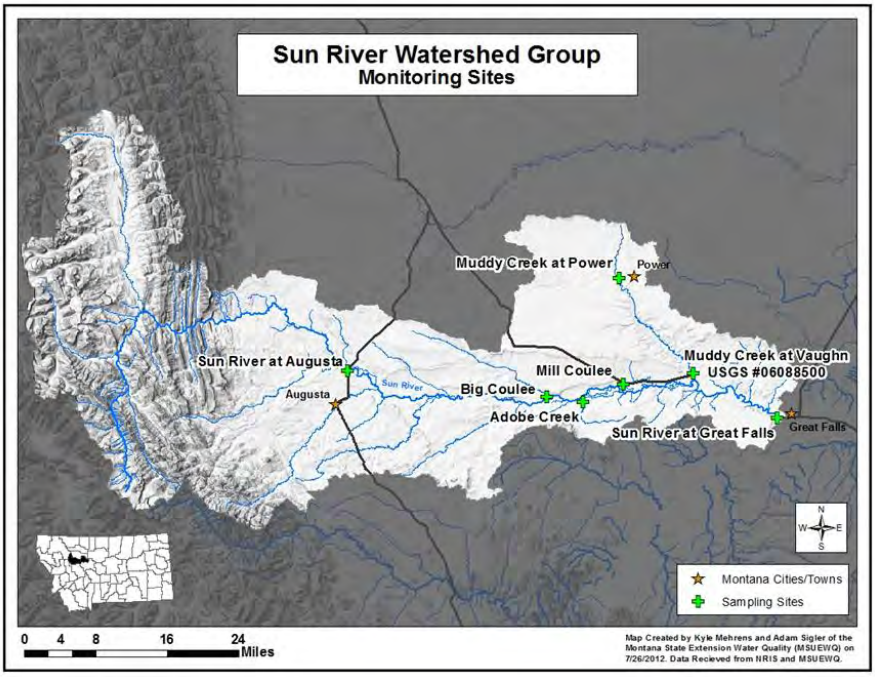
Sun River
Quality Assurance Project Plan

Version 1.0 - September 19, 2012



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Document Summary and Purpose

This document provides overarching guidance for water quality data collection within the Sun Watershed as directed by the goals of the Sun River Watershed Group (SRWG). Monitoring goals and priorities laid out in this document are derived from feedback from the stakeholders involved with the SRWG. Feedback was gathered from stakeholders at public meetings in January and April of 2012, from Alan Rollo (watershed coordinator) and through email follow-up with additional stakeholders in February of 2012. Data is being collected in the watershed by the SRWG, the US Geological Survey, the US Forest Service, the US Bureau of Reclamation, the US Fish and Wildlife Service and the MT Dept. of Fish Wildlife and Parks. It is understood that each of these groups has specific goals and data collection policies that direct their data collection efforts. One goal of this document is to bring a degree of shared vision and methodology for long term trend monitoring to the fore which may help shape agency data collection efforts.

This document outlines methods and design for SRWG volunteer water monitoring efforts so those efforts can help to meet the data use objectives of the SRWG. This document will also serve as an umbrella document under which special SRWG monitoring projects can be structured. The scope of work that the SRWG conducts is too broad for this document to exhaustively cover possible sampling designs. However, general guidance is provided for designing monitoring projects to assess the effectiveness of BMPs or to meet other data use objectives. This guidance should be considered when specific sample analysis plans (SAPs) are written for future projects.

Distribution List

All stakeholders affiliated with this project should be informed and receive copies when subsequent versions of this document are created. A distribution list of these stakeholders can be found in Appendix A.

Background Information

Watershed Description

The Sun River watershed is located in west-central Montana and drains 2,200 square miles. The Sun River begins along the eastern Rocky Mountain Front and flows 97.4 miles through Cascade, Lewis & Clark, and Teton counties to its confluence with Missouri River at Great Falls, Montana. The watershed contains approximately 100,000 acres of irrigated land, 300,000 acres of dry cropland, 400,000 acres of rangeland, and 100,000 acres of pasture. The balance of the acreage is forested. The watershed houses two irrigation districts - Greenfield Irrigation District and Fort Shaw Irrigation District. Collectively, the districts irrigate 96,000 acres within the watershed. The Sun River watershed is connected to the Teton River watershed via man-made canals and irrigation works. However, Total Maximum Daily Loads (TMDL) and Water Quality Management Plans for the Teton and Sun Rivers have been developed in separate documents.

Several sections of the watershed were included on the Montana 2012 List of Impaired Waters. The Sun River has an "impaired" designation, unable to support designated uses from Gibson Dam to Muddy Creek and also from Muddy Creek to the mouth at its confluence with the Missouri River. Causes of impairment from Gibson Dam to Muddy Creek include alteration in stream-side or littoral vegetative covers, other flow regime alterations, sedimentation /siltation, and water temperature. From Muddy Creek to the Missouri, causes include total nitrogen, total phosphorus, other flow regime alterations, and sedimentation/siltation. Other sections with impairment designations include Muddy Creek (headwaters to mouth), Ford Creek (from mouth to 2 miles upstream), Gibson Reservoir, Willow Creek Reservoir and Freezeout Lake. More detailed information regarding 303(d) listings within the watershed can be found on Montana DEQ's Clean Water Act Information Center website (http://cwaic.mt.gov/).

Sun River Watershed Group Description

Intensive data collection in the Sun River watershed began in the 1970s and has been collected at numerous sites, by multiple agencies, for a variety of reasons since that time. The Sun River Watershed Group (SRWG) and the Muddy Creek Task Force (MCTF) were formed in 1992 to coordinate watershed restoration efforts in the Sun River Watershed. The SRWG is made up of an executive board of five members and a coordinator, Alan Rollo, who has been the watershed coordinator since 1995. The SRWG incorporated in 1995, and began addressing nonpoint source pollution through projects funded by grants in the late 1990s. MDEQ worked with the SRWG on these restoration efforts and completed a restoration plan and TMDL document for the watershed in 2004.

The SRWG has been coordinating with the US Geological Survey (USGS), MSU Extension Water Quality (MSUEWQ), and the Sun River Science Club (SRSC) to collect meaningful data on the Sun River and its

tributaries since 2004. MSUEWQ led water quality data and lab sample collection efforts between 2004 and 2009, with a plan to gradually transfer of responsibility to Rai Hahn and the SRSC. The SRSC has collected data independently with modest support from MSUEWQ since 2009.

The responsibility of collecting discharge data at the various SRWG sample sites has fluctuated historically. Currently, this information is being gathered by Bureau of Reclamation (BOR), Department of Natural Resources and Conservation (DNRC), and USGS.

SRWG Structure and Goals

The SRWG is a consensus-based organization that works to address natural resource management conflicts within the watershed, while meeting the needs of all stakeholders. SRWG consists of four workgroups including: water management, fisheries, water quality, and weeds. The following water data collection goals have been articulated to help the workgroups address their concerns:

1. To assess long term (years to decades) water quality trends in the Sun and its tributaries. Primary water quality concerns are for sediment/erosion, nutrients and salinity. All of these parameters are related to flow, so flow data is also a high priority.
2. To determine if best management practice (BMP) projects are improving water quality in the Sun River and its tributaries. This includes monitoring of long term persistence/maintenance of BMP projects and assessment of whether projects are performing the intended purposes.
3. To collect data that helps to refine the SRWG work plan, identify water resource issues, and prioritize projects for funding.

Sampling Design

Sampling Design Overview

With limited resources for collecting data, it is important for SRWG to be strategic about data collection to ensure that it can be used for the goals outlined above. Each goal has different considerations for the type of data needed, and limiting data collection to only those parameters necessary to assess the stated water quality goals is critical to cost-efficient monitoring. It is important to remember that without flow data, nutrient and sediment loads cannot be calculated, and interpretation of water quality data is difficult or impossible. Therefore, corresponding flow data must accompany any other data collection efforts.

The content in this QAPP document is focused on the goal of long term trend monitoring. The methods and parameters discussed within were chosen in an effort to facilitate efficient data collection that can be used meaningfully to assess trends in the threats to water quality that are of primary concern to the SRWG (erosion, nutrient loading, and salinity).

Setting up a monitoring plan to assess the effectiveness of BMPs must be done in the context of a specific project, with a working knowledge of the goals of the BMP and the water problems it was intended to address, and will be stated explicitly in the plans for the corresponding project. The approach for every BMP effectiveness project will be different but a few key considerations are

presented here. A full guidance document on this topic is available from the NIFA Northern Plains and Mountains Regional Water Team at http://www.uwyo.edu/bmp-water/ .

BMP Effectiveness Projects:

1. Consider what the objectives of the BMP project are and cater the monitoring specifically to assess the intended project outcome. It is important to think about what water quality parameters are expected to be affected by a BMP, how quickly the BMP is expected to start providing benefits, and the timing of the benefit during the water year.
2. Consider what the BMP is actually doing to reduce pollution. What is the physical delivery process and pathway for the pollutant to the stream and the timing? Understanding these processes is essential before designing the monitoring project. Sampling at the wrong time of year or in the wrong place could completely miss the benefits.
3. Consider alternative ways to monitor benefits of a project. Even if a project significantly reduces the load of a pollutant to a stream, it may be very difficult to measure that improvement by taking water samples. Consider assessing bank conditions, or modeling the reduction of pollution from a project. It is also important to monitor the persistence of the project itself. If the project is not maintained, it cannot do what it was intended to do.

Water Quality Parameter Justification

A comprehensive list of important field and lab parameters, including preferred methods for data collection and justifications, can be found in Table 1. If resources do not allow for collection of flow and water quality at all sites in a given year, it is recommended that all data be collected at fewer sites each year, and that a schedule be developed to guide rotation through the sites from year to year. Cost-efficiency can also be improved by estimating flow at one site based on flow at a nearby site, or by collecting less expensive water quality data that can be used to estimate other parameters (for example, specific conductance to estimate total dissolved solids, or turbidity to estimate suspended sediment concentration).

Table 1. Field and lab parameters to be collected in the Sun River watershed for the purpose of long term trend assessment.

	Preferred Method	Alternative Method	Preservation	Hold Time	Justification
Field Parameters:					
pH	YSI 556 multi-meter	Horiba U-10	NA	NA	Collected when samples are collected.
Temperature	YSI 556 multi-meter	Horiba U-10	NA	NA	Collected when samples are collected.
Specific Conductance (SC)	YSI 556 multi-meter	Horiba U-10	NA	NA	Cheap and easy surrogate for salinity.
Dissolved Oxygen (DO)	YSI 556 multi-meter	Horiba U-10	NA	NA	Collected when samples are collected.
Discharge (Q)	USGS Gage Data	Field Observation of Gage w/ rating curve	NA	NA	Necessary to calculate loads; affects sediment, salinity and all WQ parameters.
Turbidity	Hach 2100 P	-	NA	NA	Erosion is a concern, meter already acquired, hands-on opportunity for SRSC students.
Photos	Digital Camera	-	NA	NA	Tracking riparian condition; cheap and easy.
Lab Parameters:					
Suspended Sediment Conc. (SSC)	ASTM D3977-97	-	≤ 6° C	7 days	Sedimentation listed as cause of impairment for Sun and tributaries on 2010 303d list.
Nitrogen (total persulfate)	A4500-N C	A4500-N B	≤ 6° C	30 days	Total N listed as cause of impairment for Sun and tributaries on 2010 303d list.
Nitrate + Nitrite as N	EPA 353.2	A4500-NO3 F	H_2SO_4, ≤ 6° C	28 days	Total N listed as cause of impairment for Sun and tributaries on 2010 303d list.
Phosphorus (total)	EPA 365.1	A4500-P F	H_2SO_4, ≤ 6° C	28 days	Total P listed as cause of impairment for Sun and tributaries on 2010 303d list.

Sample Site List and Descriptions

A list of data collection sites, including site location descriptions and justifications, can be found in Table 2. A more comprehensive list of sites, including more detailed site descriptions, driving directions, and photos, is available in the SRWG Standard Operating Procedures (SOPs) in Appendix B.

Table 2. Monitoring sites within the Sun River watershed for the purpose of long term trend assessment.

Site Name	SITE ID	Latitude	Longitude	Site Description	Site Justification
Sun River at Augusta	SR-AG	47.547861	-112.366250	On Hwy. 287, approx. 3 miles north of Hwy. 287/ Hwy. 21 intersection.	Upstream comparison.
Big Coulee	BC-SM	47.516972	-111.887306	On Simms Ashuelot Rd., 1 mile north of Hwy. 200/ SR 565 intersection.	Confluence with Sun River, assess tributary contributions.
Adobe Creek	AC-200	47.510583	-111.800611	1 mile north of town of Fort Shaw on Hwy. 200.	Confluence with Sun River, assess tributary contributions.
Mill Coulee	ML-200	47.540611	-111.705806	1/2 mile east of town of Sun River on Hwy. 200.	Confluence with Sun River, assess tributary contributions.
Muddy Creek at Power	MC-PWR	47.712451	-111.722831	At Power water treatment facility. 1237 7th Road NE.	Upstream comparison for Muddy Creek.
Muddy Creek at Vaughn USGS	MC-VHN	47.561056	-111.538306	On Hwy. 200, just west of I-15 at exit 290.	Confluence with Sun River, assess tributary contributions.
Sun River at Great Falls	SR-GF	47.492028	-111.334361	At the end of 13th Avenue SW in Great Falls.	Confluence with Missouri, assess contributions from Great Falls.

