This QAPP was largely derived from the companion Monitoring Plan via copy/paste/edit operations.
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Ariel font, black – QAPP-only language

EXAMPLE ONLY

Quality Assurance Project Plan

For

Sycamore Creek Bacterial Sources ID Project

Proposal Identification Number: SC417

Prepared by: Patrick Tech

Sycamore County Resource Conservation District

This QAPP is based on USEPA QA/R-5 requirements and QA/G-5 guidance

Final draft
May 30, 2007

Note:

This is an example of a QAPP, not a *real* QAPP.

It is for QAPP training purpose only.

The names of people and places are fictitious, but the roles, responsibilities, types of institutions, and regulatory drivers are real. Instruments, methods, QA requirements, and attainable data quality objectives are also real, and so are the management measures, watershed activities, types of communities, and types of problems. All these entities are realistically set in an imaginary landscape.

APPROVAL SIGNATURES

GRANT ORGANIZATION:

Title:	Name:	Signature:	Date*:
Project Manager	Armand Smith		
Laboratory Manager	Josh Cooper		
QA Officer	Jared Holmes		

REGIONAL BOARD

Title:	Name:	Signature:	Date*:
Contract Manager	Cecilia Regal		
QA Officer	Fred Arditi		

** This is a contractual document. The signature dates indicate the earliest date when the project can start.*

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3 Distribution List

Title:	Name (Affiliation):	Tel. No.:	QAPP No*:
Contractor Project Manager	Armand Smith, Sycamore RCD	209 333 5555	1
Contractor QA Officer	Jared Holmes, Sycamore RCD	209 333 5556	1
Regional Board Contract Manager	Cecilia Regal , RB	209 246 5577	ORIGINAL
Regional Board QA Officer	Fred Arditi , RB	209 246 5586	1
Technical Leader	Patrick Tech, Sycamore RCD	209 333 5557	2
Trainer	Christine Pond, Sycamore RCD	209 333 5559	1
Advisor	John Expert, Hilltop Advisors Inc	216 124 4609	1
Laboratory Manager	Josh Cooper, Happy Flask Lab	209 334 3577	1
Laboratory QA/QC officer	Josh Cooper, Happy Flask Lab	209 334 3577	1

4 Project/Task Organization

4.1 Project Personnel.

The Sycamore County Resource Conservation District (RCD) received a small grant to identify the sources of *E. coli* within the Sycamore Creek river network. This organization is the lead agency on this effort, as it is the grant recipient, and will manage all field activities and laboratory analyses. The RCD has contracted Happy Flask Laboratory to conduct the laboratory analyses and recruited members of the Friends of Sycamore Creek to conduct the field monitoring. **Table 4-1** lists the representatives from these three organizations who will assume all necessary Project Personnel roles to assure data quality and timely delivery of reliable and usable monitoring data. They will be responsible for all Project tasks and deliverables.

Armand Smith, the Project Manager, will be responsible for all contract management tasks including invoicing and reporting, management of the laboratory contract, and oversight of project progress. Patrick Tech is the Technical Leader of this Project and the author of the Monitoring Plan and this QAPP. He will be responsible for the scientific defensibility of the data collection effort throughout the life of the Project, for technical dialogs with advisors and experts, and for collaboration with other agencies and stakeholders active in the watershed. Pat will be assisted by Dr. Don Ensin, a retired scientist who resides in Pensia and is a member of the Friends Sycamore Creek (FSC), who will provide the daily technical liaison with the contract laboratory.

Table 4-1. Project personnel, their roles, and contact information

Name	Affiliation	Role	Phone	Email
Armand Smith	Sycamore RCD	Project Manager	209 333 5555	Armand@Sycamore.org
Jared Holmes,	Sycamore RCD	QA Officer	209 333 5556	Jared@Sycamore.org
Patrick Tech,	Sycamore RCD	Technical Leader and data manager	209 333 5557	Pat@Sycamore.org
Christine Pond,	Sycamore RCD	Trainer and QA person	209 333 5559	Chris@Sycamore.org
Sharon Org	Friends of Sycamore Creek	Volunteer Coordinator	209 678 3345	sorg@hotmail.com
Don Ensin. Ph.D.	Friends of Sycamore Creek	Laboratory Liaison	209 679 1234	Densin2@yahoo.com
Dale Griffin	Sycamore RCD	Team Leader & Field Operator	209 333 5568	Dale@Sycamore.org
Eddie Joy	Sycamore RCD	Education and Outreach coordinator	209 333 5563	Eddie@Sycamore.org
Josh Cooper,	Happy Flask Laboratory	Laboratory QA officer	209 334 3577	Jcooper@happyflask.com

Friends Sycamore Creek (FSC) is a community-based organization interested in the assessment and improvement of their watershed. Eddie Joy of the RCD will design and carry out a public education campaign in the watershed in collaboration with FSC, and assist them with recruiting volunteers for monitoring. Christine Pond of the RCD and Sharon Org of FSC will be responsible for training volunteer field crews and for scheduling sampling days. Chris will also take care of purchasing and maintaining equipment and calibration Standards, reviewing data sheets and calibration records, entering the data into electronic format, calculating measurement error, etc. Dale Griffin is one of the Field Operators team leaders and will be the lead field activities person. He has already participated in all reconnaissance activities in the watershed. Josh Cooper is the Quality Assurance Officer for the Happy Flask Laboratory. Josh will be responsible for assuring that the analysis of submitted samples is done in accordance with all method and quality assurance requirements found in this Plan. He will interact with Patrick Tech and Dr. Ensin regarding data quality.

4.2 Other parties associated with the Project.

There are several individuals who will be associated with the Project in various capacities but will not be a part Project personnel. John Expert (Hilltop Advisors Inc) is involved with review of the Project's planning documents and has already helped in development of a sound monitoring design. Foothills Regional WQ Control Board staff Cecilia Regal (NPS Division) and Ephraim Kandor (TMDL Division) have been, and will be, providing input on data needs and desired data quality, and will use the data for various purposes. Other interested parties and stakeholders are represented by Tanya Coli from DHS, Riva Gill from the Sycamore Water District, Fanny May of the Sycamore County Flood Control District, Judy Mansion (Sycamore Estates Homeowner Association), and numerous community members represented by Frank Carpio of the Friends of Sycamore Creek who may be able to use the data to identify sources of *E. coli* and target implementation of management measures.

4.3. Specific Quality Assurance roles

Patrick Tech, the Project's technical leader, will be responsible for the usability of the data and for complete documentation of data quality. He is the author of the Monitoring Plan and this QAPP, and has been charged with seeking expert advice and review during the process of Project Planning and design. Patrick Tech will be working closely with Jared Holmes, Sycamore RCD's Quality Assurance Officer.

Christine Pond will be in charge of implementing Field QA procedures as described in the Monitoring Plan and in this QAPP. She will also be conducting periodic reviews to assure fulfillment of requirements. Patrick and Christine will be using communication and tracking tools that cater to the detail needed at the field level of the operations. These tools are described in later Elements of this QAPP.

