**Quality Assurance Project Plan**

**For**

**The Silver City Watershed Keepers**

**December 2013**

**QAPP Version No. 1.0**

*Prepared by:*

**SILVER CITY WATERSHED KEEPERS**

**and**

**GILA RESOURCES INFORMATION PROJECT**

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*Funded by:*

The Corporation for National and Community Service - AmeriCorps VISTA, Office of Surface Mining, Southwestern Conservation Corps, Western Hardrock Watershed Team, and Gila Resources Information Project.

*Prepared for:*

Schools, Citizens, and Volunteers conducting and participating in Silver City Watershed Keepers monitoring events in the San Vicente Watershed, Agency personnel assisting with Silver City Watershed Keepers monitoring events, and any entities utilizing data generated from the Silver City Watershed Keepers program.

**TITLE PAGE**

**Silver City Watershed Keepers Water Monitoring Program**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Project Name)

**Gila Resources Information Project**

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(Responsible Agency)

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(Date)

**Allyson Siwik**

*Project Manager \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_*

Typed Signature Date

**Dave Menzie**

*Project QA Officer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_*

Typed Signature Date

**Madeline Alfero**

*Project Field Coordinator \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_*

Typed Signature Date

*Technical Advisory \_\_\_\_\_***Jeff Hill***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_*

*Committee Rep.* Typed Signature Date

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1. Project Manager

2. QA Officer

3. MA Agency Project Manager

1. MA Agency QA Officer
2. Project Field Supervisor
3. Project Lab Supervisor
4. Key Volunteers
5. Aldo Leopold Charter School
6. Gila Resources Information Project
7. Town of Silver City
8. New Mexico Environment Department – Surface Water Quality Bureau

A file copy of this approved QAPP will be maintained in the GRIP host office for the SCWK at 305 A. North Cooper Street, Silver City, NM 88061, and will be accessible for all volunteers and interested community members to examine. For more information, contact Gila Resources Information Project by calling: 575-538-8078 or emailing: [andrew@gilaresources.info](mailto:andrew@gilaresources.info).

**Table 3.1 Distribution List**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Affiliation/Role** | **Address** | **Phone** | **Email** |
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**4. PROJECT/TASK ORIENTATION**

The Silver City Watershed Keepers Technical Advisory Committee (SCWKTAC) is the primary entity responsible for supporting and coordinating the Silver City Watershed Keepers (SCWK) program in the Silver City Watershed. The SCWKTAC provides support services to the monitoring program, including: basic trainings, public communications, educational materials/events, equipment coordination, sampling/measurement assistance, assistance with data entry/analysis, and assistance with report writing and review/distribution. The SCWKTAC is comprised of the community partners and concerned community citizens.

The project manager will be responsible for all project activities for the SCWK program, and oversees the deployment and evaluation of the SCWK QAPP. The quality assurance officer is responsible for ensuring that all aspects of the SCWK monitoring project follows the quality assurance requirements outlined in the QAPP. The field coordinator organizes all the elements of the field monitoring program, providing the following: training to volunteers, access to equipment and documents, and assessing field monitoring performance in accordance with QAPP outlines. Field monitoring volunteers are responsible for conducting quantitative and qualitative assessments of water quality at each SCWK monitoring sites, recording observations and measurements on data sheets, and entering collected data in the SCWK monitoring database.

The New Mexico Environment Department – Surface Water Quality Bureau (NMED-SWQB) is a partnering organization with the SCWK. The role of the NMED-SWQB in the SCWK monitoring project is to be available upon request to: provide specialized equipment such as flow meters and mulit-parameter SONDES, provide appropriate trainings, and review monitoring data and reports of concern. The SCWK will report to the NMED-SWQB when the collected monitoring data do not meet established NM water quality standards.

**Figure 4.1 Organizational Chart**

Silver City Watershed Keepers Technical Advisory Committee

NMED-SWQB

Project Manager

Field Coordinator

QA Officer

Field Monitoring Volunteers

Table 4.1 Key Personnel

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **Responsibility** | **Name** | **Address / Phone / email\*** |
| Responsible Agency | Fiscal management of the project, project objectives, data uses, program changes, etc. | Gila Resources Information Project | 305 N. Cooper St., Silver City, NM 88061  (office) 575-538-8078  grip@gilaresources.info |
| Technical Advisory Committee | Primary assistance in identifying project objectives, data quality objectives and methods, and oversight of project assessment. | To Be Assigned | To Be Assigned |
| Project Manager | Directs all project activities for the agency and oversees development and evaluation of the QAPP, member of Technical Advisory Committee. | Allyson Siwik | 305 N. Cooper St., Silver City, NM 88061  (office) 575-538-8078  grip@gilaresources.info |
| QA Officer/QAPP writer | Assists with or writes the QAPP and ensures that all elements of the project follow QA procedures in the QAPP. | A.J. Sandoval | 305 N. Cooper St., Silver City, NM 88061  (office) 575-538-8078  andrew@gilaresources.info |
| Monitoring Project Coordinator (Field Coordinator) | Coordinates all elements of the field monitoring, provides training to volunteers and assesses field monitoring performance, member of Technical Advisory Committee. | Madeline Alfero | Aldo Leopold Charter School  1422 Hwy. 180 E., Silver City, NM 88061  (office) 575-574-2902  jmcintosh@aldohs.org |
| QA officer | Reviews the QAPP for accuracy and completeness, member of Technical Advisory Committee. | Dave Menzie | [3082 32nd St. Bypass](http://maps.google.com/maps?f=q&hl=en&geocode=&q=3082+32nd+Street+Bypass,+Silver+City,+New+Mexico+88061&sll=37.0625,-95.677068&sspn=34.861942,59.238281&ie=UTF8&t=h&g=3082+32nd+Street+Bypass,+Silver+City,+New+Mexico+88061&latlng=32789684,-108242407,7778070239806016598&ei=nHRaSa-4EomsNpzH7fwM&cd=4) - Suite D, Silver City, NM 88061  (office) 575-956-1548  david.menzie@state.nm.us |

\* Title, Responsibility, Name, and Contact items marked in red are not confirmed.

**5. PROBLEM DEFENITION/BACKGROUND**

The Silver City Watershed Keepers (SCWK) is a volunteer environmental quality monitoring group coordinated by the Gila Resources Information Project (GRIP). Volunteers donate their time and talents to help protect our local Silver City watershed near where they live, work, and play through monitoring, community outreach, and education. The SCWK was created in 2010, as part of the Office of Surface Mining/Volunteers In Service To America (OSM/VISTA)’s Western Hardrock Watershed Team (WHWT) three-year grant program awarded to GRIP (2010-2013), and a 4th year extension (2013-2014). The OSM/VISTA WHWT grant provides GRIP with a full-time volunteer position that fulfills the mission of the WHWT “to address environmental degradation and community impoverishment, providing rural mining communities with the skills and capacity they need to make their neighborhoods / watersheds better places to live and work.” Coordinated by the OSM/VISTA member, GRIP has been able to mobilize community members to become “citizen scientists” for the SCWK.

The goals of the Silver City Watershed Keepers (SCWK) include: 1) Maintain a reliable and credible database of baseline water quality/quantity, potential/existing streambank and trail erosion, and potential/existing point and non-point source pollution monitoring data to determine if San Vicente Creek is impaired and the possible extent of impairment; 2) to interpret and compare the collected data against existing NM state water quality standards, and make recommendations, when applicable, to the NMED-SWQB; 3) to use the SCWK monitoring program as a tool for environmental education in both the community and in classrooms; 4) to use the SCWK monitoring program and outreach materials to breed awareness of current and potential issues affecting the Silver City Watershed in the community; 5) to increase the frequency of watershed data collected within the Silver City Watershed, and to share the collected data with the NMED-SWQB.

The SCWK focus primarily on the San Vicente Watershed; located in Grant County, NM, with the southern perennial reaches flowing through downtown Silver City. The Silver City Watershed is a sub-watershed to the larger Mimbres River Watershed. The main stem of the San Vicente Watershed is San Vicente Creek, which is the perennial reach that flows through downtown Silver City, starting in a stabilized and entrenched channel called “The Big Ditch.” The majority of the perennial San Vicente Creek is owned by the Town of Silver City, where access to the creek is not only available, but encouraged with the existing Big Ditch Park, the San Vicente Creek Trail and Park, and proposed Silver City Greenways Project. The public amenities listed above give Silver City residents and tourists direct opportunities to interact with the San Vicente Creek riparian zones and perennial waters. Over the years, citizens of Silver City have voiced numerous concerns questions about the quality of the water in San Vicente Creek, many of which are addressed by the NMED-SWQB in the “Water Quality Survey Summary for the Mimbres River Watershed,” which is an investigation and publication completed every seven years in the Mimbres River Basin. According to the latest NMED-SWQB report published in 2009, the San Vicente Arroyo has “exceeded dissolved oxygen and nutrient standards associated with its warm water aquatic life designation. Stream flow conditions and water quality at the time of this survey indicate that this stream may have intermittent or ephemeral reaches. Additional data will be collected before a TMDL [total maximum daily load] is scheduled.” In addition, in the 2012-2014 State of New Mexico Clean Water Act §303(d)/§305(b) Integrated Report, Appendix A, List of Assessed Surface Waters; Designated Uses are listed as: livestock watering, primary contact, warm-water aquatic life, and wildlife habitat, all of which are fully supporting except warm-water aquatic life; Probable Causes of Impairment include Nutrient/Eutrophication Biological Indicators; and Probable Sources of Impairment are unknown.