Watershed Map

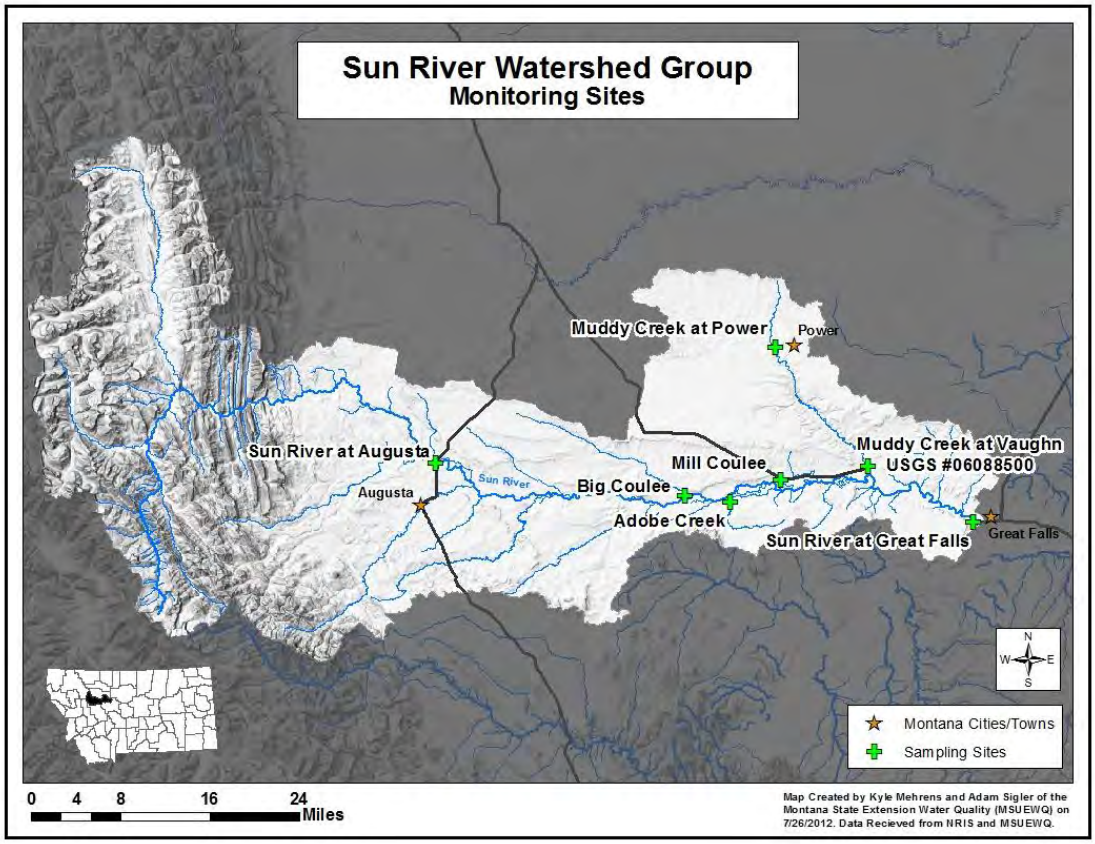

Figure 1. Map of sample site locations within the Sun River watershed.

Data Collection Responsibilities

In order to have a complete dataset that can be meaningfully interpreted, it is important that every group participating in the data collection process understands their responsibilities. A list of sites, including the organizations with data collection responsibilities at each, can be found in Table 3.

Table 3. Data collection responsibilities by site.

Site Name	Site ID	Data Collection Responsibilities	
		Discharge	Water Quality
Sun River at Augusta	SR-AG	Bureau of Reclamation contracts USGS to maintain automated gauge.	Sun River Science Club, Fairfield Public Schools
Big Coulee	BC-SM	DNRC maintains/rates gauge, SRSC takes gauge readings at visits	Sun River Science Club, Fairfield Public Schools
Adobe Creek	AC-200	Fort Shaw Irrigation District maintains/rates gauge, SRSC takes gauge readings at visits	Sun River Science Club, Fairfield Public Schools
Mill Coulee	ML-200	DNRC maintains/rates gauge, SRSC takes gauge readings at visits	Sun River Science Club, Fairfield Public Schools
Muddy Creek at Power	MC-PWR	Municipality of Power	Municipality of Power
Muddy Creek at Vaughn	MC-VHN	USGS (automated gauge)	Sun River Science Club, Fairfield Public Schools
Sun River at Great Falls	SR-GF	USGS (via Sun River @ Vaughn automated gauge)	Sun River Science Club, Fairfield Public Schools

Sampling Supply Responsibilities

Alan Rollo will be responsible for ordering sample bottles from the contracted analytical laboratory prior to each sampling season. Rai Hahn (SRSC) will be responsible for obtaining calibration solutions and other consumable items necessary for the maintenance of the YSI 556, Hach turbidity meter, and other sampling equipment.

Sampling Methods

SRSC is responsible for water quality parameter sampling efforts, and will conduct sampling according to the SRWG SOP document, located in Appendix B. A Site Visit Form (see Appendix C) will be completed for each site visit and will include all field data collected and an inventory of samples collected for analysis at the contracted laboratory. Site locations will be corroborated using the GPS coordinates, driving directions and photographs provided in the SOP document. A GPS reading will be taken and recorded on the field visit form, using the NAD 1983 State Plane Montana datum, in decimal degrees to at least the fourth decimal. Photographs will be taken using a digital camera. Field parameter data will be collected with a YSI 556, calibrated on the day of the sampling event, according to manufacturer instructions. Site Visit Forms will be checked for completeness before leaving the sample site by Rai Hahn.

Instrument / Equipment Maintenance and Calibration

The storage, maintenance, and calibration of all data collection equipment are the responsibility of Rai Hahn of the Sun River Science Club.

A calibration log should be kept for each meter employed for SRWG data collection efforts. The performance standards for the YSI 556 can be found in Table 4, and detailed instructions on YSI maintenance and calibration can be found in the SOP document (Appendix B).

Table 4. Performance characteristics for YSI 556.

Parameter	Measurement Range	Resolution	Accuracy
Temperature	-5 to 45° C	0.01° C	±0.15° C
pH	1.0 to 14.00 units	0.01 units	±0.2 units
Spec. Conductance	0 to 200 mS/cm	0.001 mS/cm to 0.1 mS/cm	±0.5% of reading or ±0.001 mS/cm
Dissolved Oxygen	0 to 50 mg/L	0.01 mg/L	±2% of the reading or 0.2 mg/L

Turbidity will be measured with a Hach 2100P turbidity meter. Detailed instructions on maintenance and calibration can be found in the SOP document (Appendix B).

Flow (Discharge) Measurement

USGS uses automated gauges to collect flow data at Sun River at Augusta (SR-AG), Muddy Creek at Vaughn (MC-VHN), and Sun River near Vaughn, which is used as a surrogate for flow at Sun River at Great Falls (SR-GF). USGS maintains and calibrates these gauges in accordance with their own procedures and standards. DNRC creates rating curves for the gauges at the Big Coulee (BC-SM) and Mill Coulee (ML-200) sites via monthly visits May through October. Fort Shaw Irrigation District also creates rating curves for the Adobe Creek (AC-200) site using this method.

Water Sample Collection and Handling for Laboratory Analysis

Grab samples will be collected for delivery to the contracted lab for chemistry analysis using acid washed, polyethylene bottles provided by the testing laboratory. Table 5 details the analytical methods and handling procedures for each parameter. A detailed sampling schedule for each stream is included in the Sampling Schedule and Parameters table of the SOP (Appendix B).

Table 5. Lab parameter analytical methods, reporting limits, hold times, and preservatives.

Parameter	Preferred Method	Alternate Method	Req. Report Limit ug/L	Holding Time	Bottle	Preservative
Suspended Sediment Concentration (SSC)	ASTM D3977-97	-	4000	7 days	500ml HDPE	≤ 6° C
Total Nitrogen	A4500-N C	A4500-N B	50	30 days	500ml HDPE	≤ 6° C
Nitrate	EPA 353.2	A4500-NO3 F	10	28 days	500ml HDPE	H_2SO_4, ≤ 6° C
Total Phosphorous	EPA 365.1	A4500-P F	3	28 days	500ml HDPE	H_2SO_4, ≤ 6° C

Bottles must be rinsed three times with stream water prior to sample collection in a well-mixed portion of each stream. During sampling, the sample bottle opening should face upstream and should be drawn through the water column once, carefully avoiding disturbance of bottom sediments. Samples will be preserved in the field and stored on ice until shipment to the lab well in advance of the hold times listed above. Sample preservation is explained in detail in the Sample Collection and Bottle Labeling section of the SOP (Appendix B).

Quality control (QC) samples consisting of blanks and duplicates will be collected two times per sampling season at different sites each time. A field blank is prepared by transporting laboratory-grade deionized (DI) water to the field (provided by the laboratory) and pouring it into sample containers provided by

the lab. The blank will be prepared at the same time that the samples are collected from the stream. A duplicate sample is a second stream sample collected at the same time in the same way that the regular stream sample is collected. Duplicate and blank samples are labeled according to the labeling protocol below, which does not identify which sample is which to the lab. Blank and duplicate samples are handled and delivered to the lab in the same manner that regular samples are handled.

Sample labels should be filled out with Company (SRWG), the date, the time, and the sample ID. The sample ID is very important and includes the year, the month, the day, the site ID and a letter indicating they type of sample (regular, duplicate, or blank).

Sample ID = [Year, Month, Day]_[Site ID]_[Sample-Type Letter]

A = Regular Sample
B = Duplicate Sample
C = Blank Sample

Sample ID Examples:

A regular sample collected at the Adobe Creek site on August 15th, 2012 would be labeled:

20120815_AC-200_A

A duplicate at the same place and time as above:

20120815_AC-200_B

A blank at the same place and time as above:

20120815_AC-200_C

Immediately following grab-sample collection, samples should be put on ice. The contracted analytical lab's chain of custody (COC) forms will be used to document and track all samples collected during the project. COCs will be completed for each set of samples submitted to the laboratory. A sample COC can be found in the SOP document (Appendix B). SRWG Coordinator Alan Rollo will be responsible for QC of the analyte sample COCs and sending samples on to the contracted analysis laboratory.

Data Quality Control

In order for water quality data to be useful, it needs to accurately represent the conditions in the river or stream at the time the samples were collected. This requires proper sample handling, processing, and assessment of data to ensure quality. Data quality objectives (DQOs) state the required quality of data for the intended use and data quality indicators (DQIs) are the specific criteria by which data are assessed to determine quality. These indicators are assessed by collecting quality control (QC) samples and then performing quality assurance (QA) checks on those samples.

QC samples are blank, duplicate and spike samples collected or created in the lab and/or the field for evaluation of quality indicators. Once the lab results are returned for the QC samples, QA involves assessing the data through use of indicators to determine data quality. A glossary of QA/QC terms can be found in Appendix D.

Data Quality Objectives

Provisions are in place to ensure sensitivity of data collected to differences in stream water quality and comparability of data collected to other datasets. These provisions include the collection of grab samples and field QC for submission to a certified laboratory and assessment of QC data relative to data quality indicators.

In order to ensure the highest degree of data completeness possible, volunteers need to fill out datasheets completely and review them before leaving a site. Rai Hahn of Sun River Science Club will review datasheets for completeness and will follow-up with his student volunteers if any fields are illegible, inaccurate, or incomplete.

Data Quality Indicators

Quality control (QC) samples can be broken down into a field and a laboratory component. The field component consists of collection of blank and duplicate samples and comparison of data to criteria. The laboratory component consists of analysis of blanks, duplicates, and spiked samples by the lab. Blank samples should ideally yield results indicating "no detection" of the analyte in question. Duplicate samples should ideally produce identical results and analysis of spiked samples should recover exactly the amount of analyte added. Methods are not perfect however, so the criteria outlined in the following section should be used to determine if data is of acceptable quality.

Quality Assurance for Quality Control Samples

For SRSC sites, field quality control samples are typically collected for 10% of all samples collected; this means two sets of field QC samples should be collected each season (5 sites x 4 sample events = 20 samples per season). If a 6th site is added, collecting a third set of QC samples should be considered so that a QC rate of greater than 10% is maintained. Each set of field QC samples will include a blank and a duplicate for each analyte being sampled. Accuracy for field QC samples will be assessed by ensuring that blank samples return values less than the data quality indicator criteria specified in Table 6. If a blank sample returns a result greater than the threshold for a given parameter, all data for that parameter in that batch of samples may need to be qualified when it is entered into the database. The exception is that data with a value greater than 10 times the detected value in the blank does not need to be qualified. Precision for field QC samples will be assessed by ensuring that relative percent difference (RPD) between duplicates is less than 25%. RPD is calculated using the equation below. In addition to these accuracy/precision checks, it will be necessary to check that all samples were processed within their specified hold times.