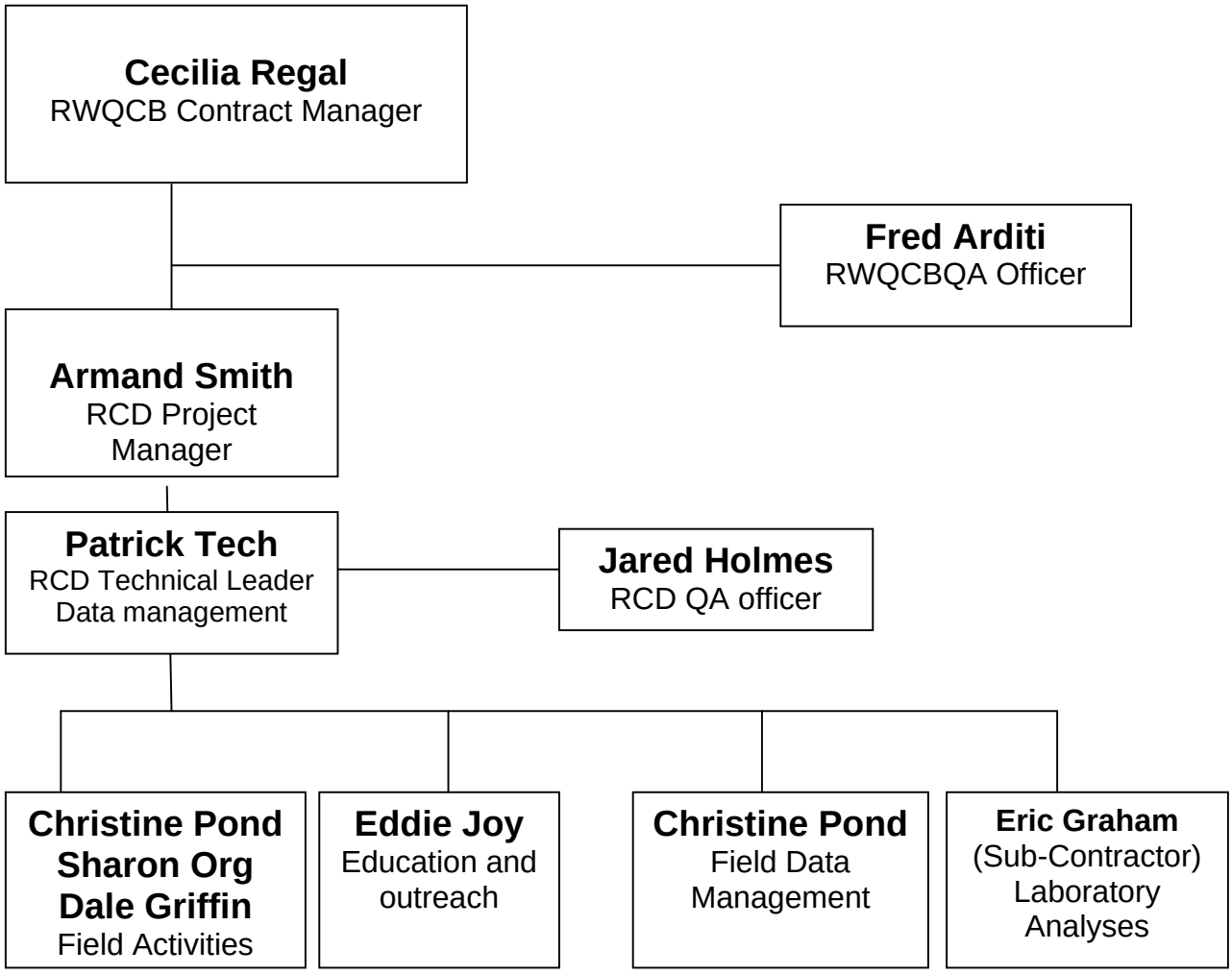
Jared Holmes will review and assure implementation of the quality assurance and quality control procedures found in this QAPP for the field measurements and sample collection. He will interact with Patrick and Christine as needed. Jared will also work with Josh Cooper, the Quality Assurance Officer for the Happy Flask Laboratory. He will review each of the laboratory reports and communicate all quality assurance and quality control issues contained in this QAPP to the Laboratory.

Jared Holmes will also review and assess all procedures during the life of the contract to assure that all QAPP requirements are met. Jared Holmes will report all findings to Patrick Tech, including all requests for corrective action. Jared Holmes may stop all actions, including those conducted by Happy Flask Laboratory if there are significant deviations from required practices or if there is evidence of a systematic failure.

Both Quality Assurance Officer are responsible for QAPP update and maintenance. Changes and updates to this QAPP may be made after a review of the evidence for change by Sycamore RCD's Project Manager and Quality Assurance Officer, and with the concurrence of both the Regional Board's Contract Manager and Quality Assurance Officer. Sycamore RCD's Quality Assurance Officer will be responsible for making the changes, submitting drafts for review, preparing a final copy, and submitting the final for signature.

Figure 4-1 shows the organizational chart for the project, and the relationship between grant recipient organization's personnel and the Regional board Staff.

Figure 4-1 Sycamore Creek Monitoring Project Organizational chart.



5 Problem Definition / Background

5.1 Problem Statement

Sycamore Creek flows east to west from the Snowy Mountains into the Big Valley through an array of rolling foothills. There are few urban centers in the watershed, but small communities are widely dispersed in the foothill areas, and many of them rely on septic systems. The most prominent of these communities is the town of Pensia, located close to the South Fork about two river miles above confluence with the North Fork of Sycamore Creek. The mountain and foothill segment of the stream is relatively undisturbed and has been designated the beneficial uses of WARM, COLD, AQUA, MUN, and WILD. [[MP 3.1]]

Sycamore Creek water is used for domestic supply to more than 50,000 households within the service area of the Sycamore Water District (SWD, or the District). The intake of the SWD treatment plant is located three river miles downstream of the North fork/South fork confluence, and the District is running routine bacteriological tests on its raw water. The District is also required to test water samples collected from different parts of the stream network at least four times during the summer. In the summers of 2005 and 2006 there have been several incidents of elevated *E. coli* concentrations in the main stem of Sycamore Creek just downstream of the South fork/North fork confluence. The source of these contaminants is not known at this time. [[MP 3.2]]

5.2 Decisions or Outcomes

This monitoring effort will attempt to identify the source of bacterial contamination. Specifically, the project will attempt to answer the following question: What are the sources of *E. coli* to the main stem of Sycamore Creek during summer? Data collected at the intake of the SWD treatment facility may be used to assess compliance with health standards established for raw water. Water Quality data that were recorded during sample collection to support the *E. coli* counts, including ammonia and nitrate concentrations, may or may not be used for regulatory purpose, depending on what each data point represents in the environment.

5.3 Water Quality or Regulatory Criteria

This project will yield bacterial counts data, collected in a special study to identify the dry weather sources of *E. coli*. This data may be used by the Regional Board for status reporting (305b), comparison to Basin Plan water quality objectives (and 303d listing or de-listing), and watershed assessments. The homeowner association may use the data to identify septic hot spots so that failing septic systems can be fixed.

