with the revision date and the reason for modification. The appended QAPP will be sent to the quality assurance panel that approved and signed this plan. When the appended QAPP is approved, the citizen monitoring leader will work with the data coordinator to ensure that all data meeting the new DQOs are entered into the database. Archived data can also be entered.

APPENDIX 1. Monitoring Leaders and Plans

**Tahoe-Truckee Citizen Monitoring
 Quality Assurance Project Plan**

Group Name	Truckee River Watershed Council Snapshot Day
Project Managers	Beth Christman
Data Management Coordinator	Beth Christman
QA/QC Officer	Beth Christman
Equipment & Supply Manager (Responsible for Calibration & Accuracy Tests)	Beth Christman
Data and Records, Storage Location	Truckee River Watershed Council 10418 Donner Pass Road Truckee, CA 96161
Parameters Measured: Any of the following: temperature, pH, conductivity, turbidity, dissolved oxygen, nutrients, bacteria	
Frequency of Sampling: Annually, on Tahoe Truckee Snapshot Day	
Locations of Sampling: Any of the following creeks may be sampled in any one year	
Bear Creek	
Deer Creek	
Deep Creek	
Squaw Creek	
Pole Creek	
Silver Creek	
Trout Creek	
Martis Creek	
Cabin Creek	
Truckee River (multiple locations)	
Donner Creek	
Cold Creek	
Gray Creek	
Mystic Creek	

Bronco Creek
Trout Creek
Union Creek
Prosser Creek
Alder Creek
Sagehen Creek
Independence Creek
Boca Tributaries
Little Truckee River
Davies- Merrill Creeks
Upper Little Truckee River
Sagehen Creek

**Tahoe-Truckee Citizen Monitoring
 Quality Assurance Project Plan**

Group Name	Truckee River Aquatic Monitors
Project Managers	Beth Christman, Sid Harris, Meri McEneny, Chris Rosamond, Jill Wilson
Data Management Coordinator	Beth Christman
QA/QC Officer	Chris Rosamond
Equipment & Supply Manager (Responsible for Calibration & Accuracy Tests)	Beth Christman
Data and Records, Storage Location	Truckee River Watershed Council 10418 Donner Pass Road Truckee, CA 96161
Parameters Measured: Benthic Macroinvertebrates, Physical Habitat Assessment,	
Frequency of Sampling: 5-10 sampling events between June and September	
Locations of Sampling: Locations determined by project managers and volunteers prior to the beginning of sampling season. All sampling locations located within the Middle Truckee River watershed.	

See maps of monitoring sites in Appendix 2.

**Tahoe-Truckee Citizen Monitoring
 Quality Assurance Project Plan**

Group Name	Marine Research and Education
Project Managers	John Shearer
Data Management Coordinator	Jenny Francis
QA/QC Officer	Jenny Francis
Equipment & Supply Manager (Responsible for Calibration & Accuracy Tests)	Jenny Francis
Data and Records, Storage Location	900 Ski Run Blvd., Suite 102 South Lake Tahoe, CA 96150 (530) 544-7409
Parameters Measured: Transparency (Secchi Disc), Sensory Observations (oil, litter, color, odor), Oxygen, Temperature, TDS (conductivity)	
Frequency of Sampling: Once a month from November through March (winter conditions, little or no runoff), twice a month from April through June (spring runoff), once a month during July and August (summer, low runoff), and twice a month in September and October (early rainfall/runoff).	
Locations of Sampling: Station #1 in Ski Run Harbor and Station #2 offshore at N 38° 57.9' and W 119° 58.0'. An offshore alternate for station #2 is Station #2A (to be used during windy conditions) at N 38° 58.4' and W 119° 57.3'.	

**Tahoe-Truckee Citizen Monitoring
 Quality Assurance Project Plan**

Group Name	Lake Tahoe Environmental Education Coalition (LTEEC)
Project Managers	John Cobourn and Heather Segale
Data Management Coordinator	Heather Segale
QA/QC Officer	Heather Segale
Equipment & Supply Manager (Responsible for Calibration & Accuracy Tests)	Heather Segale
Data and Records, Storage Location	865 Tahoe Blvd. Suite 110 Incline Village, NV 89452-8208 (775) 832-4150

Frequency & Location of Sampling: The Lake Tahoe Environmental Education Coalition (LTEEC), through its Citizen Monitoring Working Group, is currently coordinating annual water quality snapshot events. At these snapshot events approximately 40 sites and 100 volunteers from area monitoring groups are involved in collecting visual observations, photographs, conventional water quality measurements and samples for laboratory analysis. A list of sample locations included in the 2001 Snapshot Day event and map of the sites are in Appendix 2. Sites change annually and can include focus on specific research topics such as TMDL.