RPD as % = ((D1 – D2)/((D1 + D2)/2)) x 100

Where: D1 is first replicate result, D2 is second replicate result

Certified laboratories run QC samples for at least 10% of their sample volume. Integrity of laboratory data will be determined by comparing results for laboratory QC samples to the data quality indicator criteria in Table 6. Reports with lab QC results and data quality indicator calculations should be provided by the lab with each set of sample results. Each of the quality indicator criteria in Table 6 must be checked for each analyte for each batch of samples submitted to the lab. This process is easier if a matrix is used to systematically check the numbers. An example of a completed matrix is provided in Appendix E.

Table 6. Data quality indicator criteria for lab and field QC samples.

Parameter	Suspended Sediment Concentration	Total Nitrogen	Nitrate-Nitrite as N	Total Phosphorus as P
Field Blank Threshold	4000 µg/L	0.05 mg/L	0.01 mg/L	0.005 mg/L
Field Duplicate RPD	< 25% RPD	< 25% RPD	< 25% RPD	< 25% RPD
Analysis Method	ASTM D3977-97	A4500-N C or A4500-N B	A353.2 or A4500-NO3 F	EPA 365.1 or 4500-P F
Method Blanks	4000 µg/L	0.05 mg/L	0.01 mg/L	0.005 mg/L
Lab Duplicates (RPD)	< 10% RPD	< 10% RPD	< 10% RPD	< 10% RPD
Lab Control LCS/LFB (% recovery)	70%-130%	90%-110%	90%-110%	90%-110%
Matrix Spike/ Matrix Spike Dup (% recovery)	-	90%-110%	90%-110%	90%-110%

Data Qualification

When data is uploaded to EQuIS, if data quality criteria are not met, the quality of the data points in question needs to be qualified. Data qualifier codes are provided in Appendix F for different types of data quality issues.

Monitoring Program Maintenance

Training

Water quality data is currently collected by the Sun River Science Club under the supervision of Rai Hahn at the Sun River at Augusta (SR-AG), Big Coulee (BC-SM), Adobe Creek (AC-200), Mill Coulee (ML-200), Sun River at Great Falls (SR-GF) sites, and tentatively at the Muddy Creek at Vaughn (MC-VHN) site. On June 8th of 2012, Torie Bunn from MSUEWQ accompanied Alan Rollo and Rai Hahn to each of these sample sites to confirm site locations and to collect site coordinates, photos, and driving directions. Torie also went over calibration of the new YSI 556 meters, bottle labeling and preservation, and the use of the site visit forms with Rai and Alan. This served as pre-sample season training for the 2012 season.

Beginning in early 2013, a two-phase, ongoing program maintenance and training program has been proposed. In February of each year, Alan will meet with representatives from DEQ and/or MSUEWQ, Rai Hahn, and other volunteer monitors to review data from the previous year and discuss logistics and other details for the upcoming sample season. Any noteworthy outcomes of this meeting will be brought to the Sun River Water Quality Work Group meeting, held annually in March. Then in April of

each year, DEQ and/or MSUEWQ personnel will conduct a field audit with volunteers, reviewing the procedures outlined in the SRWG SOP.

Water Quality data for the Muddy Creek at Power (MC-PWR) site will be collected by Municipality of Power wastewater treatment personnel, per the Municipality's training and collection procedures.

Data Management

Data management is necessary to ensure that data sets are complete and accurately interpreted. Clearly articulated data pathways ensure that all stakeholders understand their responsibilities throughout the monitoring process, from sample collection to data reporting.

Copies of SRWG laboratory reports and electronic data spreadsheets in the EQuIS format will be provided by the analytical lab to Alan Rollo for further data processing and SRWG reporting, to Rai Hahn for SRSC's educational purposes, and to Montana DEQ.

Spreadsheets with all field data collected by SRSC will be emailed to Alan Rollo, who will review all laboratory and field data and conduct all QC procedures outlined in the Data Quality Control section of this document prior to data entry into the SRWG master spreadsheet. A checklist of necessary QC activities is included for guidance in Appendix G. The spreadsheet will ultimately be publically accessible via the SRWG website. SRWG data will be housed in these spreadsheets and uploaded to EQuIS on an as-appropriate basis, with assistance from Jolene McQuillan (MT DEQ EQuIS Database Manager) or other DEQ and/or MSUEWQ personnel.

In an effort to simplify data compilation, MSUEWQ has created a master data spreadsheet for each site. These spreadsheets are up-to-date with historic discharge and water quality data, and only need to be amended at the end of the sampling season each year.

Discharge Data Collection

Qualified water quality data needs to be paired with corresponding discharge data before annual data summaries and other meaningful reporting can be completed. Discharge data for SRWG is collected by a variety of sources, and is accordingly compiled through a variety of processes. For example, USGS data is downloaded from the National Water Information System (NWIS) website and/or requested from USGS if it has not been published to the web by the time of reporting. Bureau of Reclamation, DNRC, and Fort Shaw Irrigation District data is obtained through other methods. Various resources and processes for obtaining relevant discharge data are outlined in Appendix H.

Annual Data Summaries for SRWG

Annual data summaries will be prepared for SRWG annual meetings by Alan Rollo. In addition to reporting for the SRWG annual meeting, electronic copies of raw data and data summaries will be maintained on SRWG's website. In order to streamline this process, MSUEWQ has created an appendable Excel spreadsheet for each monitoring site that includes graphs of water quality parameters of interest using available historic data. The addition of the current year's water quality and discharge data, and some minor changes to the source data used to create the graphs is all that's needed to bring these files up-to-date. A video tutorial outlining this process can be found at: https://camtasia.msu.montana.edu/Relay/Files/p55w886/SRWG%20Data%20Management%20Tutorial/SRWG_Data_Management_Tutorial_-_Flash_%28Small%29_-_20120510_04.15.05PM.html

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Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. Michael Suplee, Ph.D. - Montana Department of Environmental Quality; Vicki Watson, Ph.D. – University of Montana; Arun Varghese and Josh Cleland – ICF International. Available on the web at: http://deq.mt.gov/wqinfo/standards/PDF/WhitePaper_FNL3_Nov12-08.pdf [verified June 5, 2010]. Appendix B: Site Visit Form and QC Checklist

Water Quality Planning Bureau Field Procedures Manual for Water Quality Assessment Monitoring. Montana Dept. of Environmental Quality, WQPBWQM-020, revision 2. February, 2012. Available at http://deq.mt.gov/wqinfo/qaprogram/PDF/SOPs/WQPBWQM-020.pdf

Appendices

A. SRWG Distribution List
B. SRWG Standard Operating Procedures (SOPs)
C. SRWG Site Visit Form
D. Glossary of QA/QC Terms
E. QA/QC Matrix
F. Data Qualifiers and Descriptions
G. QC Checklist
H. Obtaining SRWG Discharge Data

Appendix A: SRWG Distribution List

Organization	Name	Title	Phone	Email Address
Personnel involved with writing of QAPP				
Sun River Wshed Grp.	Alan Rollo	Watershed Coord.	727-4437	arollo7@msn.com
MSU Extension WQ	Adam Sigler	Assoc. Specialist	581-8871	asigler@montana.edu
MT DEQ	Mark Ockey	Water Quality Specialist	444-5351	Mockey@mt.gov
Sun River Watershed Stakeholders				
Lewis & Clark CD	Mike Cobb	LCCD board /SRWG rep	562-3694	cobbcow1@3rivers.net
Teton CD	Brad DeZort	TCD board /SRWG rep	467-2971	-- none --
Cascade CD	John Chase	CCCD board /SRWG rep	453-5097	johnchase01@gmail.com
USGS	Wayne Berkas	Supvervisor Hydrologist	457-5903	wrberkas@usgs.gov
BLM	Mike Philbin	State Hydrologist	896-5041	mphilbin@blm.gov
Forest Service	Wayne Green	Forest Hydrologist	791-7740	wgreen@fs.fed.us
Forest Service	Mike Munoz	District Ranger	466-5341	mamunoz@fs.fed.us
BOR	Jim Forseth	Staff Hydrologist	247-7319	jforseth@usbr.ov
NRCS - Cascade	Matt Crampton	District Conservationist	727-3603 x124	matt.crampton@mt.usda.gov
NRCS - L&C	Mindy Gauthier	District Conservationist	449-5000 x101	melinda.gauthier@mt.usda.gov
NRCS - Teton	Paula Gunderson	District Conservationist	466-5722 x116	paula.gunderson@mt.usda.gov
MT FWP	George Liknes	Reg 4 Fisheries Manager	454-5855	gliknes@mt.gov
MT FWP - Freezeout	Mark Schlepp	Wildlife Area Manager	467-3234	mschlepp@3rivers.net
MT Dept. of Ag.	Rick Mulder	Hydrologist	444-5422	rmulder@mt.gov
MT Dept. of Transportation	none for now			
MBMG	John Weaton	Sr. Rsrch Hydlgst, Prog. Mgr –GW	496-4848	jweaton@mtech.edu
DEQ	Mark Ockey	Water Quality Specialist	444-5351	mockey@mt.gov
USFW Benton Lk.	Vanessa Fields	Wildlife Bioligist	727-7400 x219	vanessa_fields@fws.gov
USFW - Partners Program	Sue McNeal		449-5225 x209	susan_mcneal@fws.gov
MT Salinity Control	Jane Holzer	Program Director	278-3071	msca@3rivers.net
DNRC - Water Resources	Larry Dolan	Hydrologist	444-6627	ldolan@mt.gov
DNRC- State Lands	Erik Eneboe	Unit Manager	278-7869	eeneboe@mt.gov
MSU Extension - Cascade	Rose Malisani	county agent	454-6980	rose.malisani@montana.edu
MSU Extension - L&C	Brent Sarchet	county agent	447-8346	bsarchet@montana.edu
MSU Extension - Teton	none for now	county agent	466-2491	
MSU Extension WQ	Adam Sigler	Assoc. Specialist	994-7381	asigler@montana.edu
Co. Commiss. - Cascade	Jane Weber	Commissioner	454-6814	jweber@cascadecountymt.gov
Co. Commiss. - L&C		Board of Commisioners	447-8304	bocc@co.lewis-clark.mt.us
Co. Commiss. - Teton	Jim Hodgskiss	Commissioner	466-2151	jimhodgskiss@3rivers.net
Great Falls Int Airport	Rod Hall	Dept. Dir. Operations	727-3404	Rhall@gtfairport.com
PPL MT	Andrew Welch	Compliance Professional	533-4312	atwelch@pplweb.com
City of Great Falls	James Young	Senior Civil Engineer	771-1258	jyoung@greatfallsmt.net
Fairfield	Lillian Alfson	Mayor	467-2510	lills@3rivers.net
Sun Prairie Village Water & Sewer	William Decker	Manager	965-3944	billd@spvws.com
Teton Co. Power Water & Sewer	Ross Fitzgerald	chairman	216-2032	rhfitz@3rivers.net
Two Buttes Water (Ft Shaw/Simms)				
Vaughn Water & Sewer	Karol Walker	Operator	463-2351	gkwalker@3rivers.net
Greenfield Irrig. District	Bob Hardin	Manager	467-2533	grid@3rivers.net
Fort Shaw Irrig. District	Rich Boyle	Manager	788-1023	raboyle@3rivers.net
Sun Riv. Valley Ditch Co.	Lyle Christensen	Vice-chair	965-3276	lecent@imt.net
Nilan Water Users	Dick Artz	board member	562-3229	-- none --
Broken O Ranch	Dan Freeman	manager	799-2758	dtfreeman@3rivers.net
Augusta School	Katie Meier	Science teacher	868-9445	augusta.science@gmail.com
Fairfield School	Rai Hahn	Science teacher	264-5852	hahn@3rivers.net
Trout Unlimited	Laura Ziemer	Montana Director	522-7291 x103	lziemer@tu.org
Missouri River Fly Fishers	Sam Wike	board member		samw@csww.net
Medicine River Canoe Club	Gil Payne	board member	750-2434	lynda@payneenterprises.biz
Missouri River Cons. Dist. Council	Laurie Riley	coordinator	375-2272	mrcdc@missouririvercouncil.info
Audubon				
Nature Conservancy				

Appendix B: SRWG Standard Operating Procedures

Sun River Watershed Group
Standard Operating Procedures (SOPs)

TABLE OF CONTENTS

SRWG Gear Checklist

General

1. SAP/SOP
2. Volunteer Waivers
3. Landowner Consent Form
4. YSI multi parameter meter or handheld meters
5. Calibration solutions
6. Calibration logs
7. Solution discard bottle
8. pH solutions (7 and 10)
9. EC 1413 µS/cm Standard
10. Deionized water squirt bottle
11. Kim wipes
12. Tap water for YSI storage
13. Calibration Log for YSI
14. Clipboard
15. Site Visit Forms
16. Pencils and Extra lead
17. Fine tip permanent marker
18. Broad tip permanent marker
19. Calculator
20. Batteries (4 C for YSI, 2 AA for GPS)
21. Duct tape
22. Camera
23. First aid kit
24. Bear spray plus transport container
25. Garmin eTrex GPS Unit
26. Multi-tool or screwdriver
27. Life Jacket (pfd)
28. Backpack to carry gear