6 Project / Task Description

6.1 Work Statement and Produced Products

Data collection will proceed in one line of inquiry. The Question – **"What are the sources of *E. coli* to the main stem of Sycamore Creek during summer?"** - will be addressed via three concerted "snapshot type" events, each including sampling at multiple location within the river network conducted at the same time. Field activities will be led by Sycamore RCD staff, and lab analyses will be performed at Happy flask Laboratory. Four team leaders will be selected from Sycamore RCD staff, and each will lead a field crew augmented by trained FCD volunteers. [[MP 6.1]]

6.2. Constituents to be monitored and measurement techniques

Field measurements (including field testing with probes and test kits) will be conducted and the following parameters will be measured: dissolved oxygen, temperature, specific conductivity, pH, and turbidity

The constituents that will be monitored using laboratory methods consist of the following:

- conventional constituents (chlorine, ammonia, nitrate, chloride, and fluoride)
- bacteria and pathogens (*E. coli* and Total Coliform counts)

6.3 Project Schedule

Sycamore RCD staff and community members will conduct a survey to identify sources of indicator bacteria during the summer and fall of 2008.

Figure 6-1 shows the major tasks that will be undertaken, and the anticipated time line for the performance of each task. Essentially, the first months of 2008 will be used to conduct all the preparations and training sessions needed to get the field crews ready and equipped for the bacterial source identification study. Source ID sampling events will be conducted three times during the summer and fall of 2008 and will be summarized by December 15, 2008. There will be an interim data validation and interpretation effort as soon as data from the first sampling round come in, and lessons learned will be immediately applied to refine logistics and methods for the second and third sampling round, as needed. Draft of the technical report will be submitted to the contract manager and the advisors no later than February 28th, 2009, and the report will be finalized by May 30, 2009. [MP-5.0]

Task	S,O, N	D, J, F	M,A, M	J, J, A	S,O, N	D, J, F	M,A, M
	2007	07-08	08	08	08	08-09	2009
Complete QAPP and have all parties' approval							
Conduct Training & preparation for bacterial source ID study							
Conduct Sampling & analysis for bacterial source ID study							
Conduct data validation and prepare draft Technical Report							
Solicit Review, receive comments, and finalize of Technical Report							

Figure 6-1 –Project Time Line for Major Tasks

Figure notes: Time is divided into four periods of three-months, (a) Cold Season (Dec, Jan, Feb) Warming Season (Mar, Apr, May), Hot Season (Jun, Jul, Aug); and Cooling Season (Sept, Oct, Nov).
[[MP section 5]]

6.4 Geographical Setting

Sycamore Creek flows east to west from its headwaters in the Snowy Mountains, through 30 miles of rolling foothills and about 10 miles of valley floor, into the Big Valley Wetland Monument, a remnant of historic wetlands that covered a considerable part of the Big Valley. The wetland has clearly defined waterways during the winter, and these are connected to a series of navigation canals and sloughs that, eventually, reach the Ocean. The river network is made of two major branches, the North fork that drains about 34 square miles and the South fork that drains 67 square miles. Total watershed area is 112 square miles.

Figure 6-2 shows the potential sampling locations on a map of the watershed with the major waterways, roads, and townships.
[[MP 6.4, not included yet]]

6.5 Constraints

Monitoring work will be performed during dry weather only (however, the data will be augmented with results of wet-weather monitoring conducted by other entities). If it rains the crews will go home.

7 Quality Objectives and Criteria for Measurement Data

The Data Quality Objectives for this project provide quality specifications for the level of the study in question and are listed below.

Data acquisition activities will include both field measurements and laboratory analyses, and the quality objectives depend on the amount of error that can be tolerated. However, data collected for this Project has the potential of being used for additional purposes in conjunction with other data sets collected in accordance with SWAMP requirements, and the quality objectives selected for the Project have been refined to reflect this foresight. The quality objectives for field measurements are listed in **Table 7-1; Table 7-2** shows the quality objectives for laboratory analyses and bacterial counts. [MP section 7]

Table 7-1 – Measurement Quality Objectives and Other Quality Objectives for Field Measurements

Study question or intent	**Characteristic (Parameter)**	**Unit**	**Accuracy** (unit or Percent) (Note a)	**Precision** (unit or RPD) (Note a)	**Reso-lution**	**Target Reporting Limit**	**Comp-leteness**
Source ID	pH	pH	± 0.2	± 0.2	0.1	nap	90%
	Specific Conductivity	uS/cm	± 2 or ± 10%	± 2 or ± 10%	1	1	90%
	Dissolved oxygen	mg/L	± 0.5 or 10%	± 0.5 or 10%	0.2	0.2	90%
	Temperature	C	± 1 or 10%	± 1 or 10%	0.5	-5	90%
	Turbidity	NTU	± 1 or 10%	± 1 or 10%	0.1	0.5	90%
	Velocity	m/sec	nap	± 0.2 or 50%	0.1	0.1	90%

Note a: Unit or percentage, whichever is greater.
RPD – Relative percent Difference – is the difference between two repeated measurements expressed as a percentage of their average.
uS/cm – microsiemen per centimeter, equivalent to micromhos/cm. Note: Specific conductivity is the value after correction for temperature, which is done by the instrument automatically.
nap – not applicable

Table 7-2 shows the quality objectives for all quantitation activities that will take place at Happy Flask laboratory.

Table 7-2: - Measurement Quality Objectives (MQOs) and Other Quality Objectives for Laboratory Analyses and Bacterial Counts

Study question or intent	**Character-istic (Parameter)**	**Unit**	**Accuracy** (Note a)	**Precision** RPD	**Recovery**	**Target Reporting Limit**	**Comp-leteness**
Source ID	*E. coli*	MPN /100mL	Meet Positive and Negative controls	± 50%	nap	2	90%
	Total coliform	MPN /100mL	Meet Positive and Negative controls	± 50%	nap	2	90%
	Total Ammonia	mg N/L	± 10	± 10	80–120%	0.05	90%
	Nitrate	mg N/L	± 20	± 20	70–130%	0.1	90%
	Chloride	mg/L	± 10	± 10	80–120%	0.05	90%
	Chlorine	mg/L	± 10	± 10	80–120%	0.01	90%
	Fluoride	mg/L	± 10	± 10	80–120%	0.05	90%

Note a: Unit or percentage, whichever is greater.
RPD – Relative Percent Difference – is the difference between two replicate test tubes or matrix spike and matrix spike duplicate, expressed as a percentage of their average.
nap – not applicable

[MP section 7]

The following data quality indicators will be assessed:

7.1 Accuracy

Accuracy of field measurements: Accuracy, a measure of how close the Results are to the perceived 'true value', will be assured by calibration adjustments for adjustable instruments before every trip, or as specified in Element 16 of this QAPP. Accuracy will be checked by comparing the readings of all instruments and kits (both adjustable and non-adjustable), when placed in established Standard solutions, with the 'true value' of these Standards. Field instruments will undergo accuracy checks after each Trip, and the difference between the instrument's reading and the Standard value will be recorded. This value, the 'instrument drift', will be used to report accuracy (in measurement units, e.g., for pH, or as a percentage of the true value of the Standard). Calibration Standards will be selected at values that are as close as

possible to expected ambient values.

Accuracy for laboratory analyses will be determined by running Laboratory Control Samples of known concentrations, and/or Standard Reference Materials, in each analytical batch at the same conditions as the samples. It will be reported as percent distance of the Result from of the nominal value. Spike recovery will be another measure of accuracy, that takes the matrix effect into account, and recovered concentration will be reported as the percent of the nominal concentration spiked.