In Summary, San Vicente Creek has failed to meet some of the designated water quality standards set by the NMED, San Vicente Creek is being accessed and interacted with by community members, tourists, and pets, and there is insufficient and non-regular water quality monitoring ongoing within the San Vicente Watershed. The SCWK are striving to alleviate mounting concerns about the water quality in San Vicente Creek by increasing the frequency of collected water quality data via quarterly “citizen science” monitoring events, and sharing the results with the NMED-SWQB either confirming or alleviating public concern through community collected data. The hope is that with reports of public concern with supporting water quality data, the NMED will become more compelled to initiate follow-up studies and any applicable remediation projects.

Throughout the past four years, the SCWK and the OSM/VISTA member project coordinator have partnered with the New Mexico Environment Department – Surface Water Quality Bureau (NMED-SWQB), in which NMED-SWQB personnel have been available to provide training on instrumentation, measurement and sampling procedures, data recording methods, database structure, and be present at every scheduled monitoring event. However, as the SCWK program continues to grow within the community, there is a need for a Quality Assurance Project Plan (QAPP). A QAPP would provide current and future community volunteers, and existing and potential community partners with a document that provides an opportunity to improve on the reliability and credibility of the SCWK data; integral to providing the Silver City community with safe and enjoyable places to live and work.

**Tables 5.1 Summary of the Current Status of Waters of Interest**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Assessment Unit ID:** | **Designated Uses (from 305b report)** | **Actual Uses & Values Apply to Designated Uses? Y or N (from your own experience)** | **Waters Assessed? Y or N (from 305b report)** | **Uses Supported? Y or N (from 305b report)** |
| NM-9000.A\_025 | Livestock Watering | No | Yes | Yes |
| NM-9000.A\_025 | Primary Contact | Yes | Yes | Yes |
| NM-9000.A\_025 | Warmwater Aquatic Life | Undetermined | Yes | No |
| NM-9000.A\_025 | Wildlife Habitat | Yes | Yes | Yes |

**Tables 5.2 Summary of the Current Status of Waters of Interest**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Assessment Unit ID:** | **Source of Impairment  (from 303d list)** | **Cause of Impairment (from 303d list)** | **Known Problems, Conflicts, or Threats (from your experience or other studies)** | **Known Efforts To Address Problems (from your experience or other studies)** |
| NM-9000.A\_025 | Source Unknown | Nutrient/Eutrophication Biological Indicators | Various forms of non-point source pollution (trash, storm drains) and low spring groundwater input | Occasional trash cleanups and ongoing water quality monitoring |

**6. PROJECT TASK/DESCRIPTION**

**Work Statement and Produced Products:**

The SCWK will continue monitoring the perennial reaches of San Vicente Creek, at the 6 existing SCWK monitoring stations (Table 6.1), adding to the existing database of water quality data collected quarterly. The program also relies on the existing NMED-SWQB database for water quality data in the greater Mimbres Watershed to both fill in and confirm the quality of SCWK data. The monitoring program is designed to continuously measure the quality of San Vicente Creek water at a higher frequency than the NMED-SWQB, at minimum quarterly, thus alleviating some of the burden of citizen concern.

The SCWK will provide monitoring reports to the NMED-SWQB and the public regarding the quality of San Vicente Creek water, when the most recent NM water quality standards for designated use are not met. In addition, the entire SCWK water monitoring database will be open to the public and available upon request.

**Monitoring Parameters and Measurement Techniques:**

Six monitoring sites will be established in the project (see Figure 6.1). Each monitoring site will be assessed for qualitative characteristics, including: weather conditions, site location and sketch map, stream characterization, watershed features, riparian vegetation, aquatic vegetation, and sediment / substrate; and quantitative measurements, including: water and air temperature, pH, conductivity, dissolved oxygen, phosphates, nitrates, turbidity, and when possible, E. coli. Stream flow will also be recorded using a portable velocity meter provided by the NMED-SWQB when available. Samples for E. coli will be collected during normally scheduled monitoring events, and samples will be dropped off at the Silver City Waste Water Treatment Plant for processing. Sampling and measurement techniques and procedures are detailed in the Silver City Watershed Keepers Standard Operating Procedures.

**Project Schedule:**

The SCWK monitoring program is continuous and community driven. Routine baseline measurements and sampling, when water is present, will provide consistent and targeted data throughout each year; allowing the SCWK staff to make sound judgments about water quality and inform the NMED-SWQB when concern arises. E. coli should be sampled on a quarterly basis, when resources are available. Volunteer recruitment and engagement will continue throughout each year on a continuous basis, and will primarily focus on local students within the school year (August – May). During the summer months, community groups and community wide events will be held to engage volunteers. Data processing and interpretation will occur directly after each field monitoring event. Monitoring results will be available to the public upon request at the SCWK headquarters at the Gila Resources Information Project office.

**Geographical Setting:**

The San Vicente Creek Watershed (SVW) is a sub-watershed, part of the greater Mimbres Watershed, located in Grant County, NM. The San Vicente Watershed drains a catchment area of approximately 18 mi², with the headwaters in the Pinos Altos Range on the Continental Divide. The SVW drains out through downtown Silver City, NM in San Vicente Creek in an entrenched and stabilized channel known as “The Big Ditch.” San Vicente Creek is the only perennial reach within the SVW, and starts at the confluence of Silva Creek and Pinos Altos Creek, also located in downtown Silver City, NM south of Hwy. 180. The perennial reach of San Vicente Creek runs for approx. 1.2 miles from the Silva Creek and Pinos Altos Creek confluence down to the “Wetland Habitat Restoration Site” and the southern extent of Slout Farm. The average elevation of the perennial San Vicente Creek is approx. 5900 feet above sea level.

There are six SCWK monitoring sites in total, located in the lower reaches of Silva Creek and Pinos Altos Creek, and along the perennial sections of San Vicente Creek. The Silva Creek and Pinos Altos Creek sites are located immediately downstream of the Hwy. 180 bridges crossing both arroyos; these two sites are intermittent after storm events and spring melt. The four monitoring sites along San Vicente Creek are located at the following points of reference: (1) Big Ditch Park upstream from pedestrian walking bridge, (2) bedrock pools under Hwy. 90/Hudson St. bridge underpass, (3) San Vicente Creek crossing at southern extent of San Vicente Mill cleanup site, and (4) San Vicente Creek at the southern extent of the landfill site (see table 6.1 and figure 6.1).

**Table 6.1 Project Site Locations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Site ID** | **UTM Location** | | | **Water Body** | **Physical Description** |
| **Zone** | **Easting** | **Northing** |
| Site 1 | 12 S | 0755217 | 3629371 | San Vicente Creek | In Big Ditch Park, upstream from walking bridge stationed on grade control structure |
| Site 2 | 12 S | 0755344 | 3628626 | San Vicente Creek | Near San Vicente Creek Trail – trail head, downstream from Hwy. 90 overpass at rocky outcrop on right bank |
| Site 3 | 12 S | 0755817 | 3627993 | San Vicente Creek | On San Vicente Creek Trail near stream crossing at San Vicente Mill Site Tailings Cleanup Site |
| Site 4 | 12 S | 0755644 | 3628391 | San Vicente Creek | On San Vicente Creek Trail immediately downstream of southern extent of informal landfill site |
| Site 5 | 12 S | 0754786 | 3630275 | Silva Creek | On Silva Creek, downstream from Hwy. 180 bridge at rocky outcrops in stream bed |
| Site 6 | 12 S | 0756019 | 3630576 | Pinos Altos Creek | On Pinos Altos Creek, downstream from Hwy. 180 bridge at rocky outcrops in stream bed |

**Constraints:**

All the sampling and physical water quality measurements are constrained by the need for surface water to be present at each designated monitoring site. Qualitative assessments of the monitoring sites can still be performed in the absence of flowing surface water, including notes on: weather conditions, site location and sketch map, stream characterization, watershed features, riparian vegetation, aquatic vegetation, and sediment/substrate. If surface water is not present at any of the selected monitoring sites, qualitative assessments will be collected and recorded on the field data sheets, and a note will be made so a replacement monitoring event can be scheduled when/if surface water flows are again present.