Collecting Samples for Lab Analysis

1. Cooler from lab
2. Chain of Custody form (COC)
3. One set of sample bottles for each site and for any blank and duplicate QC samples
4. Sample Preservative (sulfuric acid)
5. Laboratory grade deionized water for blank samples
6. Plastic gloves
7. Safety glasses
8. Chain of Custody Forms
9. Ice
10. Packing tape for labels

Personal Items

1. Cell Phone
2. Sun screen
3. Waders
4. Bug spray

Field Activity Checklist

_____ 1. Calibrate YSI meter before going to the field

_____ 2. Deploy YSI meter

_____ 3. Begin filling out field visit form

_____ 4. Label sample containers

_____ 5. Collect water samples

_____ 6. Collect YSI meter measurements

_____ 7. Take staff gauge readings (where applicable)

_____ 8. Prepare samples for shipping

_____ 9. Fill out chain of custody

_____ 10. Check that all forms are complete

_____ 11. Check that all gear is accounted for

Sampling Schedule and Parameters

Sun River at Augusta

Month	Parameters
April	YSI measurements, Nitrate, Total N, Total P, SSC
May	YSI measurements, Nitrate, Total N, Total P, SSC
June	YSI measurements, Nitrate, Total N, Total P, SSC
July	YSI measurements
August	YSI measurements
September	YSI measurements, Nitrate, Total N, Total P, SSC
October	YSI measurements, Nitrate, Total N, Total P, SSC

Big Coulee

Month	Parameters
April	YSI measurements, Nitrate, Total N, Total P, SSC
May	YSI measurements, Nitrate, Total N, Total P, SSC
June	YSI measurements, Nitrate, Total N, Total P, SSC
July	YSI measurements
August	YSI measurements
September	YSI measurements, Nitrate, Total N, Total P, SSC
October	YSI measurements, Nitrate, Total N, Total P, SSC

Adobe Creek

Month	Parameters
April	YSI measurements, Nitrate, Total N, Total P, SSC
May	YSI measurements, Nitrate, Total N, Total P, SSC
June	YSI measurements, Nitrate, Total N, Total P, SSC
July	YSI measurements
August	YSI measurements
September	YSI measurements, Nitrate, Total N, Total P, SSC
October	YSI measurements, Nitrate, Total N, Total P, SSC

*Underlined parameters will be processed by the lab.

Mill Coulee

Month	Parameters
April	YSI measurements, Nitrate, Total N, Total P, SSC
May	YSI measurements, Nitrate, Total N, Total P, SSC
June	YSI measurements, Nitrate, Total N, Total P, SSC
July	YSI measurements
August	YSI measurements
September	YSI measurements, Nitrate, Total N, Total P, SSC
October	YSI measurements, Nitrate, Total N, Total P, SSC

Muddy Creek at Vaughn

Month	Parameters
April	USGS is not collecting WQ data per Wayne Berkas.
May	
June	
July	
August	
September	
October	

Sun River at Great Falls

Month	Parameters
April	YSI measurements, Nitrate, Total N, Total P, SSC
May	YSI measurements, Nitrate, Total N, Total P, SSC
June	YSI measurements, Nitrate, Total N, Total P, SSC
July	YSI measurements
August	YSI measurements
September	YSI measurements, Nitrate, Total N, Total P, SSC
October	YSI measurements, Nitrate, Total N, Total P, SSC

*Underlined parameters will be processed by the lab.

Sample Site IDs and HUC Codes

Site ID	Site Name	Latitude	Longitude	HUC Code
SR-287	Sun River at Augusta	47.547861	-112.366250	100301040601
BC-SM	Big Coulee	47.516972	-111.887306	100301040706
AC-200	Adobe Creek	47.510583	-111.800611	100301040707
ML-200	Mill Coulee	47.540611	-111.705806	100301040901
MC-VN	Muddy Creek at Vaughn	47.561056	-111.538306	100301040809
SR-GF	Sun River at Great Falls	47.492028	-111.334361	100301040907

Site Photos and Driving Directions

Sun River at Augusta (SR-287)

(1) Upstream at site

(2) Across at site

(3) Downstream at site

(4) View from parking on 287, facing south. Note 'War on Weeds' sign.

Directions: Approximately 4 miles north of the town of Augusta on highway 287. Cross over Sun River and park in pullout on northeast side of bridge. Sampling site is ~75 yards upstream of bridge on the north bank. Looking upstream, USGS gauge is located by old piling seen in photo 1.

GPS Coordinates: 47.47.547816 lat
112.366250 lon

Big Coulee (BC-SM)

(1) Upstream from bridge

(2) Across (west) at bridge

(3) Downstream from bridge

(4) View of sampling site on SE corner of bridge.

Directions: From Hwy 200 at Simms, take SR 565 (Simms Fairfield Road) north 1 mile to Simms Ashuelot Road on right. Follow Simms Ashuelot Road (zigzagging L, R, L, R) ~ 3 miles to site bridge. Access Big Coulee on the southeast corner of bridge, downstream (photo 4).

GPS Coordinates: 47.516972 lat
111.88736 lon

Adobe Creek (AC-200)

(1) Across at sampling site

(2) Upstream from road

(3) Downstream from site

Directions: Take highway 200 northeast from Fort Shaw for ~1 mile. Adobe Creek flows just west of driveway #13402. Park on west side of bridge and sample ~100 ft upstream/south side of road, past barbed wire fence. From road, gauge can be seen upstream (picture 2).

GPS Coordinates: 47.510583 lat
111.800611 lon

Mill Coulee (ML-200)

(1) Upstream from site

(2) Across (west) at site

(3) Downstream from site

(4) View of bridge from Hwy 200 facing W, note Ramble Inn on right.

Directions: On highway 200 between Ramble Inn Road and Dracult Hill Road, ~0.5 miles east of town of Sun River. Park on west side of bridge and sample downstream/south side of road. Gauge at site may be used or alternate gauge across highway 200, TBD. Ramble Inn hotel is on highway 200, across from site (picture 4).

GPS Coordinates: 47.540611 lat
111.705806 lon

Gauge readings elsewhere? TBD

Muddy Creek at Vaughn (MC-VN)

(1) Parking on Hwy 200, view to west. Note Exxon station on N side of road

(2) View to north of sampling from Hwy 200.

Directions: From I-15, take Exit 290 to highway 200 west. Parking is ~ 0.25 west of interchange on 200. Historic WQ data was collected at railroad bridge just north of highway 200. Park east of Muddy Creek bridge on highway 200, use Exxon gas station as landmark (photo 1). USGS gauge can be seen on right side of Muddy Creek (photo 2).

GPS Coordinates: 47.561056 lat
111.538306 lon

Sun River at Great Falls (SR-GF)

(1) Upstream from site

(2) Across (north) from site

(3) Downstream from site

(4) View of sampling access at end of 13th Ave SW.

Directions: Site is at the end of 13th Avenue SW in Great Falls. Park in Beacon Bar overflow parking and follow path at east side of fence down to site (photo 4). Sampling is upstream from railroad bridge on south side of river.

GPS Coordinates: 47.492028 lat
111.334361 lon

Verifying Site Locations with GPS

Lat/Long and Elevation

Using the Garmin E-Trex GPS to take a waypoint:

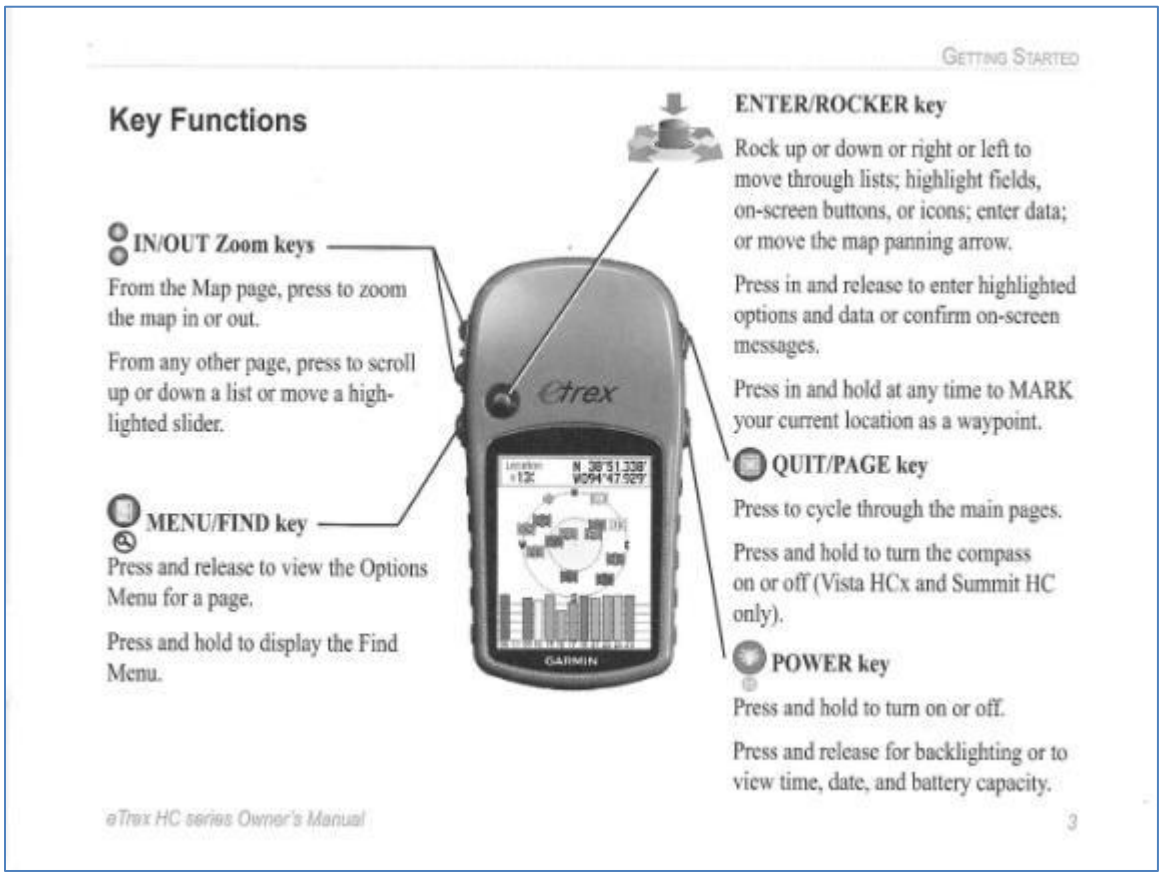


Figure 1: Key functions for Garmin ETrex GPS unit.

Use power key to turn device on. Press and hold the rocker key until the Mark Waypoint page appears. The waypoint name, and lat/long/elevation data can be found on this screen. To accept the waypoint with the data, highlight OK.

Latitude and Longitudes should be obtained in decimal degrees using a GPS unit reading NAD83. If a lat/long is obtained by another method, the datum and method must be recorded in the Site Visit Comments. Elevation should be recorded in feet.

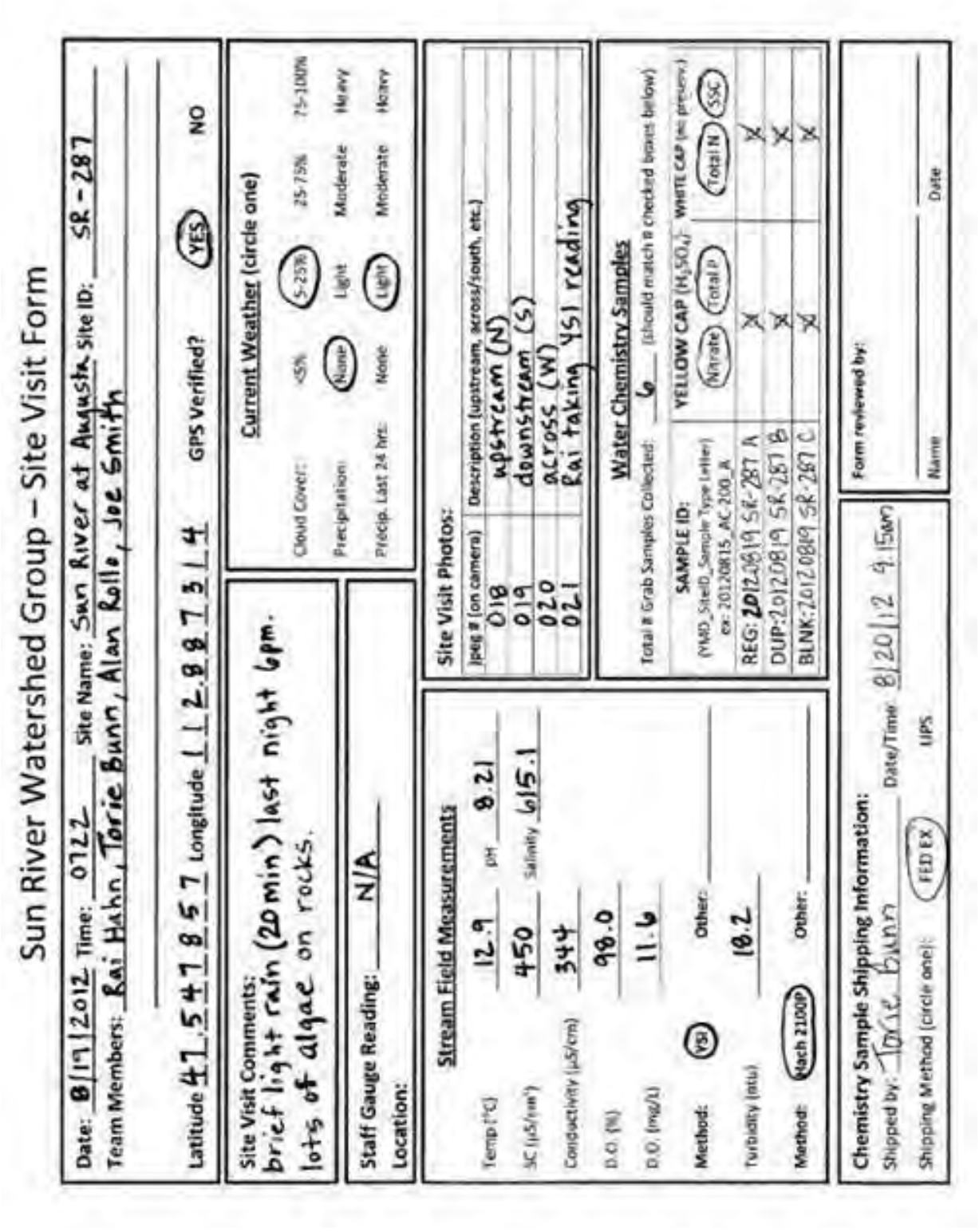
GPS Datum and Verification

The GPS unit should be reading NAD83 and the point will be verified by the data entry person upon entry of data.

Way point

Record a waypoint for the site with the GPS unit and note the waypoint number on the form.

Example Site Visit Sheet



Sun River Watershed Group – Site Visit Form

Date: 8/19/2012 Time: 0722 Site Name: Sun River at Augusta Site ID: SR-287

Team Members: Rai Hahn, Torie Bunn, Alan Rolle, Joe Smith

Latitude 47.547857 Longitude 112.887314 GPS Verified? YES NO

Site Visit Comments: brief light rain (20 min) last night 6pm. lots of algae on rocks.

Staff Gauge Reading: N/A

Location:

Current Weather (circle one)

Cloud Cover:	<5%	5-25%	25-75%	75-100%
Precipitation:	None	Light	Moderate	Heavy
Precip. Last 24 hrs:	None	Light	Moderate	Heavy

Stream Field Measurements

Temp (°C)	12.9	pH	8.21
SC (µS/cm²)	450	Salinity	0.15.1
Conductivity (µS/cm)	344		
D.O. (%)	98.0		
D.O. (mg/L)	11.6		
Method:	YSI	Other:	
Turbidity (ntu)	18.2		
Method:	Hach 2100P	Other:	

Site Visit Photos:

Jpeg # (on camera)	Description (upstream, across/south, etc.)
018	upstream (N)
019	downstream (S)
020	across (W)
021	Rai taking YSI reading

Water Chemistry Samples

Total # Grab Samples Collected: 6 (should match # checked boxes below)

SAMPLE ID: (YMD_SiteID_Sample Type (eller) ex: 20120815_AC-200_A)	YELLOW CAP (H_2SO_4): Nitrate	Total P	WHITE CAP (no preserv.): Total N	SSC
REG: 20120819 SR-287 A	X			X
DUP: 20120819 SR 287 B	X			X
BLNK: 20120819 SR-287 C	X			X

Chemistry Sample Shipping Information:

Shipped by: Torie Bunn Date/Time: 8/20/12 4:15pm

Shipping Method (circle one): FED EX UPS

Form reviewed by:

Name Date

Sample Collection and Bottle Labeling

1. All samples (including quality control samples) should be labeled with a permanent marker before being filled and then covered with clear packing tape so that the labeled information does not smear. Labels should include:
    a. Company Name (Client): Sun River Watershed Group = SRWG
    b. Project = Sun River
    c. Date and time (military time)
    d. Sample ID (includes year, month, day, site ID, and letter indicating sample type)
        Sample ID = Year-Month-Day_SiteID_Sample Type Letter
            A = Regular Sample
            B = Duplicate Sample
            C = Blank Sample
2. Samples will be collected in a well-mixed portion of each stream.
3. Bottles and lids shall be rinsed three times with stream water prior to sampling. During sampling, the sample bottle opening should face upstream and should be drawn through the water column once, carefully avoiding disturbance of bottom sediments.
4. One set of quality control (QC) samples consisting of blanks and duplicates will be collected for approximately every 10 stream samples collected.
    a. A field blank is prepared by transporting laboratory-grade deionized (DI) water to the field and pouring it into sample containers provided by the lab. The blank will be prepared at the same time that the samples are collected from the stream. A duplicate sample is a second stream sample collected at the same time in the same way that the regular stream sample is collected.
    b. Duplicate and blank samples will be collected at the same location for each event but the site they are collected at will rotate through the sample sites for subsequent sample events.
5. Blank and duplicate samples are handled and delivered to the lab in the same manner that regular samples are handled.
6. Any preservative necessary should be added to samples in the field. Preservatives are included with the sample bottles in small vials with caps that correspond in color to the bottles they are intended to preserve. Sulfuric acid (H_2SO_4) (yellow vials and bottle caps) is typically added to samples for nutrient analysis and nitric acid (red vials and bottle caps) is added to samples for metal analysis. Add the entire vial contents to the corresponding sample bottle, replace the lid securely, and agitate gently.

Sample ID Examples:

A **regular sample** collected at the Adobe Creek site on August 15th, 2012 would be labeled:
20120815 AC-200 A

A **duplicate** at the same place and time as above:
20120815 AC-200 B

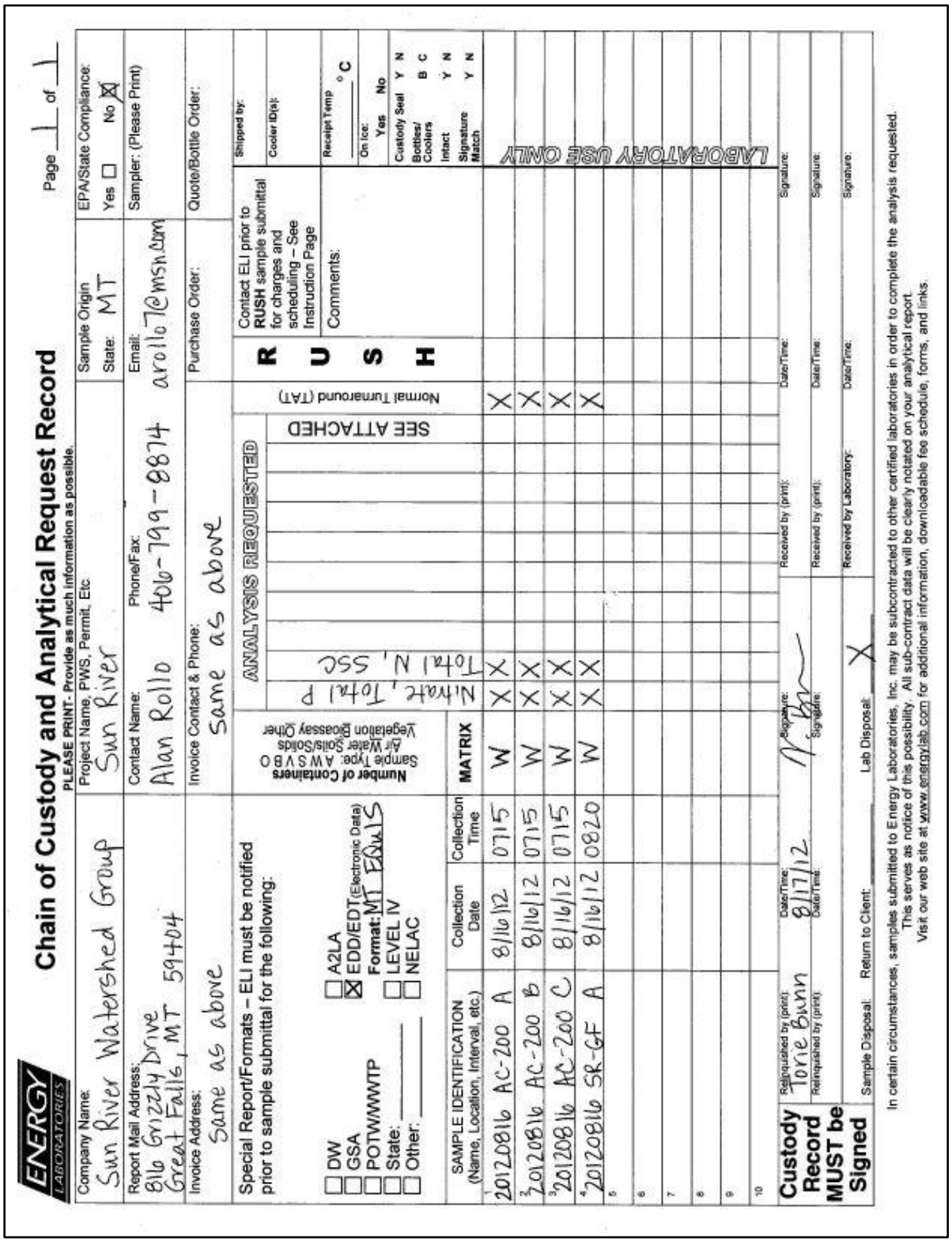
A **blank** at the same place and time as above:
20120815 AC-200 C

A regular sample collected at the Sun River at Augusta site on July 3rd, 2012 would be labeled:
20120703 SR-AG A

Packaging Samples for Shipment

1. Samples need to be kept on ice or in a refrigerator until shipping.
2. Samples should be shipped as quickly after collection as possible but need to be shipped on a Monday or Tuesday and not later than Wednesday. Next day delivery is ideal, but if outside temperatures aren't too high, two day delivery would work too. Samples need to be shipped so they do not arrive on a weekend.
3. Samples should be packaged immediately before shipping to avoid unnecessary loss of ice before shipping.
4. Organize all samples on a table, grouped by site, in the order they were collected.
5. Check that all sample labels are completely filled out.
6. Fill out the chain of custody for the testing laboratory. This includes listing all of the sample IDs and sampling times. See the completed example on the following page.
7. Place a large trash bag inside the cooler. This bag will hold all of the samples and be tied off at the end to prevent any liquids from leaking from the cooler.
8. Place sample bottles in the ziplock bags (they may have come from the lab in bags initially which can be used). Samples preserved with nitric acid (red caps) should be bagged together separately. This is because nitrogen in the form of acid was added to these bottles and we don't want them to contaminate the nutrient samples if they were to leak.
9. Fill a minimum of 2 gallon ziplock bags with ice purchased from a store or ice from your freezer (whichever is more convenient) to include with the samples. The volume of ice should be at least equal to that of the samples.
10. Place all of the samples and the bagged ice inside the trash bag, inside the cooler and tie off the top of the trash bag.
11. Tear off the pink sheet on the completed chain of custody to give to Rai. Place the other COC completed sheets inside a ziplock bag and tape it to the top of the cooler.
12. Close the cooler and tape it closed. Sign and stick the custody seal on the cooler. Peel the tracking sticker on the UPS prepaid sticker and place it on the pink sheet. Deliver the cooler to the shipping center immediately.
13. Timely delivery of samples is critical so the ice doesn't melt. Especially if temperatures are hot, samples need to reach the lab quickly to avoid overheating.

Example Chain of Custody



ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

PLEASE PRINT- Provide as much information as possible.