Accuracy objectives for bacterial counts cannot be numerical due to the difficulty in preparing solutions of known bacterial concentration, but each batch will include presence/absence testing of Positive controls (i.e., 'target' organisms that these reagents and testing procedure should detect) and testing pf Negative controls that should yield negative results for non-target organisms.

7.2 Precision

Precision is how close two measurements or analyses of the same thing are to each other. Precision will be reported as RPD - Relative Percent Difference - which is the difference between two replicate test tubes or matrix spike and matrix spike duplicate, expressed as a percentage of their average.

7.3 Completeness

Completeness is the number of successful activities (measurements or sampling and analyses that have yielded valid data) expressed as a percentage of the total activities planned for the Project.

7.4 Resolution and reporting limits (Sensitivity)

These two aspects of method sensitivity have been tailored to the study question as shown in tables 7-1. and 7-2 above.

7.5 Comparability

The monitoring data collected in this effort will be comparable to SWAMP in terms of sampling protocols, measurement quality objectives, and QA requirements fulfilled.

7.6 Representativeness

Field operators will conduct measurements and collect samples in a manner that will assure the representativeness of the data (in terms of what each data point represents in the environment). Where needed, crews will perform additional testing in the vicinity of each station to describe the inherent spatial variability. Temporal variability will be assessed using continuous monitoring data, which will be obtained from SWAMP crews under a separate effort.

8 Special Training Needs / Certification

8.1 Specialized Training or Certification

The only specialized training required for this Project is an 8-hour Health and Safety training, required for all the leaders of field crews (and optional for other crew members). The course participants receive a completion certificate and they need to maintain it current if they want to participate in additional Projects. [[MP 9.1]]. As for non-specialized training, all Project personnel will be offered courses that should help them to fulfill their roles. These include an 8-hour training class on field measurements and a six hour class on water sampling techniques, for the field operators; a 12-hour Train the Trainer class and an 8 hour data validation class for the Trainers; and a 6-hour DQO course and 12 hour study design development course for the Technical Leader. These training courses will be available to Sycamore RCD personnel and field crews, as well as to members of FSC.

8.2 Training and Certification Documents

All Training materials, handouts, class rosters, and certification records related to this Project will be kept at the Sycamore RCD main office. The Happy Flask Laboratory maintains its own training documents and certification records.

8.3 Training Personnel

Technical liaison trainers from the State Water Resources Control Board will provide training sessions for the RCD personnel filling the roles of the Technical Leader and the Trainer. Training workshops will be provided to all field operators by Sycamore RCD Trainer. The Happy Flask Laboratory maintains its own training personnel.

9 Documents and Records

Patrick Tech will be responsible for maintaining the project QAPP. Copies of the QAPP will be distributed to all parties involved with the project including Copies of this QAPP will be distributed to all parties involved with the project, including Team leaders of field operators from Sycamore RCD and FSC. Copies will be sent to the Happy Flask Laboratory Manager for distribution within Happy Flask. Any future amended QAPPs will be held and distributed in the same fashion. All originals of this first and subsequent amended QAPPs will be held at Sycamore RCD. Copies of versions, other than the most current, will be discarded so as not to create confusion..

Sycamore RCD personnel assisted by FSC volunteers will collect and maintain all their field records including field data sheets, sampling log sheets, and Chain of Custody forms. Happy Flask Laboratory generates records for sample receipt, and storage, preparation, and analyses in hardcopy and electronic formats.

The Sycamore RCD Project Manager will oversee the maintaining and storage of all records and will arbitrate any issues relative to records retention and any decisions to discard records. The Happy Flask Laboratory Manager will be responsible for maintaining and retaining all analytical records including

sample log in records, chain-of-custody records, and printed and electronic data records from laboratory analyses.

All records generated by this project will be stored at Sycamore RCD's main office. All lab records will also be stored at Happy Flask Laboratory main office, and all records received from other organizations/agencies will also be stored at Sycamore RCD's main office. All records will be passed to the State Board Contract Manager at project completion. Copies of the records will be maintained at Sycamore RCD and Happy Flask Laboratory for five years after project completion then discarded, except for the data files, which will be maintained without discarding.

The Happy Flask Laboratory will archive all of the analytical records generated for this project. Patrick Tech will be responsible for archiving all of the other records (e.g. the field operation records and training records.

All field operation records will be entered into electronic formats and maintained in a dedicated directory on the Sycamore RCD network. Each file will also have at least two back-up copies on CDs. The lab will have a dedicated directory for Sycamore RCD in their data repository. They will deliver data in hardcopy and electronic format to Sycamore RCD, and the Technical Leader will be responsible for storage and safekeeping of these records.

10 Sampling Process Design

Sampling design and logistics are described in detail in Section 6 of the attached Monitoring Plan. This Plan also provides all the maps that show the sampling locations and discusses the considerations involved in Station selection. The following paragraphs summarize that information.

Data collection will proceed in one line of inquiry. The Question – **"What are the sources of *E. coli* to the main stem of Sycamore Creek during summer?"** - will be addressed via three concerted "snapshot type" events, each including sampling of selected characteristics at multiple locations within the river network conducted at the same time. Field activities will be led by Sycamore RCD staff, and lab analyses will be performed at Happy flask Laboratory. Four team leaders will be selected from Sycamore RCD staff, and each will lead a field crew augmented by trained FCD volunteers.

Table 10-1 shows a summary of the groups of characteristics that will be monitored for this line of inquiry. The entire "Parameter package" is listed. It also shows responsible personnel, sampling frequency & intervals, time of day, target weather/flow conditions (e.g., dry, base flow), and the total number of Station Visits for each characteristic group. The paragraphs below provide a brief description of the logistics, methods, and sampling options.
[MP-6.1]

Table 10-1: Parameter Package and Logistics for the *E. coli* Source ID Study

Study question or intent	Characteristics (Parameter package)	Personnel	Activity type	Activity Frequency and Interval	Time of Day	Weather & flow conditions	# of Station Visits
Source ID	Five "vital signs" (*Note a*)	Sycamore RCD and FSC	Field measurements	3/Project, 4-6 weeks apart	Any	Dry, base flow	**60 planned** (3 sampling rounds, 4 crews collecting 5 Samples in each round), plus **36 optional**
	Estimated Flow	Sycamore RCD and FSC	Field measurements	3/Project, 4-6 weeks apart	Any	Dry, base flow	"
	E. coli and total coliform	Sampling RCD+FSC, lab Happy Flask	Sample; lab count	3/Project, 4-6 weeks apart	Any	Dry, base flow	"
	Nutrients (ammonia, nitrate)	"	Sample; lab analysis	3/Project, 4-6 weeks apart	Any	Dry, base flow	"
	Human use indicators (chlorine, chloride, and fluoride)	"	Sample; lab analysis	3/Project, 4-6 weeks apart	Any	Dry, base flow	"

Note a The five "vital signs" are: temperature, pH, dissolved oxygen, specific conductivity, and turbidity [MP-6.1]

Who? Field activities will be led by Sycamore RCD staff, and lab analyses will be performed at Happy flask Laboratory. Four team leaders will be selected form Sycamore RCD staff, and each will lead a field crew augmented by trained FCD volunteers.