List of Sites:

Truckee River Watershed:

Truckee River - Near Truckee

Truckee River - Near Truckee

Truckee River Dam Outlet

Squaw Creek

Shirley Creek

Steamboat Creek

Steamboat Creek

Trout Creek - Railroad Tracks near Truckee River

Bear Creek

North Shore Lake Tahoe Watershed:

Blackwood Creek

Dollar Hill Creek

Burton Creek

General Creek
McKinney Creek
Hatchery Creek at Star Harbor
Third Creek (Incline Village)
Incline Creek (Incline Village)
Ward Creek
Meeks Creek
Griff Creek (Kings Beach)
Marlette Creek (East Shore)
East Shore near Thunderbird Lodge
North Shoreline (Lake Tahoe)
Rosewood Creek (Incline Village)
South Shore Lake Tahoe Watershed:
Airport Reach
Angora
Trout Creek Behind LTCC
Christmas Valley
Edgewood
Upper Truckee (Elks Club to Golf Course)
Fallen Leaf Lake
Glen Alpine Creek (Fallen Leaf Lake)
Shoreline South Shore Lake Tahoe
Tahoe Keys
Trout Creek
Trout Creek (south of Pioneer Trail)
Heavenly Ski Area
Upper Truckee Moshier Reach
Cold Creek
Burke Creek
Taylor Creek

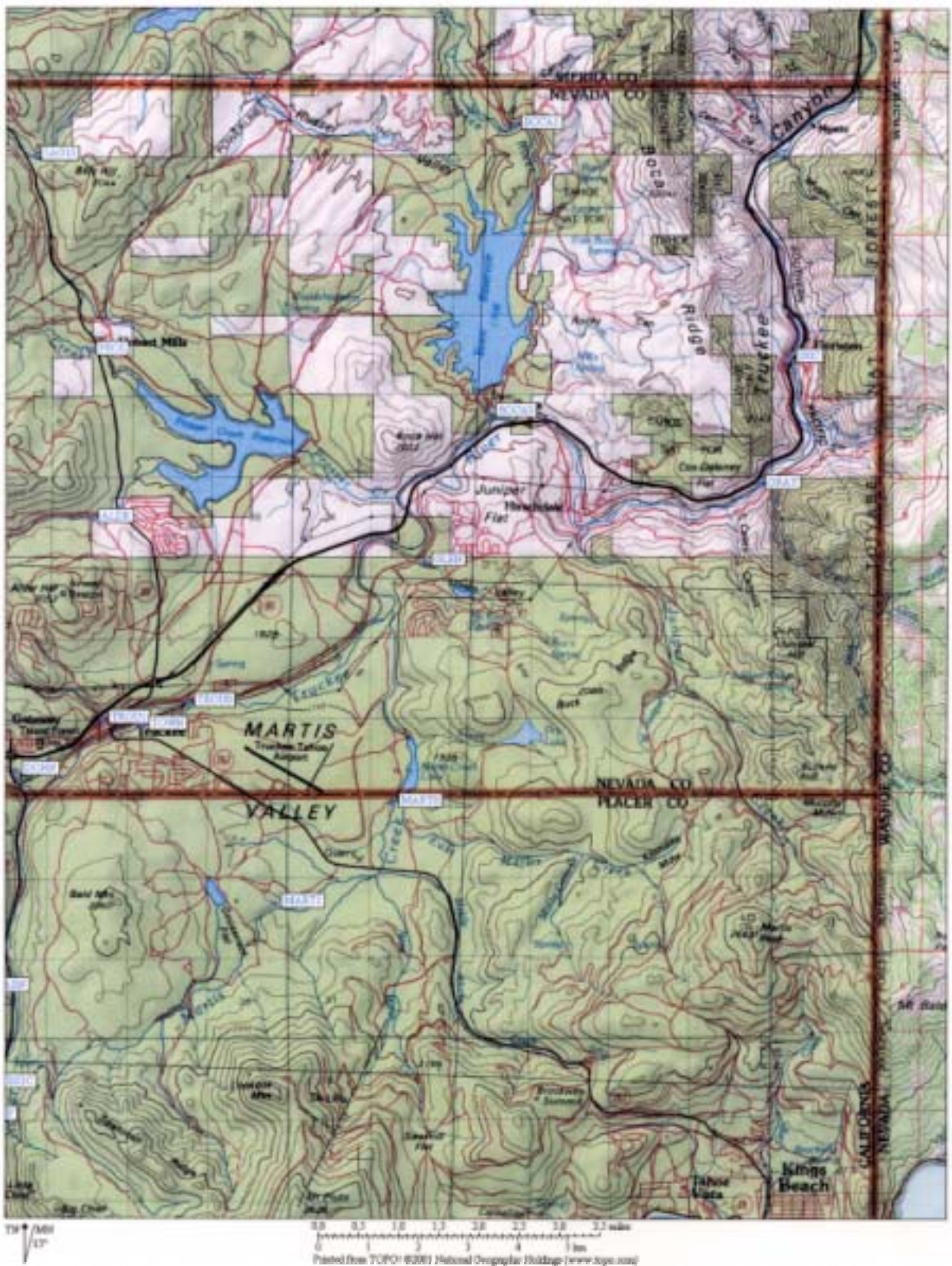
**Tahoe-Truckee Citizen Monitoring
 Quality Assurance Project Plan**