Page 1 of 1

Company Name: Sun River Watershed Group
Project Name, PWS, Permit, Etc: Sun River
Sample Origin State: MT
EPA/State Compliance: Yes ☐ No ☒

Report Mail Address: 816 Grizzly Drive Great Falls, MT 59404
Contact Name: Alan Rollo
Phone/Fax: 406-799-8874
Email: arollo7@msn.com
Sampler: (Please Print)

Invoice Address: Same as above
Invoice Contact & Phone: Same as above
Purchase Order:
Quote/Bottle Order:

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

☐ DW ☐ A2LA
☐ GSA ☒ EDD/EDT (Electronic Data) Format: MT EQuIS
☐ POTW/WWTP ☐ LEVEL IV
☐ State: _____ ☐ NELAC
☐ Other: _____

ANALYSIS REQUESTED

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Number of Containers / Sample Type: A W S V B O / Air Water Soils/Solids Vegetation Bioassay Other	Nitrate, Total P	Total N, SSC	SEE ATTACHED	Normal Turnaround (TAT)
1 20120816 AC-200 A	8/16/12	0715	W	X	X			X
2 20120816 AC-200 B	8/16/12	0715	W	X	X			X
3 20120816 AC-200 C	8/16/12	0715	W	X	X			X
4 20120816 SR-GF A	8/16/12	0820	W	X	X			X
5								
6								
7								
8								
9								
10								

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by:
Cooler ID(s):
Receipt Temp ____ °C
On Ice: Yes No
Custody Seal Y N
Bottles/Coolers B C
Intact Y N
Signature Match Y N

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Tone Bunn	8/17/12				
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
Sample Disposal: Return to Client: _____ Lab Disposal: X			Received by Laboratory:	Date/Time:	Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly noted on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

YSI Calibration & Care Instructions

(Adapted from a QAPP for the Gallatin Volunteer Monitoring Program written by Tammy Crone)

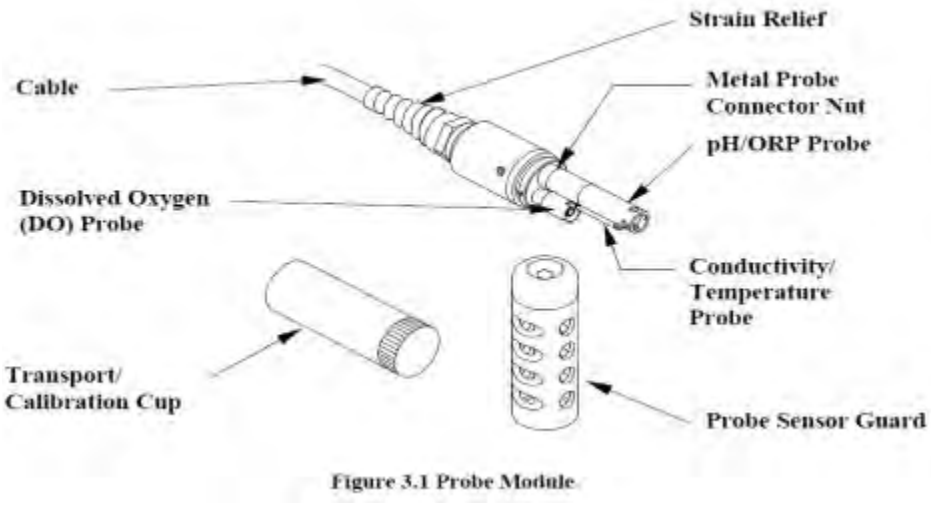


Figure 1: Probe Module from the YSI 556 Manual

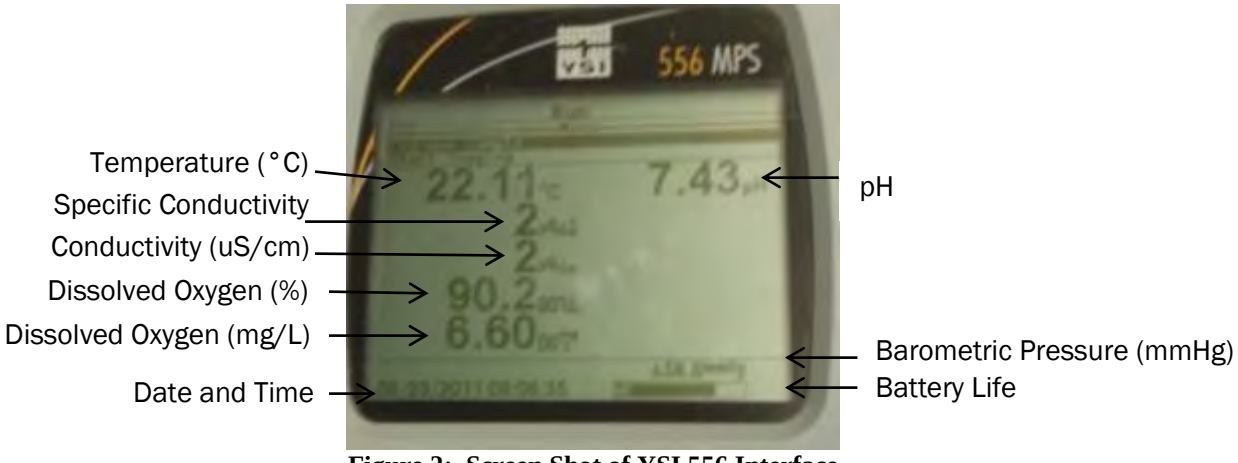


Figure 2: Screen Shot of YSI 556 Interface

YSI 556 CARE

- Before calibrating the YSI, check the condition of all of the probes
  - The pH glass bulb at the end of the probe should be clear. If it is starting to get cloudy or if you notice the pH taking a long time (> 5min) to calibrate then consider replacing the pH probe
  - Inspect the membrane on the dissolved oxygen probe. The membrane should be clear and not cloudy/dirty or scratched. There should not be bubbles under the membrane.
  - Check all probes to make sure they are free of sediment or buildup that may have accumulated since the last time it was used.

CALIBRATION TIPS & HINTS

- Calibration solutions should ideally be stored at room temperature and calibration should be performed at room temperature.
- The transport/calibration cup that comes with the probe serves as a calibration chamber for all calibrations and minimizes the volume of calibration solutions required.
- Ensure all sensors are immersed in the calibration solution. Many of the calibrations factor in readings from other sensors (e.g., temperature sensor). The top vent hole of the conductivity sensor must also be immersed during some calibrations.
- Make sure to loosen the seal of the transport/calibration cup prior to the DO calibration to allow pressure equilibration.
- For maximum accuracy, use a small amount of previously used calibration solution to pre-rinse the probe (Figure 1).
- Put some deionized (DI) water at ambient temperature to rinse the probe between calibration solutions.

Figure 1. Bottles of solution for each calibration solution for rinsing.

- Have several clean, absorbent paper towels or Kim-wipes available to dry the probe between rinses and calibration solutions. Shake excess rinse water off the probe. Dry off the outside of the probe and sensor guard. (Making sure the probe module is dry reduces carry-over contamination of calibration solutions and increases the accuracy of the calibration.)

PROBE INSPECTION

- Ensure the o-ring is installed in the o-ring groove of the transport/calibration cup and that the bottom cap is securely tightened. **NOTE:** Do not overtighten!
- Remove the probe sensor guard, if installed.
- Remove the o-ring, if installed, from the probe and inspect for defects. Replace with extra o-ring if defects found.

PROBE STORAGE

- Store the probe with about half an inch of tap water in the storage cup.

ACCESSING THE CALIBRATION SCREEN

1. Press the **On/Off** key to display the **Run** screen.

2. Press the **Escape** key to display the main menu screen (figure 2).
3. Use the arrow keys to highlight **Calibrate** (figure 3).
4. Press **Enter** key. **Calibrate** screen is displayed. Conductivity will automatically be highlighted on this screen.

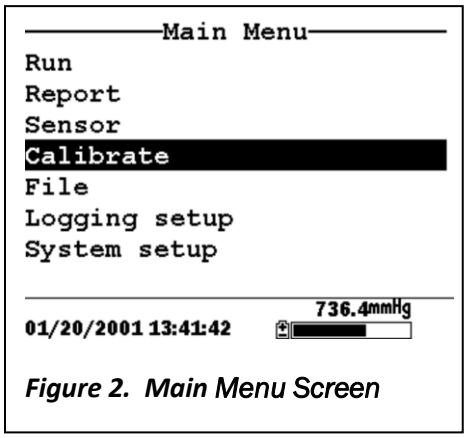


Figure 2. Main Menu Screen

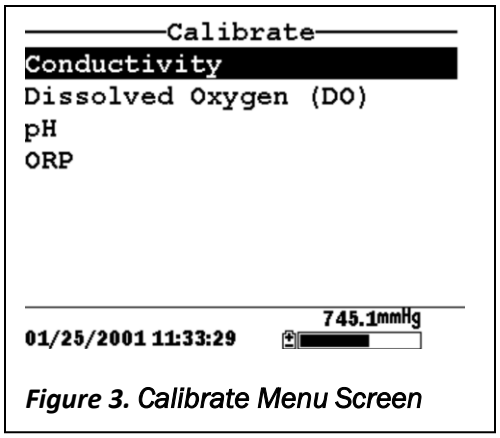


Figure 3. Calibrate Menu Screen

CONDUCTIVITY CALIBRATION

Picture 1

Picture 2

1. Go to **Calibrate screen** as described above.
2. Highlight **Conductivity** and press **Enter**. The Conductivity Calibration Screen is displayed.
3. **Specific Conductance** parameter will automatically be highlighted. Press **Enter.**
4. Remove the plastic **transport/calibration cup (Picture 1)**.
5. Pre-rinse the conductivity sensor with a little bit of the **1413 standard conductivity calibration solution** and discard into a waste jar.
6. Pour enough new **1413 standard** into the **transport/calibration cup** to entirely cover all 3 sensors including the vent hole on the conductivity sensor (~55ml) **(Picture 2, arrow)** and secure the cup to the probe. Tap the probe gently to remove air bubbles.
7. Use the keypad to enter the **calibration value** of the standard being used. The **1413 uS/cm Standard Solution** should be entered as**: 1.413** (the 1.413 value may automatically be displayed)
8. Press **Enter**. The **Cond Calibration Menu** Screen will be displayed.

Note: *the YSI is set-up for "temperature compensation". Always use the value for the calibration standard at* ***25°C****.*

9. Allow at least one minute for **instrument temperature** to stabilize. The current values of enabled sensors will appear on the screen and will change with time as they stabilize.

10. Observe the reading under **Specific Conductivity (uS/cm^{C})**. When the reading shows no significant change for ~**30 seconds**, then record the **"Temp of Standard"** and record the **Specific Conductivity** (**uS/cm^{C})** value on the calibration log sheet under **"Reading Before Cal"** then press **Enter** key.

If the meter displays a warning similar to "Value out of range, accept anyway?" Do **NOT** accept the value. Recalibrate and try again

11. Record the **"Set to" values** in the **YSI Calibration Log** (which should be 1413 uS/cm^{C})
12. Remember to record the **"Expiration Date"** of the solution too
13. Press **Enter** key again, screen will indicate calibration has been accepted.
14. Record the new Specific Conductivity (uS/cmC) value under **"Reading After Cal"** on the calibration log sheet
15. Press **Enter** key again, to return to the **Conductivity Calibration Selection Screen**.
16. Press **Escape** to return to the **Calibrate Menu Screen**.
17. **Rinse** the probe and sensors with **DI water**

DISSOLVED OXYGEN CALIBRATION in % SATURATION

Picture 3

1. In the **Calibration Screen**, use the **arrow keys** to highlight **DO 2 mil PE (Blue)**.
2. Press **Enter** key. The **DO %** will automatically be highlighted.
3. Press Enter key again. The Enter Baro mmHG screen will be displayed. Enter the local barometric pressure, determined online or with the included benchtop barometer.
4. Record the **Barometric Pressure** on the calibration log sheet
5. Pour approximately 1/8 inch of water (Picture 3, arrow 2) in bottom of **transport/calibration cup**. * **Do Not** immerse any of the sensors in the water.
6. Screw the **transport/calibration cup** onto the probe using only 1 or 2 threads, so it is just hanging on (Picture 3, arrow 1).
7. Press **Enter** key. The **DOsat Calibration Menu Screen** will be displayed.
8. Allow 10 minutes for the **DO probe** to stabilize (and for the temperature to stabilize).
9. When the **DO %** reading is stable for 30 seconds, record the **DO%** and **DO mg/L** values in the calibration log.
10. Press **Enter** key to accept the reading.

If the meter displays a warning "Value out of range, accept anyway?" Do **NOT** accept the value, recalibrate and try again

11. **Record** the new **DO% and DO mg/L** values in the **YSI Calibration Log**
12. Press **Enter** key again. This returns you to the **DO Calibration Menu Screen**.
13. Press **Escape** key, to return to the **Calibrate Menu Screen**.

pH CALIBRATION

Picture 4

1. In the **Calibration Screen**, use the **arrow keys** to highlight **pH**.
2. Press **Enter** key. The pH Calibration Screen will be displayed.
3. Use **arrow keys** to highlight **2-point** option to calibrate the pH sensor.
4. Press the **Enter** key, the **pH Entry Screen** will be displayed.
5. **Enter value** of **pH standard** being used - **NOTE:** Always calibrate in **7 buffer** first.
7. **Rinse** the **pH sensor** with little bit of the **7.00 buffer** and discard.
8. **Pour ~35 ml 7.00 buffer** into the **transport/calibration cup (picture 4)** and secure the cup to the probe. Tap the probe gently to remove air bubbles.
9. Use the keypad to enter the **calibration value** of the **pH standard** being used.
10. Press **Enter**. The **pH Calibration Screen** will be displayed.
11. Allow **1 minute** for temperature to stabilize. **Observe pH reading**. If **no significant change** in **30 seconds**, record the current pH value under **"Reading Before Cal"** and the temperature of the standard under **"Temp of Standard"**
12. Press **Enter** key. The screen will indicate **calibration accepted.**

***If the meter displays a warning similar to "Value out of range, accept anyway?"
Do **NOT** accept the value. Recalibrate and try again***

13. **Record** the **"Set to"** value on the **Calibration Log** and record the new pH reading under **"Reading After Cal"**
14. Pour used solution into a waste container and rinse the probes with DI water.
15. Press **Enter** key to return to **pH Calibration Screen**, continue with the **second point** of calibration for **pH 10.00** (**repeat steps 5-13).**
16. Press **Enter** to return to the **pH Calibration Screen**. Press **Escape** twice to return to the data logging menu.
17. **Rinse** the probe and sensors with **DI water.**

Hach Turbidity Meter Calibration & Care Instructions

1. Preparing calibration standards:

There are several ways to prepare turbidity calibration standards. For simplicity and portability, MSUEWQ recommends using stabilized standards in factory sealed bottles (Figure 1). These can be purchased from Hach or other online environmental monitoring equipment retailers. If another method of standard preparation is necessary, please see the Instrument and Procedure Manual included with the turbidimeter.

Figure 1. Hach StablCal Sealed Vial Turbidity Standards, and a DI water blank (left).

Follow the steps below (Figure 2) from the Hach 2100P Instrument and Procedure Manual to prepare your calibration standards for use in calibration.

3.6.1.3 Preparing StablCal Stabilized Standards in Sealed Vials

Sealed vials that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at *step 1* for these standards. If the standards are used on at least a weekly interval, start at *step 3*

Important Note: These instructions do not apply to <0.1-NTU* StablCal Standards; <0.1NTU StablCal Standards should not be shaken or inverted.

1. Shake the standard vigorously for 2-3 minutes to resuspend any particles.
2. Allow the standard to stand undisturbed for 5 minutes.
3. Gently invert the vial of StablCal 5 to 7 times.
4. Prepare the vial for measurement using traditional preparation techniques. This usually consists of oiling the vial (see *Section 2.3.2* on page *23*) and marking the vial to maintain the same orientation in the sample cell compartment (see *Section 2.3.3* on page *24*). This step will eliminate any optical variations in the sample vial.
5. Let the vial stand for one minute. The standard is now ready for use in the calibration procedure, *Section 3.6.3*.

Figure 2. Steps for preparing standard turbidity solutions in factory sealed vials for use in calibration.

2. Calibration procedure:

Follow the steps below from the Hach 2100P Instrument and Procedure Manual to calibrate your turbidimeter.

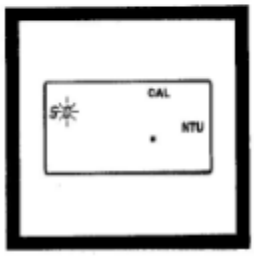
3.6.3 Calibrating the Turbidimeter

Note: *For best accuracy use the same sample cell or four matched sample cells for all measurements during calibration. Always insert the cell so the orientation mark placed on the cell during the matching procedure is correctly aligned. (See Section 2.3.4 on page 26 for matching sample cells).*

1. Rinse a clean sample cell with dilution water several times. Then fill the cell to the line (about 15 mL) with dilution water or use StablCal <0.1 NTU standard.

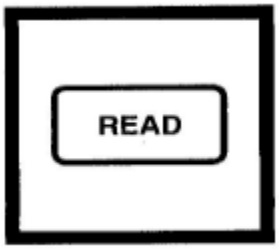
2. Insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid. Press **I/O**.

Note: *Choose signal average mode option (on or off) before pressing* **CAL** *– the* **SIGNAL AVERAGE** *key is not functional in calibration mode.*



3. Press: **CAL**

The **CAL** and **S0** icons will be displayed (the **0** will flash). The 4-digit display will show the value of the S0 standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank (as shown). Press → to get a numerical display.



4. Press: **READ**

The instrument will count from 60 to 0, (67 to 0 if signal average is on), read the blank and use it to calculate a correction factor for the 20 NTU standard measurement. If the dilution water is ≥ 0.5 NTU, E 1 will appear when the calibration is calculated (See *Section 3.6.2.3* on page *41* for more dilution water information). The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

Note: *The turbidity of the dilution water can be "forced" to zero by pressing → rather than reading the dilution water. The display will show* **S0 NTU** *and the ↑ key must be pressed to continue with the next standard.*

Calibration procedure, continued.

5. The display will show the **S1** (with the 1 flashing) and **20 NTU** or the value of the S1 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 20 NTU StablCal Standard or 20 NTU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

6. Press: **READ**

The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. The display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

7. The display will show the **S2** (with the 2 flashing) and **100 NTU** or the value of the S2 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 100 NTU StablCal Standard or 100 NTU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

8. Press: **READ**

The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Then, the display will automatically increment to the next standard. Remove the sample cell from the cell compartment.

9. The display will show the **S3** (with the 3 flashing) and **800 NTU** or the value of the S3 standard for the previous calibration. If the value is incorrect, edit the value by pressing the → key until the number that needs editing flashes. Use the ↑ key to scroll to the correct number. After editing, fill a clean sample cell to the line with **well mixed** 800 NTU StablCal Standard or 800 NTU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

10. Press: **READ**

The instrument will count from 60 to 0 (67 to 0 if signal average is on), measure the turbidity and store the value. Then the display will increment back to the S0 display. Remove the sample cell from the cell compartment.

11. Press: **CAL** to accept the calibration. The instrument will return to measurement mode automatically.

Note: *Pressing* **CAL** *completes the calculation of the calibration coefficients. If calibration errors occurred during calibration, error messages will appear after* **CAL** *is pressed. If* **E 1** *or* **E 2** *appear, check the standard preparation and review the calibration; repeat the calibration if necessary. If* **CAL?** *appears, an error may have occurred during calibration. If* **CAL?** *is flashing, the instrument is using the default calibration.*

Appendix C: SRWG Site Visit Form

Sun River Watershed Group – Site Visit Form

Date: _____ **Time:** _____ **Site Name:** _____ **Site ID:** _____

Team Members: _____

_____

Latitude __ __.__ __ __ __ __ __ **Longitude** __ __ __.__ __ __ __ __ __ **GPS Verified?** **YES** **NO**

Site Visit Comments:

Staff Gauge Reading: _____

Location:

Current Weather (circle one)

Cloud Cover:	<5%	5-25%	25-75%	75-100%
Precipitation:	None	Light	Moderate	Heavy
Precip. Last 24 hrs:	None	Light	Moderate	Heavy

Stream Field Measurements

Temp (°C) _____ pH _____

SC (µS/cm^c) _____ Salinity _____

Conductivity (µS/cm) _____

D.O. (%) _____

D.O. (mg/L) _____

Method: **YSI** **Other:** _____

Turbidity (ntu) _____

Method: **Hach 2100P** **Other:** _____

Site Visit Photos:

jpeg # (on camera)	Description (upstream, across/south, etc.)

Water Chemistry Samples

Total # Grab Samples Collected: _____ (should match # checked boxes below)

SAMPLE ID: (YMD_SiteID_Sample Type Letter) ex: 20120815_AC-200_A	**YELLOW CAP** (H_2SO_4): Nitrate	Total P	**WHITE CAP** (no preserv.): Total N	SSC
REG:	☐		☐	
DUP:	☐		☐	
BLNK:	☐		☐	

Chemistry Sample Shipping Information:

Shipped by: _____ Date/Time: _____

Shipping Method (circle one): FED EX UPS

Form reviewed by:

_____ _____

Name Date

Appendix D: Glossary of QA/QC Terms

QA/QC Terms

Accuracy. A data quality indicator, accuracy is the extent of agreement between an observed value (sampling result) and the accepted, or true, value of the parameter being measured. High accuracy can be defined as a combination of high precision and low bias.

Analyte. Within a medium, such as water, an analyte is a property or substance to be measured. Examples of analytes would include pH, dissolved oxygen, bacteria, and heavy metals.

Bias. Often used as a data quality indicator, bias is the degree of systematic error present in the assessment or analysis process. When bias is present, the sampling result value will differ from the accepted, or true, value of the parameter being assessed.

Blind sample. A type of sample used for quality control purposes, a blind sample is a sample submitted to an analyst without their knowledge of its identity or composition. Blind samples are used to test the analyst's or laboratory's expertise in performing the sample analysis.

Comparability. A data quality indicator, comparability is the degree to which different methods, data sets, and/or decisions agree or are similar.

Completeness. A data quality indicator that is generally expressed as a percentage, completeness is the amount of valid data obtained compared to the amount of data planned.

Data users. The group(s) that will be applying the data results for some purpose. Data users can include the monitors themselves as well as government agencies, schools, universities, businesses, watershed organizations, and community groups.

Data quality indicators (DQIs). DQIs are attributes of samples that allow for assessment of data quality. These include precision, accuracy, bias, sensitivity, comparability, representativeness and completeness.

Data quality objectives (DQOs). Data quality objectives are quantitative and qualitative statements describing the degree of the data's acceptability or utility to the data user(s). They include data quality indicators (DQIs) such as accuracy, precision, representativeness, comparability, and completeness. DQOs specify the quality of the data needed in order to meet the monitoring project's goals. The planning process for ensuring environmental data are of the type, quality, and quantity needed for decision making is called the ***DQO process*.**

Detection limit. Applied to both methods and equipment, detection limits are the lowest concentration of a target analyte that a given method or piece of equipment can reliably ascertain and report as greater than zero.

Duplicate sample. Used for quality control purposes, duplicate samples are two samples taken at the same time from, and representative of, the same site that are carried through all assessment and analytical procedures in an identical manner. Duplicate samples are used to measure natural variability as well as the precision of a method, monitor, and/or analyst. More than two duplicate samples are referred to as *replicate samples*.

Environmental sample. An environmental sample is a specimen of any material collected from an environmental source, such as water or macroinvertebrates collected from a stream, lake, or estuary.

Equipment or rinsate blank. Used for quality control purposes, equipment or rinsate blanks are types of field blanks used to check specifically for carryover contamination from reuse of the same sampling equipment (see *field blank*).

Field blank. Used for quality control purposes, a field blank is a "clean" sample (e.g., distilled water) that is otherwise treated the same as other samples taken from the field. Field blanks are submitted to the analyst along with all other samples and are used to detect any contaminants that may be introduced during sample collection, storage, analysis, and transport.

Instrument detection limit. The instrument detection limit is the lowest concentration of a given substance or analyte that can be reliably detected by analytical equipment or instruments (see *detection limit*).

Matrix. A matrix is a specific type of medium, such as surface water or sediment, in which the analyte of interest may be contained.

Measurement Range. The measurement range is the extent of reliable readings of an instrument or measuring device, as specified by the manufacturer.

Method detection limit (MDL). The MDL is the lowest concentration of a given substance or analyte that can be reliably detected by an analytical procedure (see *detection limit*).

Precision. A data quality indicator, precision measures the level of agreement or variability among a set of repeated measurements, obtained under similar conditions. Relative percent difference (RPD) is an example of a way to calculate precision by looking at the difference between results for two duplicate samples.

Protocols. Protocols are detailed, written, standardized procedures for field and/or laboratory operations.

Quality assurance (QA). QA is the process of ensuring quality in data collection including: developing a plan, using established procedures, documenting field activities, implementing

planned activities, assessing and improving the data collection process and assessing data quality by evaluating field and lab quality control (QC) samples.

Quality assurance project plan (QAPP). A QAPP is a formal written document describing the detailed *quality control* procedures that will be used to achieve a specific project's data quality requirements. This is an overarching document that might cover a number of smaller projects a group is working on. A QAPP may have a number of sample analysis plans (SAPs) that operate underneath it.

Quality control (QC). QC samples are the blank, duplicate and spike samples that are collected in the field and/or created in the lab for analysis to ensure the integrity of samples and the quality of the data produced by the lab.

Relative percent difference (RPD). RPD is an alternative to *standard deviation*, expressed as a percentage and used to determine precision when only two measurement values are available. Calculated with the following formula:

RPD as % = ((D1 – D2)/((D1 + D2)/2)) x 100

Where:
D1 is first replicate result
D2 is second replicate result

Replicate samples. See duplicate samples.

Representativeness. A data quality indicator, representativeness is the degree to which data accurately and precisely portray the actual or true environmental condition measured.

Sample analysis plan (SAP). A SAP is a document outlining objectives, data collection schedule, methods and data quality assurance measures for a project.

Sensitivity. Related to *detection limits*, sensitivity refers to the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. The more sensitive a method is, the better able it is to detect lower concentrations of a variable.

Spiked samples. Used for quality control purposes, a spiked sample is a sample to which a known concentration of the target analyte has been added. When analyzed, the difference between an environmental sample and the analyte's concentration in a spiked sample should be equivalent to the amount added to the spiked sample.

Split sample. Used for quality control purposes, a split sample is one that has been equally divided into two or more subsamples. Splits are submitted to different analysts or laboratories and are used to measure the precision of the analytical methods.

Standard reference materials (SRM). An SRM is a certified material or substance with an established, known and accepted value for the analyte or property of interest. Employed in the determination of bias, SRMs are used as a gauge to correctly calibrate instruments or assess measurement methods. SRMs are produced by the U. S. National Institute of Standards and Technology (NIST) and characterized for absolute content independent of any analytical method.

Standard operating procedures (SOPs). An SOP is a written document detailing the prescribed and established methods used for performing project operations, analyses, or actions.

True value. In the determination of accuracy, observed measurement values are often compared to true, or standard, values. A true value is one that has been sufficiently well established to be used for the calibration of instruments, evaluation of assessment methods or the assignment of values to materials.

Appendix E: QA/QC Matrix

Example QA/QC matrix

Below is an example of a matrix for use in addressing whether all data quality criteria are met for each analyte for each batch of samples. This table can be created using the thresholds from Tables 6 and 7 in this QAPP. QC numbers from the lab and calculated from the field are filled in, and compared to thresholds to perform QC checks.

Careless Creek 2010 QC Check

H1004007-1

		April			
		TDS		TSS	
		Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540D	✓
2	Method Blank	<10 mg/L	1	<1 mg/L	ND
3	Lab Control	90-100%	101	75-120%	84
4	Lab Fortified Blank	NA		NA	
5	Sample Dup	<20%	1.4	<10%	4.9
6	Matrix Spike	80-120%	98	NA	
7	Matrix Spike Dup	NA		NA	
8	Field Blank	<10 mg/L	ND	<1 mg/L	ND
9	Field Dup	<25%	0.13	<25%	0

H1005022-9

		May			
		TDS		TSS	
		Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540D	✓
2	Method Blank	<10 mg/L	5	<1 mg/L	ND
3	Lab Control	90-100%	97	75-120%	92
4	Lab Fortified Blank	NA		NA	
5	Sample Dup	<20%	Below D	<10%	Below D
6	Matrix Spike	80-120%	97	NA	
7	Matrix Spike Dup	NA		NA	
8	Field Blank	<10 mg/L	ND	<1 mg/L	ND
9	Field Dup	<25%	0	<25%	-0.08

H1007003-0

		June			
		TDS		TSS	
		Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540	✓
2	Method Blank	<10 mg/L	ND	<1 mg/L	ND
3	Lab Control	90-100%	99	75-120%	97
4	Lab Fortified Blank	NA		NA	
5	Sample Dup	<20%	0.6	<10%	0
6	Matrix Spike	80-120%	94	NA	
7	Matrix Spike Dup	NA		NA	
8	Field Blank	<10 mg/L	Not Taken	<1 mg/L	Not Taken
9	Field Dup	<25%	0.35	<25%	4.55

H1007045-0

		July											
		TDS		TSS		Alkalinity		TN		NH4		NO4		TP	
		Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540	✓	A2320B	✓	A4500 N-C	✓	E350.1	✓	E353.2	✓	E365.1	✓
2	Method Blank	<10 mg/L	6	<1 mg/L	ND	<4mg/L	2	<0.1 mg/L	0.01	<0.05 mg/L	ND	<0.01 mg/L	ND	<0.005 mg/L	ND
3	Lab Control	90-100%	98	75-120%	101	90-110%	99	90-110%	100	90-110%	102	90-110%	98	90-110%	99
4	Lab Fortified Blank	NA		NA		90-110%	99	90-110%	101	90-110%	99	90-110%	104	90-110%	99
5	Sample Dup	<20%	Blow D	<10%	Blow D	<20%	0.9	<10%	1.5	<10%	0	<10%	0.8	<10%	2.6
6	Matrix Spike	80-120%	98	NA		80-120%	101	90-110%	99	90-110%	102	90-110%	94	90-110%	95
7	Matrix Spike Dup	NA		NA		80-120%	0	90-110%	97	90-110%	102	90-110%	95	90-110%	98
8	Field Blank	<10 mg/L	ND	<1 mg/L	2	<4mg/L	4	<0.1 mg/L	ND	<0.05 mg/L	ND	<0.01 mg/L	ND	<0.005 mg/L	ND
9	Field Dup	<25%	0.19	<25%	-13.64	25%	-1.22	25%	0	25%	0	25%	0	25%	0

H1009203-9

		August													
		TDS		TSS		Alkalinity		TN		NH4		NO4		TP	
		Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540	✓	A2320B	✓	A4500 N-C	✓	E350.1	✓	E353.2	✓	E365.1	✓
2	Method Blank	<10 mg/L	ND	<1 mg/L	ND	<4mg/L	1	<0.1 mg/L	ND	<0.05 mg/L	ND	<0.01 mg/L	ND	<0.005 mg/L	ND
3	Lab Control	90-100%	99	75-120%	96	90-110%	105	90-110%	104	90-110%	105	90-110%	96	90-110%	95
4	Lab Fortified Blank	NA		NA		90-110%	105	90-110%	101	90-110%	100	90-110%	103	90-110%	95
5	Sample Dup	<20%	1.1	<10%	Blow D	<20%	0.5	<10%	0	<10%	0.4	<10%	0.9	<10%	2.5
6	Matrix Spike	80-120%	100	NA		80-120%	103	90-110%	96	90-110%	107	90-110%	105	90-110%	96
7	Matrix Spike Dup	NA		NA		80-120%	Missing	90-110%	96	90-110%	106	90-110%	106	90-110%	98
8	Field Blank	<10 mg/L	ND	<1 mg/L	ND	<4mg/L	1	<0.1 mg/L	ND	<0.05 mg/L	ND	<0.01 mg/L	ND	<0.005 mg/L	ND
9	Field Dup	<25%	-0.22	<25%	0	25%	0	25%	0	25%	0	25%	0	25%	2.99

H1009041-4

		September													
		TDS		TSS		Alkalinity		TN		NH4		NO4		TP	
		Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540	✓	A2320B	✓	A4500 N-C	✓	E350.1	✓	E353.2	✓	E365.1	✓
2	Method Blank	<10 mg/L	4	<1 mg/L	ND	<4mg/L	2	<0.1 mg/L	ND	<0.05 mg/L	ND	<0.01 mg/L	ND	<0.005 mg/L	ND
3	Lab Control	90-100%	98	75-120%	97	90-110%	103	90-110%	99	90-110%	108	90-110%	101	90-110%	98
4	Lab Fortified Blank	NA		NA		90-110%	103	90-110%	99	90-110%	91	90-110%	108	90-110%	98
5	Sample Dup	<20%	0	<10%	13	<20%	Blow D	<10%	1.8	<10%	1.4	<10%	1.5	<10%	2.7
6	Matrix Spike	80-120%	97	NA		80-120%	75	90-110%	106	90-110%	110	90-110%	112	90-110%	92
7	Matrix Spike Dup	NA		NA		80-120%	Missing	90-110%	104	90-110%	108	90-110%	114	90-110%	94
8	Field Blank	<10 mg/L	ND	<1 mg/L	ND	<4mg/L	1	<0.1 mg/L	ND	<0.05 mg/L	ND	<0.01 mg/L	ND	<0.005 mg/L	ND
9	Field Dup	<25%	0.09	<25%	1.79	25%	0	25%	0	25%	0	25%	3.98	25%	-1.19

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		October			
		TDS		TSS	
		Criteria	Value	Criteria	Value
1	Method	A2540C	✓	A2540	✓
2	Method Blank	<10 mg/L	5	<1 mg/L	ND
3	Lab Control	90-100%	98	75-120%	94
4	Lab Fortified Blank	NA		NA	
5	Sample Dup	<20%	0.4	<10%	0
6	Matrix Spike	80-120%	96	NA	
7	Matrix Spike Dup	NA		NA	
8	Field Blank	<10 mg/L	ND	<1 mg/L	ND
9	Field Dup	<25%	0	<25%	14.29

Appendix F: Data Qualifiers and Descriptions

Data qualifiers and descriptions

Result Qualifier	Result Qualifier Description
B	Detection in field and/or trip blank
D	Reporting limit (RL) increased due to sample matrix interference (sample dilution)
H	EPA Holding Time Exceeded
J	Estimated: The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
R	Rejected: The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
U	Not Detected: The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method.
UJ	Not Detected/Estimated: The analyte was not detected at a level greater than or equal to the adjusted CRQL or the reported adjusted CRQL is approximate and may be inaccurate or imprecise.

Appendix G: Quality Control Checklist

QC Checklist

___Condition of samples upon receipt
___Cooler/sample temperature
___Proper collection containers
___All containers intact
___Sample pH of acidified samples <2
___All field documentation was complete. If incomplete areas cannot be completed, document the issue.
___Holding times met
___Field duplicates collected at the proper frequency (specified in QAPP)
___Field blanks collected at the proper frequency (specified in QAPP)
___All sample IDs match those provided in the QAPP. Field duplicates are clearly marked on samples and noted as such in lab results.
___Analyses carried out as described within the QAPP (e.g. analytical methods, photo documentation, field protocols)
___Reporting detection limit met the project-required detection limit
___All blanks were less than the project-required detection limit
___If any blanks exceeded the project-required detection limit, associated data is flagged
___Laboratory blanks/duplicates/matrix spikes/lab control samples were analyzed at a minimum 10% frequency
___Laboratory blanks/duplicates/matrix spikes/lab control samples were all within the required control limits defined within the QAPP
___Project DQOs and DQIs were met (as described in QAPP)
___Summary of results of QC analysis, issues encountered, and how issues were addressed (corrective action)
___Completed QC checklist before upload to website

Appendix H: Obtaining SRWG Discharge Data

Instructions for Obtaining SRWG Discharge Data

SRWG Site Name: Sun River at Augusta
Site ID: SR-AG
Discharge Data Source: Bureau of Reclamation (BoR) Hydromet website

Notes: To query data for this site, you need to type your search terms, in URL form, directly into the address bar in your internet browser. Here's an example:

To get daily mean discharge data in cfs for 5/11/12 through 5/15/12, I would type:

http://www.usbr.gov/gpbin/webarccsv.pl?parameter=SRBM%20QD,SRBM%20WZ&syer=2012&smnth=5&sdy=11&eyer=2012&emnth=5&edy=15&format=1

Where "SRBM" = site name
"QD" = mean daily discharge in cfs
"syer", "smnth", "sdy" = start year, month, day
"eyer", "emnth", "edy" = end year, month, day
"format" = data format, 1 = tab delimited, 2 = csv (comma separated values)

This query would yield results that look like this:

USBR Great Plains Region
Hydromet/AgriMet Data Access

Although the US Bureau of Reclamation makes efforts to maintain the accuracy of data found in the Hydromet system databases, the data is largely unverified and should be considered preliminary and subject to change. Data and services are provided with the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, complete-ness, usability or suitability for any particular purpose of the information or data obtained by access to this computer system, and the United States shall be under no liability whatsoever to any individual or group entity by reason of any use made thereof.

BEGIN DATA

DATE	SRBM QD	SRBM WZ
05/11/2012	294.71	52.58
05/12/2012	293.26	54.49
05/13/2012	311.35	57.60
05/14/2012	326.63	58.18
05/15/2012	300.07	58.69

END DATA

This data can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.

SRWG Site Name: Big Coulee
Site ID: BC-SM
Discharge Data Source: Sun River Science Club staff gauge readings

Notes: This data should accompany SRSC water quality data spreadsheets, which can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.

SRWG Site Name: Adobe Creek
Site ID: AC-200
Discharge Data Source: Sun River Science Club staff gauge readings

Notes: This data should accompany SRSC water quality data spreadsheets, which can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.

SRWG Site Name: Mill Coulee
Site ID: ML-200
Discharge Data Source: Sun River Science Club staff gauge readings

Notes: This data should accompany SRSC water quality data spreadsheets, which can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.

SRWG Site Name: Muddy Creek at Power
Site ID: MC-PWR
Discharge Data Source: Teton County, Power Water & Sewer

Notes: This data can be requested from TCPWS in electronic format, which can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.

SRWG Site Name: Muddy Creek at Vaughn
Site ID: MC-VHN
Discharge Data Source: USGS National Water Information System website

Notes: The USGS gauge number for this site is "USGS 06088500". To query data for this site, you need to go to http://waterdata.usgs.gov and select [Surface Water], [Daily Data], then check the "Site Number" box and select [Submit]. From here, type "06088500" in the "Site Number" section, choose "Streamflow, ft^3/s" in the "Water Level/Flow Parameters" section, enter the "First date" and "Last date" that correspond with the dates of your data interest in the "Retrieve Data for:" section, and choose "Tab-separated data" in the "Output Options:" section. You can choose to "save to file" or "display in browser", either of which can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.

SRWG Site Name: Sun River at Great Falls
Site ID: SR-GF
Discharge Data Source: USGS National Water Information System website

Notes: The USGS gauge at Sun River near Vaughn, MT is being used for discharge at this site. The number for this site is "USGS 06089000". To query data for this site, you need to go to http://waterdata.usgs.gov and select [Surface Water], [Daily Data], then check the "Site Number" box and select [Submit]. From here, type "06089000" in the "Site Number" section, choose "Streamflow, ft^3/s" in the "Water Level/Flow Parameters" section, enter the "First date" and "Last date" that correspond with the dates of your data interest in the "Retrieve Data for:" section, and choose "Tab-separated data" in the "Output Options:" section. You can choose to "save to file" or "display in browser", either of which can then be copied and pasted into SRWG's appendable Excel spreadsheets for editing.