#### Table 6.2 Project Timetable

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| *Overall Project Timeline* | x | x | x | x | x | x | x | x | x | x | x | x |
| *Task 1: volunteer recruitment* | x | x | x | x | x | x | x | x | x | x | x | x |
| *Task 2: monthly field measurements (optional)* | x | x | x | x | x | x | x | x | x | x | x | x |
| *Task 3:quarterlty field measurements (mandatory)* |  |  | x |  |  | x |  |  | x |  |  | x |
| *Task 4: data processing* | x | x | x | x | x | x | x | x | x | x | x | x |
| *Task 5: data interpretation* | x | x | x | x | x | x | x | x | x | x | x | x |
| *Interim Program Report*  (As Necessary) |
| *Program Report*  (As Necessary) |

**7. DATA QUALITY OBJECTIVES FOR MANAGEMENT DATA**

The main objective of the Silver City Watershed Keepers QAPP is to assure the consistency of data collection methods over time, and among various monitoring volunteers and staff members. The methods used will be consistent with those used by local and state government agencies operating in Silver City and Grant County. The accuracy of each parameter measured in the field will vary somewhat, depending on the instrumentation used. The SCWK will be using YSI field instruments for each parameter measured. For each monitoring site, the same instrument will be used for each parameter tested, with the exception of NMED-SWQB involvement, in which case, they will be using YSI multi-probe sondes. Data quality objectives include collecting data that is: representative of both individual stream segments and the Silver City Watershed as a whole, collecting comparable to data collected previously by other agencies and complete enough in scope to fulfill the goals of the SCWK monitoring program. To achieve the goals of the SCWK program, and ensure the collection of credible data, proper training and program oversight/volunteer coordination must be available at all times.

The SCWK monitoring program focuses on evaluating baseline water quality and quantity parameters of surface flows in the Silver City Watershed. The data generated by the SCWK program will be both evaluated by trained SCWK volunteer members, who will screen the data for variance from the New Mexico state surface water quality standards, and be given to the NMED-SWQB for inclusion into their surface water quality database.

When the SCWK program engages in partnerships with the community and other agencies, this QAPP will be reviewed and amended to suit the particular needs of a specific project or partner.

The *representativeness* of the data will be a function of the selected monitoring locations and the number of times measurements and samples are taken. Sampling locations are selected to represent different and distinct stream reaches throughout our watershed, while at the same time, allowing for measurements and samples to be taken. The later is a challenge due to the variability of flow in the Silver City Watershed. There only being one perennial reach, approx. 1.2 miles in length, in the southern section of the watershed, along San Vicente Creek, where consistent monitoring events can be conducted. There also exists a major safety concern for SCWK volunteers in conducting monitoring events in intermittent and ephemeral reaches of the Silver City Watershed. In intermittent and ephemeral reaches, water quality data can only be collected during storm events, where the risk of flashfloods is great. Therefore, it is not advised that SCWK volunteers monitor water quality during, or immediately after storm events. This safety restriction also limits the availability of consistent and reliable monitoring sites to the perennial section of San Vicente Creek. The SCWK volunteers can, however, monitor watershed characteristics such as: streambank erosion, sediment/substrate condition, and riparian vegetation in the intermittent and ephemeral reaches of the Silver City Watershed during dry periods. Since SCWK monitoring events will occur on a monthly basis, the likelihood increases over time that the collected water quality data represents a range of climate related conditions within the Silver City Watershed.

Representativeness can also be increased during monitoring events by either collecting a sample or placing an instrument probe within the point of average flow within the water column, or the thalweg. Samples and probes should be collected / placed at a depth of 3/5 from the surface to the deepest point in the creek.

The *comparability* of SCWK data will be ensured by consistently using the same methods and procedures during each monitoring event, and using methods and procedures approved by authoritative agencies such as the NMED-SWQB. With standardized documents like the SCWK QAPP and Standard Operating Procedures (SOP), any potential partnering organization or agency can use these documents as project guidelines and procedure manuals, increasing the comparability of gathered data. At the time of volunteer training, either a NMED-SWQB employee or NMED-SWQB trained volunteer will facilitate a monitoring orientation based on methods and procedures outlined in the SCWK QAPP and SOP.

*Precision* is a measure of mutual agreement among individual measurements, conducted under similar conditions. SCWK monitoring volunteers will conduct one duplicate set of filed measurements at each site during a monitoring event. This is usually accounted for by monitoring partnerships though both tandem probe measurements with the NMED-SWQB, and multiple same-day measurement cycles though classroom outings. Precision will be calculated as the relative percent difference (RPD) between the original and duplicate measurement. A 10% RPD will be used as the acceptance threshold for the SCWK program. RPD is calculated by dividing the difference between two duplicate samples by their mean.

*Accuracy* is the degree of agreement between an observed or measured value, and the true or expected value of the measured quality. During both monitoring events and data processing, multiple sources of error can affect the accuracy of collected data. Most of the possible error rests with the human element. The best way to mitigate such error is to adhere by established monitoring, sampling, equipment calibration, and data management methodology and protocol. Much of the error within monitoring instrumentation is represented below in Table 7.1 as performance specifications as reported by the equipment manufacturer.

**Table 7.1 Data Quality Objectives**

| **Instrument** | **Indicator** | **Units** | **Accuracy\*** | **Range\*** | **Resolution\*** |
| --- | --- | --- | --- | --- | --- |
| YSI EcoSense DO200 | DO | mg/L | ±2% of the reading or ±0.2ppm, whichever is greater | 0 to 20.00 ppm (mg/L) | 0.01 mg/L |
| YSI EcoSense DO200 | DO | % | ±2% of the reading or ±2% air saturation, whichever is greater | 0 to 200% | 0.1% |
| YSI EcoSense EC300 | Temperature | °C | ±0.2°C or ±0.4% Full Scale, whichever is greater | -10.0 to 90 °C | 0.1°C |
| YSI EcoSense EC300 | Conductivity | µS/cm | ±1% of reading + 2 µS/cm  ±1% of reading + 5 µS/cm  ±1% of reading + 0.05 µS/cm  ±2.5% of reading + 0.5 µS/cm | 0.0 to 499.9 µS/cm  500 to 4999 µS/cm  5.00 to 49.99 µS/cm  50.0 to 200.0 µS/cm | 0.01 µS/cm  1 µS/cm  0.01 µS/cm  0.1 µS/cm |
| YSI EcoSense pH100 | pH | pH units | ±0.1%, ±2 Isd | -2.00 to 16.00 pH | 0.01 pH |
| Phosphate Chemets Kit K-8510 | Phosphate | mg/L P | Accuracy dependent on visual interpretation | 0.0 to 0.4 ppm (mg/L)  0.4 to 1.0 ppm (mg/L)  1 to 8 ppm (mg/L)  8 to 10 ppm (mg/L) | 0.1 ppm (mg/L)  0.2 ppm (mg/L)  1 ppm (mg/L)  2 ppm (mg/L) |
| Nitrate Chemets Kit K-6909D | Nitrate Nitrogen | mg/L N | Accuracy dependent on visual interpretation | 0 to 4 ppm (mg/L)  4 to 12 ppm (mg/L)  12 to 15 ppm (mg/L)  15 to 20 ppm (mg/L)  20 to 30 ppm (mg/L) | 4 ppm (mg/L)  2 ppm (mg/L)  3 ppm (mg/L)  5 ppm (mg/L)  10 ppm (mg/L) |
| Turbidity Tube | Turbidity | cm/NTU | Variable depending upon cm/NTU conversion table used | 0.0 to 121.6 cm | 0.2 cm |
| YSI EcoSense EC300 | Salinity | ppt | 0.2% Full Scale | 0.0 to 70.0 ppt | 0.1 ppt |
|  | Fecal Coliform, Enterococcus, E-coli | # of colonies/100 ml |  |  |  |
|  | Flow (not generally recommended for volunteers to take) | cfs |  |  |  |

\*Accuracy, Range, and Resolution are derived from each instrument manufacture’s specifications.

*Completeness* is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. Possible sources of error exist in every facet of the SCWK program, and thus have the potential to compound, amplifying total error. Such error could include: equipment calibration, misuse of equipment by volunteers and staff, failure to adhere by Standard Operating Procedures, data recording mistakes in field sheets and database entry. All these sources of error can be further compounded by the lack of thorough monitoring events and duplicate sampling. To counteract the potential loss of credibility through incomplete monitoring, percent completeness (%C) is employed as a statistical measure, ensuring that the maximum feasible amount of data is recorded per monitoring event. Percent completeness (%C) is defined as: %C = ((v/T)100), where **v** is the number of measurements judged valid, and **T** is the total number of possible measurements to be recorded. The SCWK database should be expected to meet a range of 90% - 100% completeness. To achieve the said completeness range, 100% of the required site measurements and samples should be taken at 100% of the monitoring sites identified for monitoring on any given event dates, unless site conditions prevent monitoring (e.g. weather restrictions, construction, etc.), in which case, the monitoring event should either be rescheduled as soon as possible, and/or noted as incomplete for whatever justified reason.

**8. TRAINING REQUIREMENTS/CERTIFICATION**

Training SCWK volunteer monitors and supervising staff is an important component to collecting accurate, reliable, and credible data. SCWK monitoring volunteers, both new and seasonal, will be trained in monitoring/sampling methods and protocols, and field data recording. SCWK staff, volunteers, and participating agencies and community partners will be trained in equipment maintenance and calibration, field analysis, data management, and in-field data collection and recording. Training sessions will be held as needed, with the addition of new volunteers, participating agencies, or community organizations. It is common to conduct on-the-fly volunteer trainings in tandem with festival or theme based monitoring events, especially with the prevalence of day-of volunteerism and volunteer recruitment. Note: a NMED-SWQB employee or NMED-SWQB trained SCWK staff or volunteer member must be present to facilitate day-of volunteer monitoring training. No certifications are required for sampling personnel.

#### Table 8.1 Training Program Summary

|  |  |
| --- | --- |
| **Task and Type of Volunteer Training** | **Frequency of Training/Certification and By Whom** |
| Field sampling | Once per year or as needed by SCWK project manager or previously trained monitoring volunteer |
| Water chemistry analysis | Once per year or as needed by SCWK project manager or previously trained monitoring volunteer |
| Visual observation | Once per year or as needed by SCWK project manager or previously trained monitoring volunteer |
| Data management | Once per year or as needed by SCWK project manager or previously trained monitoring volunteer |
| Data interpretation | Once per year or as needed by SCWK project manager or previously trained monitoring volunteer |

#### Table 8.2 Training Records

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project Function** | **Training Course Title** | **Provided by** | **Training Date** | **Personnel Trained** | **Personnel Function** | **Training Record Location** |
| General Water Quality Field Procedures | SCWK monitoring event participant overview | Trained SCWK Staff Member | Ongoing | Any staff or volunteers new to the SCWK program | Water quality monitoring event participant | SCWK monitoring database (training tab) |

**9. DOCUMENTATION AND RECORDS**

The SCWK will collect records for field measurements, sample collection, and any laboratory analysis. Each visit to a monitoring site will result in a completed field sheet template (appendix 1). Information that will be recorded includes: site specific background information (stream name, station#, location, etc.), monitoring event information (investigative volunteers, date/time, reason for survey, etc.), weather conditions, site sketch, stream characterization, watershed features, riparian vegetation, aquatic vegetation, field measurements, and sediment/substrate. SCWK field sheets will be compiled in hardcopy in a designated folder and storage space housed within the GRIP office, SCWK field sheets and database will be stored and maintained by the SCWK staff and volunteers. Key information from the field sheets will be transferred into the SCWK monitoring database for ease of access and analysis. Sampling information will be recorded on chain of custody forms, and will include: site ID, site location, sample date/time, type of parameter sampled, number of bottles collected, analysis requested, and any applicable comments (Table 9.2).

Any analytical results requested by and reported to the SCWK by contract laboratories will include sample ID, date/time of collection, date sample received, date of analysis, analytical method used, and when applicable, the date of sample preparation and method detection limit/reporting limit. Any relevant QA/QC information should be provided with the lab results; these could include: use of blanks, duplicates, spikes, and any relevant reference materials. SCWK staff and appropriate volunteers will evaluate water quality data on a biannual basis, and will provide the NMED-SWQB with biannual data evaluations and annual data reports.

Both digital and hard copies (with current version and date shown) of this QAPP will be located at the Gila Resource Information Project office building, located at: 305 A. North Cooper Street, Silver City, NM 88061. Requests for digital copies can be made at: (office) 575-538-8078, or [grip@gilaresources.info](mailto:grip@gilaresources.info). Other digital and hard copies of instructions, forms, and informational links can be requested from the above listed source. Such materials include, but are not limited to the following:

* YSI Inc. EcoSense® DO200 Operations Manual
* YSI Inc. EcoSense® pH100 Operations Manual
* YSI Inc. EcoSense® EC300 Operations Manual
* CHEMets® Kit Phosphate K-8510 Instructions Manual and Material Safety Data Sheet
* CHEMets® Kit Nitrate N-6909D Instructions Manual and Material Safety Data Sheet
* Water Quality Survey Summary for the Mimbres River Watershed 2009
* 2012-2014 State of New Mexico Clean Water Act §303(d)/§305(b) Integrated Report
* SCWK Physical Characterization/Water Quality Field Data Sheet
* SCWK Calibration and Pre-Monitoring Event Checklists
* SCWK Event Sign-in Sheet
* SCWK Quality Assurance Project Plan 2013
* SCWK Standard Operating Procedures 2013
* SCWK Physical Characterization/Water Quality Database
* Transparency (cm) to Turbidity (NTU) conversion sheet
* NMED-SWQB Statewide Water Quality Management Plan and Continuing Planning Process – Appendix C: Hydrology Protocol for the Determination of Uses Supported by Ephemeral, Intermittent, and Perennial Waters – May 2011
* The 2007 NMED-SWQB Standard Operating Procedures for Data Collection
* Procedures for Assessing Water Quality Standards Attainment for the State of New Mexico CWA §303(d)/§305(b) Integrated Report: Assessment Protocol – June 24, 2013
* Title 20: Environmental Protection, Chapter 6: Water Quality, Part 4: Standards for Interstate and Interstate Surface Waters
* NMED-SWQB Standard Operating Procedures for Stream Flow Measurement 3-21-2011

**10. SAMPLING PROCESS DESIGN**

The SCWK volunteer monitoring sites are measured monthly for water quality/quantity, including: pH, water temperature, turbidity, dissolved oxygen, conductivity, salinity, phosphates, nitrates, and flow; and assessed for the conditions of watershed features and climate, including: weather conditions, land use, non-point-source and point-source pollution, watershed erosion, aquatic vegetation, and sediment/substrate condition. Site photos will be recorded to document changing conditions at each site.

Monitoring sites are identified by number and location. Monitoring locations and sample collection points were justified for selection based on the following criteria: safe access and ease of access, landowner permission for site accessibility, being representative of the project area for both spatial distribution and input from potential sources of non-point-source pollution, availability of previous historical data (NMED-SWQB), and the likelihood of flow (San Vicente Creek has an approx. 1.2 mile long perennial section). All sample sites are located on Town of Silver City property, with occasional crossings on private landowner easements. The Town of Silver City has given permission to the SCWK to monitor water quality on town property, but if accessibility is affected due to property trades, sales, or easement expirations, alternate locations will be found on the remaining perennial sections of San Vicente Creek that meet the same criteria for site selection, or alternate access routes will be arranged. Six sites were selected within the project area, four on the perennial section of San Vicente Creek, and two in the upstream tributaries of Silva and Pinos Altos Creeks. The four sites in the San Vicente Creek section were determined to have adequate flow for year round monitoring, whereas the two upstream sites were selected for special distribution and evaluation of potential non-point-source pollution and erosion characterization. The sites are shown in Figure 6.1.

Field measurements will be taken at the same location, identified by semi-permanent structures (e.g. trees, rocks, fence posts, etc.), and when possible, at the same time of day (times may vary due to classroom involvement). Grab samples will be collected before hand, and at the sample location as the field measurements. Grab samples will be only be collected in tandem with field measurements when appropriate. The SCWK volunteers will collect samples to be analyzed for fecal coliform bacteria and E. coli from sites 1-4 on any Tuesday of the quarterly sampling month. Samples destined for laboratories within Grant County will be delivered to the applicable laboratories as soon as possible after collection, and within the holding times specified in Table 11.1.

With all the sites, when available, stream flow should be measured either immediately after the water quality measurements in the same location, or at the same time and downstream from the water quality measurements within the same river reach. Flow measurements should be taken along a straight run or gentle riffle, and the cross-section shouldn’t be placed through a pool. See *NMED-SWQB Standard Operating Procedures for Stream Flow Measurements* for more detailed information on site selection.

The SCWK monitoring volunteers are asked to postpone site monitoring events if or when a storm event corresponds with said event, and to reschedule as soon as possible. When this happens, the volunteers are instructed to contact the Field Coordinator so that a date change and reschedule can be recorded, and or reassigned to new volunteers. In addition, SCWK volunteers should be assigned in pairs of at least two people by the Field Coordinator.

**Table 10.2 Sampling Frequency, Period and Time of Day**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Measure(s) or Indicator(s)** | **Sites** | **Brief Description of Location** | **Type of Site** | **Frequency** | **Type of Sample Collected** | **Time of Day Sampled** | **Special Weather Conditions** |
| Fecal Coliforms, Enterococcus, E-coli | 1-4 | See table 6.1 | SCWK standard monitoring site | Once per site, quarterly or monthly as appropriate | Grab sample | Tuesday Morning between 7AM – Noon, or Monday afternoon less than 24 hours before 1PM on the following Tuesday | No sampling during storm events |
| Flow (not generally recommended for volunteers to take) | 1-4 | See table 6.1 | SCWK standard monitoring site | Once per site, quarterly or monthly as appropriate | Field measurement | Morning if possible | No sampling during storm events, refer to rule of 10 (see NMED-SWQB Flow SOP) |
| Phosphate | 1-4 | See table 6.1 | SCWK standard monitoring site | Once per site, quarterly or monthly as appropriate | In-field sample | Morning if possible | No sampling during storm events |
| Nitrate | 1-4 | See table 6.1 | SCWK standard monitoring site | Once per site, quarterly or monthly as appropriate | In-field sample | Morning if possible | No sampling during storm events |

1. **SAMPLING METHOD REQUIRMENTS**

Water quality samples will be collected with the appropriate sample bottle for each parameter. For phosphate and nitrate, the sample container will be rinsed three times with the given source water before samples are taken; whereas the sample bottle for total coliforms will not be rinsed to preserve the de-chlorination tablet. Samples will be hand dipped by wading into the stream from a location downstream the sampling site in order to not disturb the waters being sampled. Total coliforms samples will be held on ice in a cooler until they are dropped off at the Town of Silver City Waste Water Treatment Plant (TOSC-WWTP). Samples should be dropped off at the TOSC-WWTP on Tuesdays between 7:00 AM – 1:00 PM, and results are available on the following Wednesday after 1:00 PM. If there is little or no flow in the stream section being sampled, filed notes should be taken to document the current condition.

**Table 11.1 Container, Sample Size, Type, Preservation and Storage for Common Water Quality Indicators** (Standard Methods 20th edition, 1998)

| **Indicator** | **Container Type1** | **Minimum Sample Quantity (ml)2** | **Sample Type3** | **Preservation** | **Maximum Holding Time** |
| --- | --- | --- | --- | --- | --- |
| Fecal Coliforms | Sterile P, G bottles or Whirl-Pak Plastic Bags | >100 ml | g | Refrigerate, 4oC  See delayed incubation procedure 9222E in Standard Methods | Refrigerate immediately. Deliver to lab within 6 hr. Begin analysis within 2 hr. of receipt. |
| Nitrate | P, G | 100 | g, c | Analyze as soon as possible; refrigerate, 4oC  add H2SO4 to pH<2 and refrigerate | 48 hr  28 days |
| Phosphorus, total | P, G  Acid-washed; no use of detergent permitted | 100 | g, c | Immediately  Add H2SO4 to pH<2 and refrigerate at 4oC  Freeze | 48 hrs  28 days  12 months |
| Temperature | P, G | - | g | Analyze immediately | Analyse immediately |

1 Container — P = polyethylene or equivalent; G = glass

1. Minimum Sample Quantity – plan at least two minimum sample quantities for reanalysis contingencies
2. Sample Type — g = grab; c = composite
3. Published in EPA Methods (1999) or Standard Methods (AWWA,1998)
4. Recent modification in the peer reviewed literature. (Godfrey & Kerr, 2000)

**Table 11.2 Table of Sampling Methods.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **What Will Be Sampled** | **Sampling Equipment** | Sampling Method |
| E. coli | San Vicente Creek Water | Sample Bottle | Refer to TOSC-WWTP SOP |
| Total Phosphate | San Vicente Creek Water | 30ml graduated cylinder | Refer to test kit instructions |
| Total Nitrate | San Vicente Creek Water | 30ml graduated cylinder | Refer to test kit instructions |

1. **SAMPLE HANDLING AND CUSTODY**

No chain-of-custody procedures will apply to the Silver City Watershed Keepers program, because the goal of the SCWK is to refer to the NMED-SWQB with concern over questionable waters for further study based on the SCWK monitoring efforts. The SCWK monitoring data is not intended for any use other than informing community members about the possible concerns over water quality within the Silver City Watershed, which is applicable to the waters and parameters tested.

All standard SCWK monitoring and sampling is field based, and therefore do not require any special handling requirements outside of the field environment. In the event that total coliforms are sampled, the SOP for the TOSC-WWTP will be followed for field sampling protocol. After the sample is collected, it will be immediately placed on ice in a cooler and transported as soon as possible to the TOSC-WWTP between the hours of 7:00 AM – 1:00 PM on any Tuesday of any month. Total Coliforms samples should be stored on ice no longer than 24 hours after the sample is collected. In the event that total coliforms are sampled, it is recommended that the SCWK scheduled monitoring event coincide with the date/time constraints placed on total coliforms handling times by the TOSC-WWTP.

1. **ANALYTICAL METHODS REQUIREMENTS**

Field measurement methods for air temperature and transparency will follow the SCWK SOP. Methods for field measurement of water temperature, conductivity, dissolved oxygen, salinity, total dissolved solids, and pH will follow the procedures defined in the YSI Inc. EcoSense® DO200 Operations Manual, YSI Inc. EcoSense® DO200 Operations Manual, and the YSI Inc. EcoSense® EC300 Operations Manual. Field sampling methods for total coliforms will follow the TOSC-WWTP SOP. Methods for field sampling of Nitrates and Phosphates will follow the CHEMets® Kit Nitrate N-6909D Instructions Manual and the CHEMets® Kit Phosphate K-8510 Instructions Manual.

#### Table 13.1 Measurement Methods

| **Indicator** | **Method** | **Reporting Units** |
| --- | --- | --- |
| Air Temperature | Thermometer | °C / °F |
| Water Temperature | Probe- combination | °C |
| Specific Conductance | Probe- combination | μS / cm |
| Salinity | Calculation- by probe combination | ppt |
| Total Dissolved Solids (TDS) | Calculation- by probe combination | g / L |
| Dissolved Oxygen | Probe- combination | mg / L |
| Dissolved Oxygen | Probe- combination | % saturation |
| pH | Probe- combination | pH units |
| Transparency | Transparency tube | cm |
| Turbidity | Calculation- by transparency tube | NTU |

1. **QUALITY CONTROL REQUIREMENTS**

The Silver City Watershed Keepers monitoring event participants will collect one duplicate set of field measurements at each monitoring site. A regular data set will be collected for all the variables being monitored at all the scheduled monitoring sites, followed by the collection of a second set of data at each site immediately following the recording of the first measurement set. The purpose of a duplicate data set is to assess whether or not the procedures or equipment used are constantly applied or producing constant results.

For each parameter measured, a relative percent difference (RPD) will be calculated between the first and second data set collected at each monitoring site. The following equation will be used for RPD:

A 10% RPD will be used as an acceptable threshold for the monitoring program. If a variation from the 10% RPD threshold is detected, a SCWK monitoring participant will troubleshoot the problem, and attempt to identify the source or error or cause of the problem. When a solution is found, it will be recorded in the SCWK records to inform future monitoring events. The data sets that are found to exceed the 10% RPD threshold should be flagged and a second set of data should be collected and be added to the SCWK database in conjunction with the flagged data when an appropriate solution is found after error troubleshooting.

1. **INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS**

Field measurement equipment will be checked for proper operation by a SCWK staff member or trained volunteer in accordance with the manufacturer’s specifications prior to use. If any problems are found, or that equipment operation does not meet operational standards, any issues will be rectified by referring to section 16 recommendations.

#### Table 15.1 Equipment Inspection and Maintenance.

| **Equipment Type** | **Inspection Frequency** | **Type of Inspection** | **Available Parts** | **Maintenance, Corrective Action & Recordkeeping** |
| --- | --- | --- | --- | --- |
| **EcoSense® pH100** | Day before or day of each monitoring event | Battery level, operational functionality | Spare batteries, calibration solutions | Replace batteries, replace or restock expired or low calibration solutions, recalibrate (record in calibration log book) |
| **EcoSense® DO200** | Day before or day of each monitoring event | Battery level, operational functionality | Spare batteries, probe membranes, membrane solution | Replace batteries, replace worn out dissolved oxygen probe membrane, recalibrate (record in calibration log book) |
| **EcoSense® EC300** | Day before or day of each monitoring event | Battery level, operational functionality | Spare batteries, calibration solutions | Replace batteries, replace or restock expired or low calibration solutions, recalibrate (record in calibration log book) |
| **Turbidity Tube** | Day before or day of each monitoring event | Visual inspection of components | Rubber Stopper, secci disk, ½” hose | Replace broken or missing component (record in calibration log book) |
| **Thermometer** | Day before or day of each monitoring event | Visual inspection of components | Spare thermometer | Replace broken or misplaced thermometer (record in calibration log book) |
| **CHEMets® Phosphate K-8510** | Day before or day of each monitoring event | Visual inspection of components, reagent levels, expiration dates | Color comparators, activator solution, self-filling ampoules, reaction tube | Replace broken or expired components, restock low quantities of reagents and ampoules (record in calibration log book) |
| **CHEMets® Nitrate K-6909D** | Day before or day of each monitoring event | Visual inspection of components, reagent levels, expiration dates | Color comparator, reaction tube, graduated cylinder, syringe, self-filling ampoules | Replace broken or expired components, restock low quantities of reagents and ampoules (record in calibration log book) |

**16. INSTRAMENT CALIBRATION AND FREQUENCY**

Field measurement equipment will be calibrated by a SCWK staff member or trained volunteer either the day before, or the day of the scheduled monitoring event. Listed below are the calibration procedures for each instrument used in SCWK monitoring events.

**EcoSense® pH100 Meter (pH, mV, Temperature)**

The pH100 uses a 2-point calibration. The first point must be a 6.86/7.00 buffer, and the second either a 4.00/4.01 or 9.18/10.01.

1. Turn the unit on. Connect the pH electrode to the BNC connector and the ATC/Temp probe to the ATC/Temp connector of the unit; “ATC” displays. Press **MODE** until “pH” displays. Autolock may be on or off as desired.
2. Place the pH and ATC/Temp probes into the first buffer solution (either 7.00 or 6.86). Allow temperature readings to stabilize, then press and hold “STAND” for 3 seconds to calibrate. If **AUTOLOCK** is off, the first point has been calibrated. If **AUTOLOCK** is on, “WAIT” flashes until the unit detects a stable reading. Once the unit calibrates the first point, “SLOPE” flashes.

**NOTE**: If no temperature probe is connected, adjust the temperature reading to that of the first buffer using the ↑ or ↓ keys (0.0 to 60°C) BEFORE pressing “STAND”.

1. Rinse the pH and ATC/Temp probes in distilled water, then place into the second buffer solution (either 4.01/4.00 or 10.01/9.18). Allow temperature readings to stabilize, then press “SLOPE” to calibrate. If **AUTOLOCK** is off, the second point has been calibrated. If **AUTOLOCK** is on, “WAIT” flashes until the unit detects a stable reading. Once the unit calibrates the second point, the unit beeps twice and both “STAND” and “SLOPE” display steadily.

NOTE: If no temperature probe is connected, adjust the temperature reading to that of the first buffer using the ↑ or ↓ keys (0.0 to 60°C) **BEFORE** pressing “SLOPE”.

1. The unit calculates and compensates for the pH electrode slope deviation corresponding to the values of the two calibration buffers. The unit is now dual-point calibrated and ready for measurements. After calibration, press the hold **MEA./EFF.** for about 5 seconds to display the new electrode efficiency.

**EcoSense® DO200 Meter (Dissolved Oxygen, Temperature)**

Calibration Set-up:

1. Know the approximate pressure (in millibars [mBar]) of the region to be measured for dissolved oxygen. **(For Silver City, NM: Elevation = approx. 5,900 feet = approx. 816 millibars)**
2. Know the approximate salinity of the water to be analyzed. Fresh water has an approximate salinity of zero. Seawater has an approximate salinity of 35 parts per thousand (ppt). **(All waters in the Silver City Watershed = fresh water).**
3. For highest accuracy, complete all calibrations at a temperature as close as possible to the sample temperature.

Procedure:

1. For the field probe, place 5-6 drops of clean water (tap, distilled, or deionized) into the sponge inside the calibration bottle. Turn the bottle over and allow any excess water to drain out of the bottle. The wet sponge creates a 100% water-saturated air environment for the probe, which is ideal for calibration, transport, and storage of the Model DO200 probe. For calibration, the probe remains in a water saturated air atmosphere and is not submersed.
2. For the field probe, slide it into the alibration bottle. Be sure the membrane does not touch the sponge.
3. Turn on the DO200, and wait 10 to 15 minutes for the dissolved oxygen and temperature readings to stabilize.
4. Press **CAL**.
5. The LCD prompts for the local pressure in mBar. Use the ↑ or ↓ keys to increase or decrease the pressure value respectively. See the approximate mBar value for Silver City, NM as listed in the above Calibration Set-up section.
6. When the proper pressure displays, press the enter key once to view the calibration value in the lower right of the display. Once the value is in the main display stabilizes, press the enter key again to move to the salinity compensation procedure.
7. The display prompts for the approximate salinity of the water to be analyzed. Use the ↑ or ↓ keys to increase or decrease the salinity compensation value to the value of your sample (between 0 to 40 parts per thousand [ppt]). When the correct salinity displays, press the enter key. (Use the zero value for fresh water).
8. The unit holds calibration even if it is powered off. However, it is recommended to check calibration with each use and recalibrate as necessary to prevent drift. Dissolved oxygen readings are only as good as the calibration.

**EcoSense® EC300 Meeter (Conductivity, Salinity, Temperature)**

Calibration setup contains five sections: TDS, Cell, Temperature Coefficient, Temperature reference, and Conductivity Calibration. To access these sections:

1. Connect the conductivity probe and cable assembly to the unit and turn the unit on. The screen will display **CELL** and the cell constant of the conductivity probe.
2. Allow the temperature readings to stabilize, then press **CAL** to enter the calibration mode; **CAL** appears on the LCD. Press **MODE** to sequentially display the following sections:

**Note:** Press Enter to accept any values changes in each section and automatically advance to the next section. If there are no changes, the unit accepts the current value and proceeds to the next section.

**TDS:** TDS is determined by multiplying conductivity (mS) by a TDS factor. The default factor value is 0.65. To change the TDS factor, use the ↑ or ↓ keys to adjust the value between 0.30 and 1.00. Press enter to save the new value, or press **MODE** to cancel the change and display the **CELL** screen.

**CELL:** The second screen will display **CELL** and the current cell value. The default cell value is 5.00 and is displayed in the lower right of the screen. The unit allows a variance of ±0.50 before displaying an error message. The cell value cannot be adjusted at this screen; calibrating conductivity is the only way to adjust the cell constant. Press Enter to reset the cell constant to 5.00 and display the **Temperature Coefficient** screen.

**Temperature Coefficient:** The EC300 uses the temperature coefficient to calculate temperature compensated conductivity. The default value is 1.91%. To change the temperature coefficient, use the ↑ or ↓ keys to adjust the value between 0 and 4.00%. Press Enter to save the new value, or press **MODE** to cancel the change and display the **Temperature Reference** screen.

**Temperature Reference:** The EC300 uses the temperature reference value to calculate temperature compensated conductivity. The default value is 25°C. To change the temperature coefficient, use the ↑ or ↓ keys to adjust the value between 15 and 25°C. Press Enter to save the new value, or press **MODE** to cancel the change and display the **Conductivity Calibration** screen.

**Conductivity Calibration:**

1. Immerse the probe in a standard of known conductivity, preferably a standard in the middle range of the solutions to be measured. Completely submerge the probe without touching the sides of the calibration container. Shake the probe lightly to remove any air bubbles trapped in the conductivity cell.
2. Allow temperature to stabilize. The message ‘rAng’ (range) may display briefly to indicate unit auto-ranging; this is normal. After temperature stabilization, use the ↑ or ↓ keys to adjust the conductivity value to that of the conductivity standard at 25°C. Press Enter to calibrate. The unit beeps twice to indicate a successful calibration, then automatically switches to normal operation mode.

In the event that calibration results do not meet the manufacturer’s specifications, the staff member or volunteer calibrating the instrument will troubleshoot solutions and attempt to recalibrate the instrument based on appropriate manufacturer’s operation manual. If troubleshooting solutions do not work, the SCWK staff member or trained volunteer will make any necessary repairs, as suggested by the operation manual. If the equipment continues to malfunction, it should be sent the manufacturer or other qualified entities for repairs.

Any scheduled monitoring events should be continued without the use of the malfunctioning equipment, and be noted in the field notes. A duplicate monitoring event should be scheduled when the equipment problems are solved.

**IDEXX Colilert Test Kit**

**Introduction Colilert\*** simultaneously detects total coliforms and E. coli in water. It is based on IDEXX’s patented Defined Substrate Technology\* (DST\*). When total coliforms metabolize Colilert’s nutrient-indicator, ONPG, the sample turns yellow. When E. coli metabolize Colilert’s nutrient-indicator, MUG, the sample also fluoresces. Colilert can simultaneously detect these bacteria at 1 cfu/100 mL within 24 hours even with as many as 2 million heterotrophic bacteria per 100 mL present.

**Storage** Store at 2–30°C away from light.

**Presence/Absence (P/A) Procedure**

1. Add contents of one pack to a 100 mL sample in a sterile, transparent, nonfluorescing vessel.

2. Cap vessel and shake.

3. Incubate at 35±0.5°C for 24 hours. 4. Read results according to Result Interpretation table below. Quanti-Tray\* Enumeration Procedure 1. Add contents of one pack to a 100 mL water sample in a sterile vessel. 2. Cap vessel and shake until dissolved. 3. Pour sample/reagent mixture into a Quanti-Tray\* or Quanti-Tray\*/2000 and seal in an IDEXX Quanti-Tray\* Sealer.

4. Place the sealed tray in a 35±0.5°C incubator for 24 hours.

5. Read results according to the Result Interpretation table below. Count the number of positive wells and refer to the MPN table provided with the trays to obtain a Most Probable Number.

**Result Interpretation**

• Look for fluorescence with a 6-watt, 365-nm UV light within 5 inches of the sample in a dark environment. Face light away from your eyes and towards the sample.

• Colilert results are to be read after 24 hours of incubation.

• However, if the results are ambiguous to the analyst based on the initial reading, incubate up to an additional four hours (but not to exceed 28 hours total) to allow the color and/or fluorescence to intensify.

• Positives for both total coliforms and E. coli observed before 24 hours and negatives observed after 28 hours are also valid.

• In addition, laboratories may incubate samples for additional time (up to 28 hours total) for their convenience.

**Procedural Notes**

• This insert may not reflect your local regulations. For compliance testing, be sure to follow appropriate regulatory procedures. For example, samples run in other countries are incubated at 36±2°C for 24–28 hours.

• Colilert can be run in any multiple tube format. Standard Methods for the Examination of Water and Wastewater2 MPN tables should be used to find Most Probable Numbers (MPNs).

• If a water sample has some background color, compare inoculated Colilert sample to a control blank of the same water sample.

• If sample dilutions are made, multiply the MPN value by the dilution factor to obtain the proper quantitative result.

• Use only sterile, nonbuffered, oxidant-free water for dilutions.

• Colilert is a primary water test. Colilert performance characteristics do not apply to samples altered by any pre-enrichment or concentration.

• In samples with excessive chlorine, a blue flash may be seen when adding Colilert. If this is seen, consider sample invalid and discontinue testing.

• Aseptic technique should always be followed when using Colilert. Dispose of in accordance with Good Laboratory Practices.

**Quality Control Procedures**

1. One of the following quality control procedures is recommended for each lot of Colilert:

A. IDEXX-QC Coliform and E.coli 3 : Escherichia coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa

B. Quanti-Cult\*4 : Escherichia coli, Klebsiella pneumoniae and Pseudomonas aeruginosa.

C. Fill three sterile vessels with 100 mL of sterile nonbuffered oxidant-free water and inoculate with a sterile loop of ATCC5 strains, Escherichia coli ATCC 25922/WDCM 00013 or ATCC 11775/WDCM 00090, Klebsiella pneumoniae ATCC 31488/ WDCM 00206 and Pseudomonas aeruginosa ATCC 10145/WDCM 00024 or ATCC 27853.

2. Follow the P/A Procedure or Quanti-Tray Enumeration Procedure above.

3. Results should match the Result Interpretation table above.

NOTE: IDEXX internal quality control testing is performed in accordance with ISO 11133:2014. Quality Control Certificates are available at idexx.com/water.

Colilert\* Test Kit 1. IDEXX P/A Comparator, catalog #WP104; Quanti-Tray Comparator #WQTC, or Quanti-Tray/2000 Comparator #WQT2KC 2. Eaton, AD, Clesceri, LS, Greenberg, AE, Rice, EN. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, 2005. Washington, DC. 3. IDEXX-QC Coliform and E. coli—IDEXX Catalog #UN3373-WQC-TCEC 4. Quanti-Cult\* cultures—IDEXX catalog # WKIT-1001 5. American Type Culture Collection 1-800-638-6597 atcc.org \*Colilert, Defined Substrate Technology, DST and Quanti-Tray are trademarks or registered trademarks of IDEXX Laboratories, Inc. or its affiliates in the United States and/or other countries. Quanti-Cult is a trademark or registered trademark of Remel Inc. Patent information: idexx.com/patents. © 2015 IDEXX Laboratories, Inc. All rights reserved. Appearance Result Less yellow than the comparator1 Negative for total coliforms and E. coli Yellow equal to or greater than the comparator Positive for total coliforms Yellow and fluorescence equal to or greater than the comparator Positive for E. coli

1. **INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES**

Before each scheduled sampling event, the field measurement equipment, reagents, and other field supplies, will be inspected and calibrated for completeness and reliability by a SCWK staff or volunteer member in accordance with the manufacturer’s specifications. The equipment inspection and calibration should take place not less than one day before the scheduled monitoring event as to allow ample time to rectify any problems that may arise. Pre-event inspections should include supply checklists and calibration checklists.

Laboratories will provide grab sample collection bottles prior to each sampling event, when applicable, and will ensure that the grab bottles, and other sampling equipment provided, are clean and contain the appropriate preservatives prior to pickup from SCWK staff or volunteer members. Laboratories will also provide appropriate documentation, including sampling procedures, handling procedures, and maximum handling time of the sample, when applicable.

Laboratory equipment will be inspected, tested, and maintained by the contract laboratories according to the procedures documented in their Quality Assurance Manuals. The Laboratory Quality Assurance manuals are available for review at each contract laboratory upon request.

**Table 17.1 Recommended Inspection for Supplies.**

| **Supplies** | **Inspection Frequency** | **Type of Inspection** | **Available Parts** | **Maintenance** |
| --- | --- | --- | --- | --- |
| YSI EcoSense DO200 | Before each sampling date | Inspection for damage and battery levels | Spare probe membrane caps, membrane solution | Replace damaged probe membrane, calibrate before use |
| YSI EcoSense EC300 | Before each sampling date | Inspection for damage and battery levels | Batteries, fresh calibration solution | Replace batteries, calibrate before use |
| YSI EcoSense pH100 | Before each sampling date | Inspection for damage and battery levels | Batteries, fresh calibration solution | Replace batteries, calibrate before use |
| Phosphate Chemets Kit K-8510 | Before each sampling date | Visual inspection of kit completeness and cleanliness | Spare, fresh reagents, comparator, syringe, graduated cylinder, and test tube | Replacement of comparator and reagents as needed, or replacement parts as needed |
| Nitrate Chemets Kit K-6909D | Before each sampling date | Visual inspection of kit completeness and cleanliness | Spare, fresh reagents, comparator, syringe, graduated cylinder, and test tube | Replacement of comparator and reagents as needed, or replacement parts as needed |
| Turbidity Tube | Before each sampling date | Visual inspection of tube cleanliness and valve competency | Spare valve clamp | Annually or as needed |
| Reagents | Before each sampling date | Visual inspection of quantity and expiration date | Spare, fresh reagents | Annual replacement at beginning of sampling season |
| Field and Lab sample sheets | Before each sampling date | Visual | Additional copies | n/a |
| Thermometer | Before each sampling date | Integrity of column | Spare thermometer | Calibrate and replace as needed |
| Waders or Life Preservers | Before each sampling date | Visual inspection for damage | Patch kit | As needed |
| Macroinvertebrate Nets | Before each sampling date | Visual inspection for damage and cleanness | Roll of net material, extra bags | Annually or as needed  Logbook notation |
| Sample Bottles | Before each sampling date | Integrity, cleanness and seal for nutrient bottles, verified sterility of bacterial sample bottles, equipment or rinsate blank for reused bottles (see Glossary) | One set of spare bottles | n/a |
| Cooler | Before each sampling date | Cleanness, Ice packs | n/a | Annually or as needed |

**18. DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASURMENTS)**

Outside sources of historical or supplemental data and information are needed by the Silver City Watershed Keepers to aid in analysis and decision making within the program. Any data or information gathered will be obtained from sources that have credible backgrounds, with documented quality control protocols. The information and data gathered may include, but is not limited to: location data, land use, precipitation/past weather, soil characteristics, historic water data, and water quality designated use standards.

Latitude/longitude and Universal Transverse Mercator information required for locating monitoring sites is obtained via GPS coordinates taken at the sites by SCWK field staff or volunteers. The data points are geo-referenced and visually checked with the use of both Google Earth and Geographic Information System (GIS) ArcView.

Historical water quality data for monitoring sites within the San Vicente Watershed can be obtained by contacting the New Mexico Environment Department Surface Water Quality Bureau (NMED-SWQB). The NMED-SWQB collects water quality data within the San Vicente Watershed on seven-year rotations.

The water quality data collected by SCWK staff or volunteers will be evaluated by comparison to the New Mexico Water Quality Standards for the Mimbres Basin.

**19. DATA MANAGEMENT**

Field data and information will be recorded on field sheets, which will be stored via hard copy in a dated file within the Gila Resources Information Project (GRIP) host office of the SCWK (305 A North Cooper St., Silver City, NM 88061). If an organization such as a school or volunteer center participates in a stream monitoring event, a copy of the field sheet will be made, and the copy will be given to SCWK for database entry and hard copy storage. The field sheet copy may be either a hard copy or scanned copy for printing. The data and information recorded on the field sheet will be entered into the SCWK monitoring database which is located on a computer accessible at the GRIP host office.

Laboratory data will undergo QA/QC procedures at the contract laboratory as described in their QA/QC manual and SOPs. The results received from the contract laboratory will be stored via hard copy in a dated folder housed within the GRIP host office, and the information recorded on the laboratory report will be entered into the SCWK monitoring database.

Information relevant to the SCWK program will be retained by the SCWK at the GRIP host office for a minimum of 20 years from the date of generation. Any applicable information or data that is flagged for concern with not complying by the most recent New Mexico Water Quality Standards for the Mimbres Basin will be sent to the NMED-SWQB for further consideration and review.

**20. ASSESSMENT AND RESPONSE ACTIONS**

SCWK water monitoring staff and volunteers will assess the performance of the sampling and measurement procedures and equipment before, during, and after each monitoring event and at each scheduled monitoring site; and will perform corrective actions as necessary. When SCWK is partnering in a monitoring event with an outside organization like schools, volunteer centers, or individual volunteers, the staff member or primary volunteer will be responsible for all activities in the field. If a problem arises, the SCWK staff member or primary volunteer will either troubleshoot a solution in the field, or if necessary, contact the SCWK project manager immediately as to the nature of the problem, and any corrective actions taken to rectify the problem to obtain accurate and useful data. Should a problem arise, the associated data and information will be flagged and reviewed in the office for usability. The contract laboratory QA officers are responsible for ensuring compliance with the proficiency testing requirements and for reporting any corrective actions to both the laboratory manager. All significant corrective actions are to be documented and reported to the SCWK.

**21. REPORTS**

Reports of SCWK stream monitoring findings will be prepared when SCWK staff or volunteers indentify water quality data that does not comply by designated New Mexico Water Quality Standards for the Mimbres Basin. All reports generated by the SCWK will be distributed in draft form to the Technical Advisory Committee for review. After review, the SCWK findings report will be shared with the NMED-SWQB for further consideration.

**22. DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS**

The SCWK project manager will review the collected monitoring data quarterly, and consult the associated SCWK monitoring staff and volunteers to determine if the data meet the outlined QAPP quality objectives. Laboratory data will be reviewed by the SCWK staff upon receipt from the contract laboratory. All data entered into the SCWK monitoring database will be double-checked with either the original laboratory report or the field data sheets. Collected field duplicate measurements will also be reviewed by the SCWK staff, and the data that fails to comply with the objectives outlined in Section 7, will be flagged for further review or rejection.

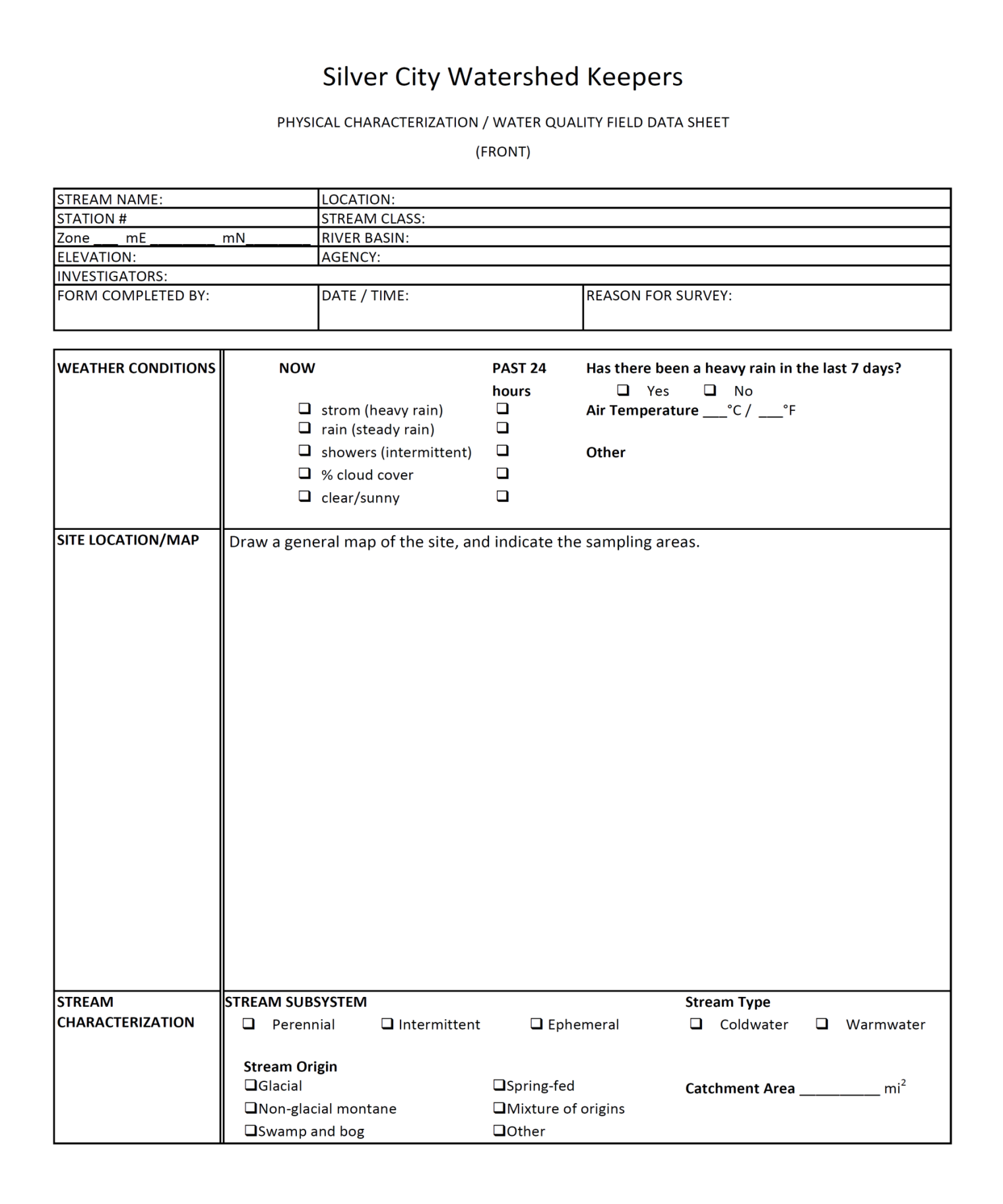
**23. VALIDATION AND VERIFICATION METHODS**

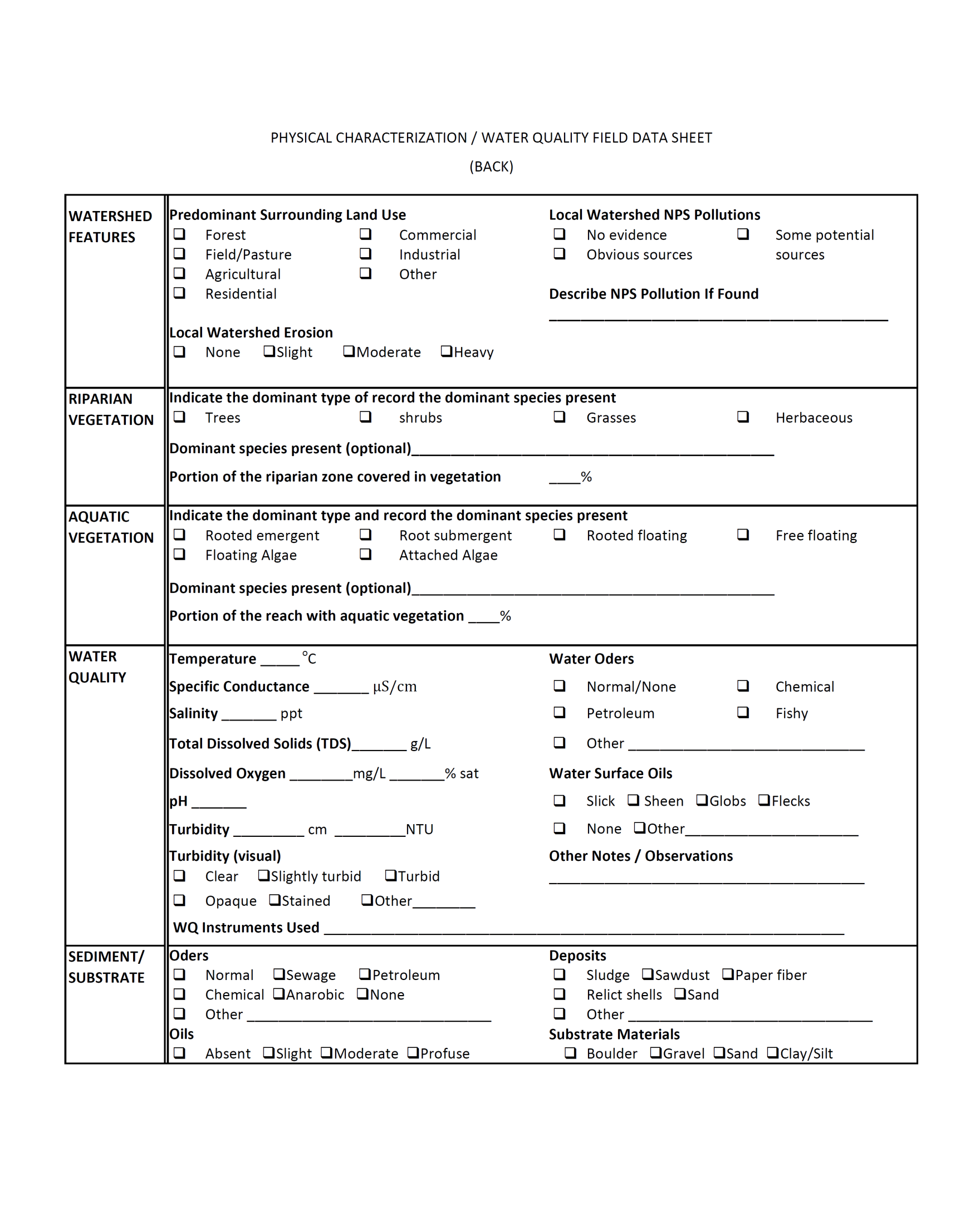
SCWK monitoring data will be verified at multiple stages of the collection process, including: sample collection, field measurement, data recording, and data entry. The collected data will be reviewed for multiple factors including: adherence to the SOPs, recording errors, conversion factors, units of measurement, and field sheet completion. The name of each SCWK staff member or monitoring volunteer associated with a scheduled site monitoring event will be recorded on the field data sheet; in addition, the initials of the recorder will be added to the appropriate space on the field sheet.

SCWK staff will be responsible for reviewing and verifying the generated data when the data is transcribed, entered into the SCWK monitoring database, or reported. If discrepancies in monitoring data are found, the data should be flagged and reported to the SCWK project manager, who will review the data and make and record any appropriate corrective actions.

**24. RECONCILIATION WITH DATA QUALITY OBJECTIVES**

SCWK staff will perform calculations and determinations for precision, completeness, and accuracy as soon as possible after each scheduled monitoring event, and implement any corrective actions as necessary. These determinations will count as the final review of the collected data in terms of correct type, quantity, and quality for the SCWK project. During the review process, if any problems with sampling or measurement performance are found, they will be discussed with the associated SCWK staff member/s and/or monitoring volunteer/s. Any issues discussed with become resolved, and the affected data will either be flagged for further review; if the flagged data is discarded, a follow-up monitoring event may be scheduled to replace the flagged data. The cause of data failure will also be evaluated for the following criteria: equipment failure, calibration/maintenance, and sampling and measurement procedures. Depending on the problem area, equipment replacement/maintenance or staff/monitoring volunteer retraining will take place. Any limitations to SCWK monitoring data will be recorded in any project reports and applicable documentation as appropriate.

**Appendix 1 SCWK Physical Characterization / Water Quality Field Data Sheet **

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