Group Name	Incline Village Clean Water Team, WASTE NOT, IVGID
Project Managers	Sarah Mae Tone, Resource Conservationist; Dominique Fellers, Resource Technician
Data Management Coordinator	Dominique Fellers/ Sarah Mae Tone
QA/QC Officer	Sarah Mae Tone
Equipment & Supply Manager (Responsible for Calibration & Accuracy Tests)	Dominique Fellers
Data and Records, Storage Location	WASTE NOT, IVGID
Parameters Measured: Nitrate (DN), Ammonium, Nitrogen (DNH4+), Total Suspended Sediment (TSS), Orthophosphate (SRP/OP), Total Phosphorous (TP), Fecal Coliform, Total Coliform, Total Kjedhal Nitrogen, Nitrogen (TKN), and visual and qualitative observations.	
Frequency of Sampling: Monthly and storm events	
Location of Sampling: Nine to eleven locations in Incline Village, Nevada. Locations on Third, Rosewood, Deer, and Incline Creeks.	

See map of locations in Appendix 2.

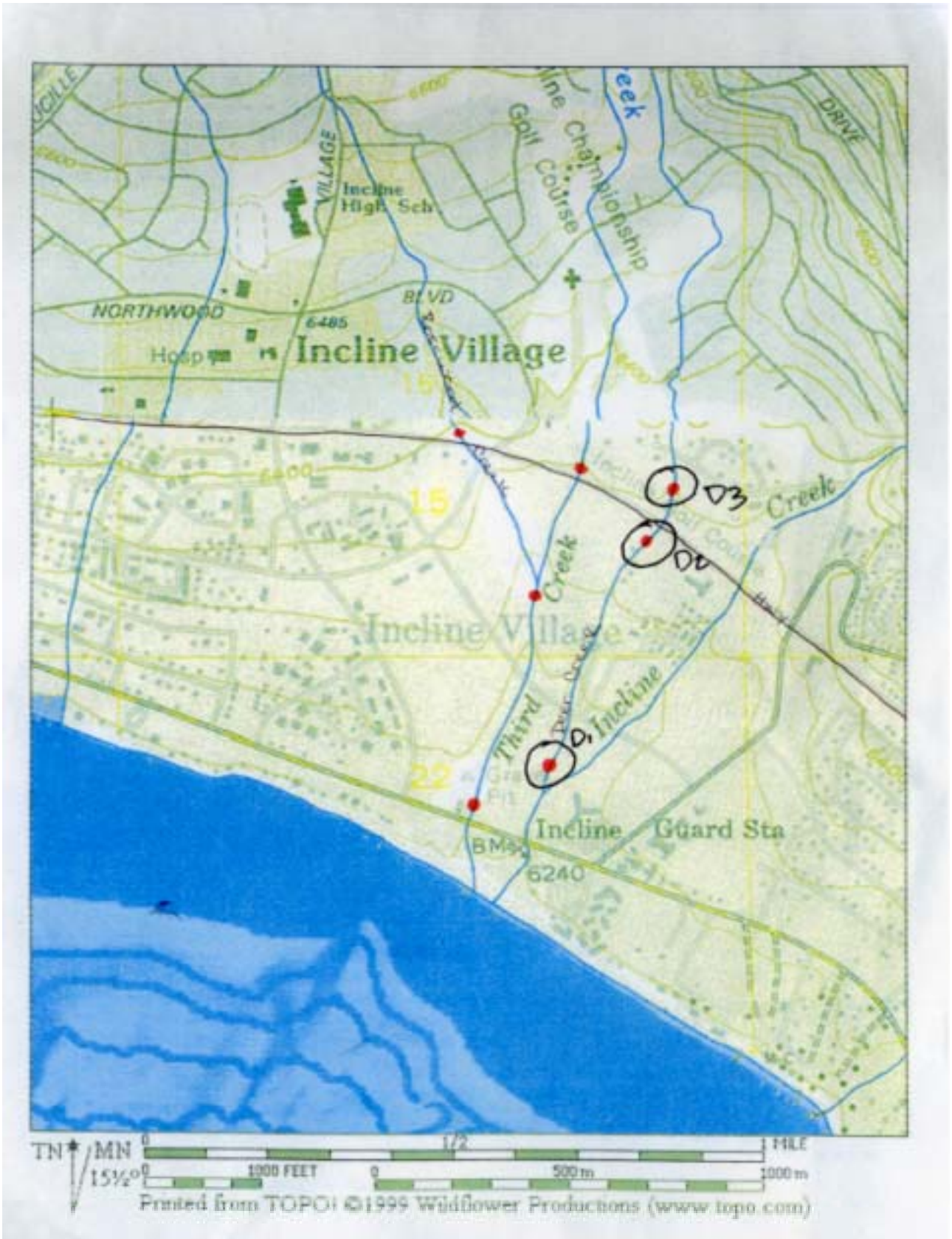
APPENDIX 2. Maps of Sampling Sites

TRAM Map 2



TRAM Map 3

IVGID Map



APPENDIX 3. Data Quality Forms

Data Quality Form: Accuracy

Quality Control Session

Monitoring Group Name	Type of Session (field or lab)
Your Name	Quality Assurance Leader
Date	

Parameter/ units	Sensitivity	Accuracy Objective	Standard Conc.	Analytical Result	Estimated Bias	Meet Objective? Yes or No	Corrective action planned	Date Corrective Action taken
Temperature °C								
Dissolved Oxygen (mg/l)								
pH standard units								
Conductivity (µS/cm)								
Turbidity (NTU)								

Comments:

Data Quality Form: Completeness

Quality Control Session

Monitoring Group Name			Type of Session (field or lab)	
Your Name			Quality Assurance Leader	
Date				