What? Sycamore RCD staff and FCD volunteers will collect sterile water samples for *E. coli* and Total Coliform counts, and additional samples for analysis of chlorine, ammonia, nitrate, chloride, and fluoride. While sampling, they will conduct field measurements of temperature, pH, dissolved oxygen, specific conductivity, and turbidity (a.k.a, the five "vital signs") coupled with observation of flow conditions and measurement of stage (water level) or flow discharge.

Where? Multiple Field crews will visit various locations on the North fork and the South fork of Sycamore Creek. Stations for this Project will be located at key points in the river network as well as upstream and downstream of the most prominent communities and resorts, to provide representation of potential sources of fecal bacteria. Planned sampling Stations will be selected from a list of access points that have already been established during the 2007 reconnaissance activities, mapped by GPS coordinates, and described by landmarks. Actual sampling sites will be determined "on the run" during the first sampling trip, and the same spots will be visited again on consecutive trips if accessible and relevant. Inaccessible locations will be substituted with alternative sites in the same reach; those will be selected from the established list. Where needed, crews will perform additional testing and/or sampling in discharging outfalls, or in the vicinity an established Station to characterize the inherent spatial variability.

When? Source ID trips will be conducted three times during the summer of 2008; exact timing (the specific day within the week or the season) will be determined based on flow, water quality conditions, and anticipated activities. Unfortunately the time of day will not be selected deliberately, for logistical reasons, because each crew will need to be at five different locations during one sampling day. Monitoring work will be performed during dry weather only, but the data will be augmented with results of wet-weather monitoring conducted by other entities (see details below).

How Many? The total number of samples for the Project may reach 96, depending on flows. Four (4) field crews will be conducting measurements and sampling on each sampling event. Each Field Crew will visit five (5) Stations in one sampling event, and collect one set of sample containers (i.e., one Sample) at each Station. Each crew will have the option of collecting three additional Samples each trip, either from flowing outfalls or in the vicinity of a Station to characterize spatial variability. Thus, each crew may bring back up to eight (8) samples from each event. The crews will perform three (3) sampling events during the Project, visiting a total of 20 Stations during each sampling event. In summary, each Station will be sampled three times, some outfalls will be sampled, and some Stations will be represented by two or three separate Samples collected at the same event. The lab will be able to receive and process up to 32 samples

per event. The total number of environmental samples collected and analyzed for this study will be 96. Please note that additional samples will be collected as field duplicates, and sets of sample containers will also be filled with clean water to serve as field blanks.[[MP-6.1]

How? Field measurements will be performed using a variety of meters, electrodes, or probes as described in Element 13 of this QAPP. Grab water samples will be delivered to Happy Flask Laboratory for counts of total coliforms and *E. coli* using the IDEXX Colilert reagent and QuantiTray system. Happy Flask Laboratory will also receive the grab samples collected by the RCD and FSC field crews for analyses of selected nutrients and ions (ammonia, nitrate, chloride, fluoride). Provisions are also made for isolating *E. coli* colonies from samples that have high *E. coli* counts and sending the colonies for DNA ribotyping to determine the host species of that *E. coli* strain. However the QA procedures for this effort are not described in the QAPP.

Additional Monitoring Data & Information (collected by others): Dry-weather data collected for this Project will be augmented by wet-weather sampling effort conducted by the Sycamore County Flood Control District, continuous flow discharge data will be available from the Sycamore Water District Stream Gauge as well as all the District's bacterial testing results.

11 Sampling Methods

Sample containers will be cleaned by the Happy Flask laboratory and delivered to the field crews before each sampling event. The containers will have a label with placeholder for the Sample ID, Station ID, Date, time, and operator initials; the operators will fill out this label before filling the container with sample water. All samples will be collected as grabs, by wading and filling the container directly. Field operators will follow SWAMP SOP (e.g., collect at the centroid of the flow, 0.1 m below the surface, facing upstream) as provided in appendix D of the SWAMP QAMP (SWAMP 2001). All containers will be rinsed three times with ambient water except for the sterile containers for *E. coli* counts and any container that already has preservative in it; those will be filled once, to the container's shoulder. Alternative methods including extension of sampling devices from the bank will be used where needed, again following procedures delineated in Appendix D of the SWAMP QAMP. Devices will be decontaminated prior to collection at each Station. If sampling devices have to be used, it will be noted in the field data sheet. Field Operators will fill out the Sampling Log part of the data sheet immediately after sampling.[MP-6.1]

The RCD QA Officer will audit each the field crews to assure the use of correct sampling procedure, and will record any deviation from SOPs. If there is any reason to suspect sample integrity, the team will be instructed to repeat the sampling using fresh containers and following appropriate procedures, and this action will be documented in the Sampling Log.

12 Sample Handling and Custody

Sample volume, type of containers, and preservation methods are dictated by the analyte and the analytical method used, because each measurement system has it own specifications and requirements. Table 12-1 shows sample handling summary for the lab analytes (see the methods in the next Element).

Sample custody will conform with the following SWAMP Requirements:

- The field crews shall have custody of samples during field sampling. Chain of custody forms will accompany all samples during shipment to contract laboratories.
- A complete chain-of-custody form will be filled by the field crews and will accompany the transfer of samples to the laboratory
- Laboratory Custody Log**:** Laboratories shall maintain custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times.

13 Analytical Methods [field and lab]

This section describes the measurement systems that will be used to collect the data for the Sycamore Creek bacterial study. The words "Measurement System" are used here as a catch-all term for "Devices and/or procedures used for quantitation of environmental characteristics, including instruments used for field measurements and sampling & analysis processes". The measurement systems selected to achieve the Measurement Quality Objectives (MQOs) developed for field measurements are shown in **Table 13-1**.

Table 13-2 shows information related to the laboratory operations.

Laboratory Procedures will include detailed review of the quality check outcomes for each analytical run and comparison of recovery and precision to lab control charts to determine whether the measurement system performed within acceptance criteria. This review will be done by lab technician and supervised by Happy Flask Laboratory Manager. The complete set of each event's Results and QA information will be delivered to Sycamore RCD, after the Lab QA Officer (QAO) review, within three weeks of sample collection. If any analytical problems are identified, the resulting data will be flagged with the appropriate lab code and the problem will be immediately reported to the Lab QAO and the Sycamore RCD QAO, who will discuss how to qualify that batch.

The samples will be stored in the lab until expiration of holding times, and then the sample water (which is essentially creek water) will be discarded into the sanitary sewer. Samples with acid preservatives will be neutralized prior to disposal. The laboratory will also be responsible for autoclaving of used IDEXX QuantiTrays prior to disposal as garbage.

Table 12-1: Specifications for Sample Handling

Characteristic	Method #	Method group	sample container material & property	minimum container volume (ml)	preservative	holding time (at 4 C)
E. coli and Total coliform	SM 9223B	Colilert kit	plastic, sterile	100	none or thiosulfate	12 h *(Note a)*
ammonia, total	4500-NH3 G	Colorimetric	Plastic (Polyethylene)	250	H2SO4 to pH<2	28 days
Nitrate	EPA 300.0	Ion chromatography	Plastic or glass	500	none	28 days
Chloride	EPA 300.0	Ion chromatography	Plastic or glass	500	None	28 days
Chlorine	4500-Cl G	Colorimetric	Plastic or glass	500	none	0 h
Fluoride	EPA 300.0	Ion chromatography	Plastic or glass	500	None	28 days

(Note a) EPA has three scenarios with three different requirements, depending on the sample source and the intended use of the data. [MP Table 8-2]

Table 13-1 Instruments and Kits Used for Field Measurements

Character-istic (Parameter)	Method base	Type /Method	Features	Model	Calibration Mode	Range and Units	Resolution
pH		Dry electrode	Pocket meter without ATC	pHtstr1	automatic (pH 4,7,10)	0 to 14 pH units	0.1
pH		Glass combination electrode	probe mounted on Sonde, ATC via Sonde	6561	manual (3 points)	0 to 14 pH units	0.01 units
Specific Conductivity		Conductivity Cell	Pocket meter, waterproof, with ATC	ECTstr low+	manual	0 to 1990 uS	1
Specific Conductivity		Conductivity Cell	probe mounted on Sonde, ATC via Sonde	6560	manual	0 to 100 mS/cm	0.1, 1, 10, 100 uS/cm
Dissolved Oxygen		Polarographic	Meter with electrode		manual, mg/L or % saturation	0 to 20 mg/L	0.1
Dissolved Oxygen		Polarographic, Rapid Pulse	probe w membrane, mounted on Sonde	6552	manual, mg/ L or % saturation	0 to 50 mg/L	0.01 mg/ L
Temperature		spirit bulb thermometer	glass in plastic armor		non-adjustable	- 5 to 45 C	0.5
Temperature		Thermistor	extension from conductivity probe, mounted on Sonde	6560	non-adjustable	-5 to 45 C	0.01 C

ATC – built-in automatic temperature compensation device

[MP-Table 8-1]

Table 13-2 Methods Selected for Bacterial Counts and Laboratory Analyses and their Performance Criteria

Parameter	**Unit**	**Method # *(Note a)***	**Method Name/Principle**	**Detection Limit**	**LCS Recovery in DI (**Lab Control Chart Limits)	**MS Recovery (**Lab Control Chart Limits)	**Repeatability** (%RPD of lab replicates	**Reproducibility (**%RPD **of field duplicates**
Total coliform	MPN /100mL	SM 9223B	Colilert (Enzyme-substrate)	2	Not applicable	Not applicable	40	50
E.coli	MPN /100mL	SM 9223B	Colilert (Enzyme-substrate)	2	Not applicable	Not applicable	40	50
Total Ammonia	mg N/L	4500-NH3 G	Ammonia by Automated Phenate	0.02	90-110%	80-120%	10	20
Nitrate	mg N/L	EPA 300.0	Inorganic Anions by Ion Chromatography	0.1	90-110%	80-120%	10	20
Chloride	mg/L	EPA 300.0	Inorganic Anions by Ion Chromatography	0.05	90-110%	80-120%	10	20
Chlorine	mg/L	4500-Cl G	Chlorine by DPD	0.01	Not available	Not available	Not available	Not available
Fluoride	mg/L	EPA 300.0	Inorganic Anions by Ion Chromatography	0.05	90-110%	80-120%	10	20

Note a: SM is the *Standard Methods for the Examination of Water and Wastewater*, 20th edition. (APHA 1998).
[MP-Table 8-3]

14 Quality Control

Data Quality will be assured via a number of actions designed to affect the quality (i.e. calibrate, clean, be persistent, train the operators, etc.), and will be checked by a number of other actions. The Monitoring Project Plan (a companion document to this QAPP) elaborates on the different aspects of data quality that will be addressed, including accuracy, precision, sample integrity (lack of contamination and lack of deterioration), and operator's competence. Generally, each aspect of data quality will be subject to the following four actions:

- Affect (act to influence the outcome)
- Check (test to evaluate or verify)
- Record (keep everything documented), and
- Report (communicate the data quality indicator outcome).

[MP 9.3]

Table 14-1 shows the frequencies of the various quality checks, including QC samples, blanks, etc.. The outcomes of these checks will be used to calculate accuracy (bias) and precision as described in detail in Element 7 of this QAPP, along with the description of procedures for calculating or evaluating the other Data Quality Indicators (completeness, comparability, representativeness, and sensitivity). The control chart limits for Recoveries and RPD have been described in detail in Element 13 of this QAPP, along with information about the review and data flagging process, the corrective action, and the responsible parties.

If Analytes are detected in any of the blanks, it will be reported to the lab QAO immediately and all results generated from that batch of samples will be flagged. The lab QAO will discuss the severity and potential source of contamination with the RCD QAO, and they will decide how to qualify the data. The QAOs may decide to run additional checks for the source of contamination, and - if the source is found - initiate corrective action immediately so that all is ready for the next sampling round. There will be extra checks on the following round to determine if the problem has been corrected.

15 Instrument/Equipment Testing, Inspection, and Maintenance

Field measurement equipment will be checked for proper operation a few days before each sampling event. The checklist varies for different types of instruments. Examples include battery checks, routine replacement of DO membranes, or cleaning of conductivity electrodes. Happy flask Laboratory maintains its equipment in accordance with its SOPs, which include those specified by the manufacturer and those specified by the method. These SOPs have been reviewed by the Sycamore RCD Quality Assurance officer and found to be in compliance with SWAMP criteria. Both field and Lab personnel keep detailed records of all testing, inspection, and maintenance activities, as well as updated inventories of equipment and supplies. Malfunctioning field instruments will be sent to the manufacturer for service and replacement be sought, either as a short term loan from other agencies (if the instrument can be repaired) or as new purchase; all loaned and new instruments will be inspected upon arrival. Sycamore RCD maintains a special cabinet for equipment and supplies in the RCD Director's office and only the Trainer, Technical Leader, and the field coordinator have a key.

Table 14-1 Frequency of Checks for Sample Integrity, Laboratory Accuracy, Laboratory Precision, and Process Reproducibility.

Charac-teristic	Unit	Method #	Trip/Field blank frequency	initial equipment blank frequency	final equipment blank frequency	other blanks and frequency	field duplicates frequency	Lab Control Sample (LCS) type/range and check frequency	CRM material, concentration range, and check frequency	Matrix Spike /MS Duplicate frequency	Sample lab replicates frequency
E. coli	MPN /100 mL	SM 9223B	10% or 1 per Sample Batch (Note 1)	1 per Trip (if using devices)	3 per Trip (if using devices)	gloves rinsate	20% or 1 per Sample Batch	positive & negative controls, 2 per reagent batch	Not applicable	Not applicable	40%
ammonia, total	mg/L	4500-NH3 G	5% or 1 per Sample Batch	1 per Sample Batch	1 per Sample Batch		10% or 1 per Sample Batch	1 per Lab Batch (Note 2)	QA-55D, 0.1-0.5ug/l, 1 per week	4 per Project	10% or 2 per Lab Batch?
nitrate	mg/L	EPA 300.0	5% or 1 per Sample Batch	1 per Sample Batch	1 per Sample Batch	**(Note 3).**	10% or 1 per Sample Batch	1 per Lab Batch (Note 2)	QA-55D, 0.1-0.5ug/l, 1 per week	4 per Project	10% or 2 per Lab Batch?
chloride	mg/L	EPA 300.0	5% or 1 per Sample Batch	1 per Sample Batch	1 per Sample Batch	**(Note 3).**	10% or 1 per Sample Batch	1 per Lab Batch (Note 2)	QA-55D, 0.1-0.5ug/l, 1 per week	4 per Project	10% or 2 per Lab Batch?
fluoride	mg/L	EPA 300.0	5% or 1 per Sample Batch	1 per Sample Batch	1 per Sample Batch	**(Note 3).**	10% or 1 per Sample Batch	1 per Lab Batch (Note 2)	QA-55D, 0.1-0.5ug/l, 1 per week	4 per Project	10% or 2 per Lab Batch?
chlorine	mg/L	4500-Cl G	5% or 1 per Sample Batch	1 per Sample Batch	1 per Sample Batch		10% or 1 per Sample Batch	1 per Lab Batch (Note 2)	QA-55D, 0.1-0.5ug/l, 1 per week	4 per Project	10% or 2 per Lab Batch?

Note 1: A Sample Batch is made of all samples collected by one Field Crew during one Trip.
Note 2: A Lab Batch is made of all the samples analyzed in one day by one lab instrument between calibrations
Note 3: add 1 lab reagent blank & 1 lab fortified blank per sample batch; add 1 calibration blank per sample batch for Nitrate [MP-Table 9-3]

16 Instrument/Equipment Calibration and Frequency

The frequencies of instrument calibration for field measurement instruments are specified in **Table 16-1**. In the laboratory, accuracy will be assured by calibration using reliable standards, at the frequency specified in the Method or Lab SOPs. Sycamore Creek operators will only use standard solutions that are:

- certified, or traceable to NIST or ASTM
- used within expiration date
- stored in the dark at non-extreme temperature, never frozen
- compared with fresh standards before used up

Table 16-1 Frequency of Calibration Adjustments & Accuracy Checks and of Repeated Measurements for Field Instruments

Character-istic	mode	Instrument name or type	Standard Material	Frequency of Calibration &Accuracy checks	Frequency of repeated measurements
dissolved oxygen	Adjust-able	DO electrode (Meter) or Probe	Humid Air or saturated water	Daily, calibration adjustment before first and accuracy check after last measurement (midday or between Stations if needed)	20% or 2 per Trip
Temperature	non-adjust-able	Bulb Thermometer	NIST thermometer	Periodic accuracy checks, examine capillary daily	20% or 2 per Trip
Temperature	non-adjust-able	Temperature probe (with multimeter or DO meter)	NIST thermometer	Periodic accuracy checks	20% or 2 per Trip
Specific Conductivity	Adjust-able	Pocket EC meter	Salt Standard solution	Periodic accuracy checks and calibration adjustments	20% or 2 per Trip
Specific Conductivity	Adjust-able	conductivity Probe	Salt Standard solution	Periodic accuracy checks and calibration adjustments	20% or 2 per Trip
pH	Adjust-able	Pocket pH meter (dry electrode) or Probe	Standard buffer solution, pH 7, 10	Daily, calibration adjustment before first and accuracy check after last measurement	20% or 2 per Trip
Turbidity	Adjust-able	Nephelometer or turbidimeter	Formazin or other	Daily, calibration adjustment before first and accuracy check after last measurement	10% or 1 per Trip

(Note a) For Sonde data logger probes: Calibration adjustment before, accuracy check after, each deployment. [MP-Table 9-2]

If during calibration an instrument cannot be adjusted to the desired Standard value, it will be examined carefully to determine functionality under variable conditions. Malfunctioning field instruments will be sent to the manufacturer for service and replacement be sought, either as a short term loan from other agencies (if the instrument can be repaired) or as new purchase; all loaned and new instruments will be inspected and calibrated upon arrival.

17 Inspections/Acceptance of Supplies and Consumables

All supplies will be examined for correct items, quantities shipped, leakage, or damage as soon as they are received. pH and conductivity standards will be given unique IDs and will be logged in with all their descriptors including lot numbers. When opened, the new Standard solutions will be compared to the old batches. Happy Flask Laboratory also uses tracking and inspection checklists, and they have an elaborate tracking system for individual bottles of Standards which they use to interpret their control charts. The inspection and checking SOP, which has been examined by the Sycamore RCD Quality Assurance Officer, are available upon request.

18 Non-Direct Measurements

Non direct measurements in the context of the Sycamore bacterial study include both existing data and new data currently collected by others.

Dry-weather data collected by the Sycamore RCD and the volunteers for this Project will be augmented by wet-weather sampling conducted by the Sycamore County Flood Control District as part of their Stormwater Characterization Program, which is described in the Monitoring Plan developed for this effort. In addition, the Regional Board surface Water Ambient Monitoring Program (SWAMP) efforts will augment this Project's data with sampling for the analysis of heavy metals, other priority pollutants selected from the 305(b) list, and toxicity in water and sediment; these trips will be conducted in April and October of 2008. SWAMP crews will also deploy probes for continuous monitoring at their three fixed Stations on the main stem and make the data available to the Sycamore RCD. The friends of Sycamore Creek conduct routine monitoring every two weeks during spring, summer and fall, and their data will also be provided to augment this Project.

The Sycamore RCD Technical Leader will also use continuous flow discharge data from the Sycamore Water District (SWD) Stream Gauge, and will have access to all the results of the District's bacterial testing (conducted routinely at their water intake point and three times a year at other locations in the watershed). The agencies sharing these data are implementing SWAMP-compatible QA procedures. [MP-6.4]

The validity status of the data generated by others will be reviewed, and data will be classified as described in Section 9.6 of the Monitoring Plan. Essentially, if the data are valid (i.e., met the performance criteria of the measurement system) they can be used by the RCD for data interpretation even if they did not meet the Project's MQOs or SWAMP MQOs, but they will not be used for decisions that cannot tolerate wider error.

19 Data Management

Sycamore RCD selected an MS Excel workbook that provides a platform for all their data documentation, manipulation, and management needs at the Project level. The amount of data expected from this effort can easily be accommodated and does not justify creation of an elaborate system using external IT expertise. Selected data fields from this Project File will be shared with others as is, or exported to central databases, but there will not be continuous direct linkage for update.

Field activities will be recorded on the Field Data Sheets tailored to this Project, which include placeholders for the Station visit identifiers, the visual observations, the field measurements, and the sampling log (see Figure **9-1** in the Monitoring Plan). Some of the field crews may opt to capture all information called for in the Field Data Sheet in electronic format while at the Station, using a Personal Digital Assistant (PDA). In that case, the crew will enter the field information into both hardcopy and electronic formats every third Station Visit (i.e., 33% duplication) and the "% mismatch" will be calculated and documented.

Calibration and accuracy check records for field instruments will be captured on the appropriate data sheet or PDA spreadsheet. Each Instrument has a unique Instrument ID that will be used to track its performance.

All Project information will be entered into the appropriate spreadsheets in the Sycamore Project File workbook. Station locations will be constantly updated in the LOCATION spreadsheet; Project personnel names, roles, and contact information (as shown in Table 4-1 above) will be copied into the PROJECT ORGANIZATION spreadsheet; field equipment will be logged into the INSTRUMENTS spreadsheet; and calibration standard solutions will be entered into the STANDARDS spreadsheet inventory. Laboratory data will be imported in electronic format into the RESULT-LAB spreadsheet, and information captured in the hardcopy field data sheets discussed below will be entered into the RESULT-FIELD spreadsheet and the CALIBRATION & ACCURACY CHECKS spreadsheet.

The concept of a unique Instrument ID has been implemented in the DQM for documenting the quality of field measurements, because it links a set of measurement results with the calibration records of the instrument that was used to collect them. Other bits of information will also be also linked via a unique ID, including Sample ID, Station ID, Project ID, Dataset ID, and Team Name. Figure 9-**2** in the Monitoring Plan shows how all the Sycamore Project File spreadsheets are linked together to provide a catch-all workbook for all Project's data and metadata. The file is constructed as a relational database, and selected fields of data and metadata will be easily "crosswalked" and exported into other relational databases as needed.

Documented, validated and qualified data generated in this Project will be stored in the Sycamore Project File as described above.

20 Assessments & Response Actions

Field activities will be overseen by the Trainer, and in some cases by other Project personnel. The QA/QC officer will audit the field operations on at least one event and conduct spot-checks for proficiency. Apparent lack of skill in using a given Instrument or collecting a sample will be noted, data collected by that Team (field crew) for that parameter will be flagged, and all field operators from that team will get refresher training ASAP. External review of QA/QC procedures will be conducted during the review of QA/QC results after each event. [MP-9.7]

If an external review or audit discovers any discrepancy, the RCD's QA Officer will discuss the observed discrepancy with the appropriate person responsible for the activity. The discussion will begin with whether the information collected is accurate, what were the cause(s) leading to the deviation, how the deviation might impact data quality, and what corrective actions might be considered.

21 Reports to Management

The Project personnel will prepare three types of report:

(a) Lessons learned, protocol deviation, QA/QC results, and data validation outcomes will be compiled and reported as Interim Reports after each event. These reports will be prepared by the Sycamore RCD QA Officer in collaboration with the Technical Leader and the Trainer, and be submitted to the project director and to the Regional Board's Contract Manager. [MP-9.7]
(b) Quarterly Administrative Progress Report will be prepared by the Project Manager and sent to the Regional Board's Contract Manager with the quarterly invoice. [MP-9.8]
(c) Technical Report will be prepared by the Technical leader with input from the technical experts who assisted with the study design. The report will be submitted to Regional Board's Contract Manager and other stakeholders. [MP11-3]

22 Data Review, Verification, and Validation

Criteria for acceptance of analytical runs and performance of field instruments are described in previous elements of this QAPP (Elements 14, 15, 16, and 17). Each batch of results will be checked against these criteria. The outcomes of quality checks for all relevant Data Quality Indicators (accuracy, precision, etc.) will then be compared with the measurement quality objectives provided in Element 7, to assess compliance. Monitoring Results will be classified and qualified as described in **Table 22-1** below.

Table 22-1: Result qualifiers for this Project's data.

Qualifier	Definition
Unknown	Information for review is not available
Not Checked	Data quality has not been reviewed
Not Valid ("R")	("R" for rejected) existing information indicates that the result was obtained in an analytical run or *E. coli* test that were not acceptable, or with the use of malfunctioning instrument
Estimated ("J")	"J"; by best professional judgment - not valid but flaw not detrimental; result can be used but with caution
Valid	Measurement system met its performance criteria: e.g., Analytical run or bacterial test were acceptable; recoveries were within control chart, positive/negative control results were acceptable, instrument was functional, sample integrity was preserved
Valid and meets Project MQOs	Result was valid and accuracy & precision error was within the measurement quality objectives specified for the dataset; dataset met completeness objective
SWAMP comparable	Result is Valid and meets SWAMP MQOs, data set meets all SWAMP requirements

[MP-9.6]

23 Verification and Validation Methods

Data verification and validation will be done based on draft SOP-9.4.4.1 of the CWT compendium, in a process that includes the following phases:

Phase	Example of Tasks
Inventory	Tally sites, Station visits, Samples, number of each type of Quality Checks, etc
Monitoring Plan and/or QAPP comparisons	Compare activities inventory w Plan
Alignment and matching	Align Teams & Stations with Samples, Instruments and Calibration and Accuracy checks records
Data entry, upload, and conversion	Type data, prepare batches for upload
Correctness Check (for manual data entry)	Run spot-check or full check for data entry errors, or utilize double-entry tools
Sample validation	Summarize blank checks outcome, Review field notes
Error Calculation	Calculate accuracy and precision by Instrument or lab batch
Performance acceptability assessment	Compare error to lab control chart for each Measurement System; review detection/reporting limits
Validity status assessment	Compare output of phase 2.2 with Project's Measurement Quality Objectives (MQOs) and with SWAMP MQOs.

[MP-9.6 (part of Table 9-4)]

The Technical Leader and Trainer will conduct this process and record all outcomes and any outstanding issues that require flagging of specific data batches as described in Element 13 of this QAPP. They will report all outstanding issues to the RCD QAO. The QAO and the Technical Leader will discuss how to flag and qualify the data as described earlier. They will also decide how to communicate the outcome to the data users and prepare the QA Chapter of the summary report accordingly.

Monitoring results generated in this project will be grouped according to what they represent in the environment (e.g., stream or outfall) and descriptive statistics such as average or median will be derived if meaningful. The nature of this study limits the need for hypothesis testing or for statistical comparisons between two "populations" of data, but the appropriate tests (e.g., t-test or ANOVA) will be applied if meaningful. In contrast, analysis of correlations will be widely used to discover relationships between different characteristics (e.g., *E. coli* counts and nitrate) across space and time.[MP-11.2]

The Presentation format or choice for this Project, being a Source ID study, is a map. For example, detections and severity of counts or concentrations will be depicted on the watershed map in meaningful icons. If the required software becomes available, concentrations (e.g., of total ammonia) will be shown as proportionally sized dots on the watershed map for each sampling event. Correlations will be shown graphically or in tabular formats. A summary of all Project data will be provided in hardcopy table in an appendix. [MP-11.3]

24 Reconciliation With User Requirements

The project's results will be evaluated to determine whether the project's objectives have been satisfied by assessing completeness and assuring that there is adequate statistical power for comparisons. Correlations between different analytes will be reviewed to determine whether they can shed light on bacterial sources. The data will also be reviewed to identify possible anomalies or departures from assumptions made when the project was planned.

There are no limitations on data use for this Project. All data will be released for review by the local stakeholders, the Contract Manager, and the Regional Board's QAO as soon as the data verification, validation, and qualifying is complete. Comments of this review will be addressed, and, when everything has been reviewed again by the contract manager, the data will be released into the public domain.

The data generated by this project are comparable to SWAMP and will be used to augment SWAMP data collected with the same intent and design. The data will be transported into the SWAMP database in a single batch if the transport mechanism is active, and will not be available for corrections later. Alternatively, the data will be transported to one of the local data Nodes of the California Environmental Data Exchange Network and will be mined alongside with SWAMP data from that Node.

End of Example QAPP.

This imaginary Plan was derived from the imaginary Sycamore Creek Bacterial source ID Monitoring Plan prepared by Revital Katznelson, who is willing to take the blame, the credit, and the questions at 510 622 2470 rkatznelson@waterboards.ca.gov