Parameter	Collection Period	No. of Samples Anticipated	No. Valid Samples Collected and Analyzed	Percent Complete
Temperature °C				
Dissolved Oxygen (mg/l)				
pH standard units				
Conductivity (µS/cm)				
Turbidity (NTU)				

Comments:

Data Quality Form: Precision

Quality Control Session

Monitoring Group Name	Type of Session (field or lab)
Your Name	Quality Assurance Leader
Date	

Parameter/ units	Mean (x)	Standard Deviation (s.d.)	s.d./x	Precision Objective	Meet Objective? Yes or No	Corrective action planned	Date Corrective Action taken
Temperature °C							
Dissolved Oxygen mg/l							
pH standard units							
Conductivity (µS/cm)							
Turbidity (NTU)							

Comments:

APPENDIX 4. Data and Observation Forms

FIELD DATA SHEET

Location:	
Latitude and Longitude:	
Date:	
Field Sampler:	
Calibration	
<u>Instrument id#</u>	<u>Standard</u> <u>calibration date and time</u> <u>first reading</u> <u>adjusted to</u>
time, military	station description (circle): stream shore dock vessel
depth of station, meters	
sampling device (if used)	rain in last 24 hours? yes no
depth of sample, meters	weather conditions:
Field measurements	Instr.ID <u>results (3 reps)</u>
water temperature, C	lake/ocean conditions
dissolved oxygen, ppm	
pH	
conductivity, μ S/cm	
turbidity (NTU)	Samples Collected
Air temp (different thermometer)	
	no. of people in water _____ no. pets in water
Secchi depth in meters	
Comments:	
Post Measurement Tests	(test the standards again)
<u>Instrument id#</u>	<u>date and time</u> <u>Standard</u> <u>result</u>
Sensory Observations:	Code
Odor	
Algae	
Foam	
Turbidity	
Flow	
Oil	
Litter	
Color	

Reviewed by:
 Data entry by:
 Checked by: