

Field Data Collection for QUAL2Kw

Model Build and Calibration

Standard Operating Procedures

Version 1.0

1.0	PURPOSE.....	1
2.0	PRE-DEPLOYMENT.....	2
2.1	SITE SELECTION	2
2.2	STATION SELECTION	2
2.3	DATA STORAGE	5
2.4	GEAR LIST	6
3.0	SAMPLING PROCEDURE - DEPLOYMENT	7
3.1	DEPLOYMENT	7
3.2	OPTIONAL DATA COLLECTION	9
3.3	GEAR LIST	11
4.0	SAMPLING PROCEDURE - RETRIEVAL	13
4.1	RETRIEVAL.....	13
4.2	GEAR LIST	15
5.0	POST SAMPLING ACTIVITIES	17
5.1	RESPONSIBILITIES.....	17
5.2	EQUIPMENT MAINTENANCE	17
5.3	DATA DOWNLOAD & STORAGE	18

APPENDIX A: SITE RECONNAISSANCE FORM

APPENDIX B: YSI PROTOCOLS

APPENDIX C: FIELD COLLECTION FORM

APPENDIX D: CHANNEL CROSS-SECTION FORM

1.0 PURPOSE

This document outlines the field sampling standard operating procedure (SOP) for the Utah DWQ's development of a QUAL2Kw model for waste load analysis (WLA) of permitted discharges to the State's flowing waterbodies. The following procedure was developed in cooperation with multiple sections within the Utah DWQ and input from contractors from Utah State University.

The following project requires the cooperative effort of DWQ employees across multiple sections. The following SOP requires the work of an analyst, field leader and database manager.

An analyst is defined as the DWQ employee who is in charge of selecting sites for sampling and populating and running the model. The list of current, trained DWQ analysts for this procedure is listed below.

The field leader is defined as the DWQ employee in charge of data collection and field activities. From this SOP, any permanent employee in the DWQ Monitoring section should have the appropriate abilities and experience to be the field leader for any sampling event. However, it is strongly recommended that the field leader be trained on the specific sampling protocols for QUAL2Kw model development. A list of DWQ employees that are currently trained as field leaders for this SOP are listed below.

Data for QUAL2Kw development comes from various sources and is considered a Tier 3 (special studies) monitoring project. It is important that the database manager is informed of planned sampling events to insure proper data flow, storage and quality. The current DWQ database manager is listed below.

Analysts

Nick von Stackelberg, Water Quality Management Section
Dave Wahm, Watershed Protection Section

Field Leaders

Mike Shupryt, Water Quality Management Section
Emilie Flemer, Water Quality Management Section
Suzan Tahir, Water Quality Monitoring Section

Database Manager

Kate Tipple, Water Quality Monitoring Section

Monitoring Section Manager

Jim Harris

2.0 PRE-DEPLOYMENT

2.1 SITE SELECTION

- 1) Facilities will be selected by Analysts
- 2) Analyst will be responsible for conveying any optional data collection to Field Leader (see Section 3.2).
- 3) Analyst will be responsible for determining number and location of stations for sampling. Sampling locations and reach will need to be ground truthed to determine suitability and confounding factors such as tributaries, diversions etc. (See Site Survey Form, Appendix A). It is recommended that potential station locations with GPS coordinates are selected before to recon to serve as a guide for the field crew.
- 4) Record GPS coordinates and driving/walking directions to each potential station or any confounding factor.

2.2 STATION SELECTION

- 1) A site reconnaissance should be performed to assist with station selection and logistical planning including site access, and to identify tributary inflows and diversions. The site reconnaissance will be performed by the analyst and assisted by field monitoring staff. Equipment for the site reconnaissance includes camera, GPS, and gear for wading in the stream.
- 2) Conditions in stream should be as close to baseflow as possible. Individual stations should be selected in A representative stream section. Model development is based on macro-processes, any small scale variations should be avoided for station selection (i.e. changes in slope, shading, channel morphology, channel flow unit etc.).
- 3) There will be a minimum of 4 stations in the study reach to be decided by the analyst and field leader. Station 1 – upstream of discharge, Station 2 – discharge, Station 3 – first downstream of discharge and mixing zone, Station 4 - second downstream of discharge. More downstream stations or tributary stations may be added as needed.
 - a) Note: Station 3 can be determined by permitted mixing zone length or actual mixing zone length determined by homogenous conductivity readings across the stream.
- 4) Distances between Stations 3 & 4 will be determined by farthest practical distance determined by confounding factors and accessibility issues.

- 5) The location of the furthest downstream station is intended to be beyond the point of maximum water quality impact of the discharge. The selection of the location will typically be based on best professional judgment of the analyst and may be limited by logistics.
- 6) DWQ currently has 6 YSI sondes with temperature, conductivity, pH, turbidity, chlorophyll a & DO (Full, 6600 V2). DWQ also has 6 YSI sondes with temperature, conductivity and DO (Partial, 600 OMS). Always deploy the Full sondes for WLA/QUAL2Kw model development. If there are more stations than Full sondes contact analyst to determine which stations to deploy partial sondes.
- 7) An example station schematic is shown below (Fig1).

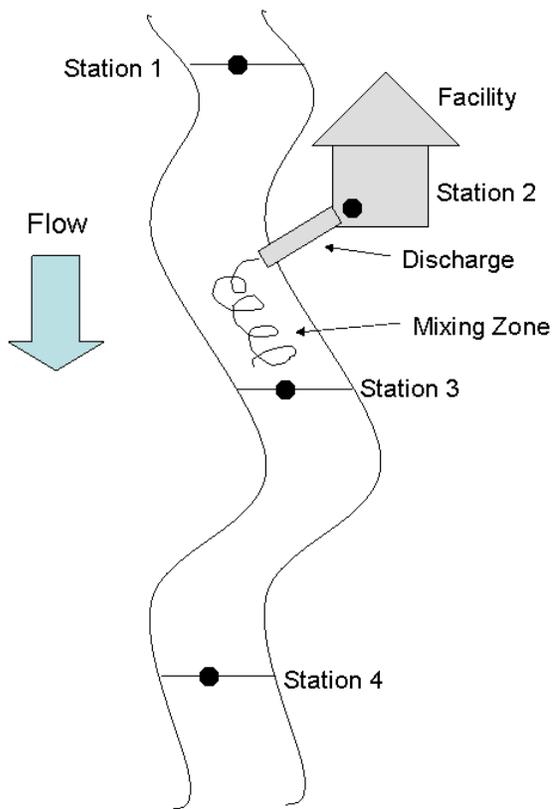


Figure 1. Schematic of example station locations in relation to permitted facility.

2.3 DATA STORAGE

- 1) All Data will be stored based on the STORET for the Facilities' discharge. STORETS will be changed to start with "598" and then the last four digits for the Facility's discharge.
- 2) For each station below the discharge increase STORET by one (1). Example: if the STORET for the Facility is 4938010, then the QUAL2Kw/WLA STORET will be 5988010. The first downstream station from the facility will be 5988011.
- 3) For all upstream stations subtract a value of one (1) from the Facility's STORET.
 - a) Be sure to check database to see if these STORETS already exist. Compensate as necessary if they are duplicated. Always keep track of new STORETS and notify database manager.
- 4) Contact the DWQ database manager prior to any sampling events and inform them that QUAL2Kw/WLA data will be coming from the State Lab. Be sure to coordinate number of bottles (number of stations x 2) to be turned into the State lab with the database manager.
- 5) All data will be stored under the shared "N" drive at the "Monitors" folder under the "QUAL2Kw/WLA" folder.
- 6) In the "QUAL2Kw/WLA" folder there is a Data Tracking Template that will be saved under a new unique folder for each sampling site and all data collected for that site will be stored in the new folder.
- 7) The field leader will be responsible for updating the "Data Collected" column depending on what was collected in the field. The person who stores final data into the folder is responsible for filling out the "Data Received" column on the template (usually the field leader or database manager).

2.4 GEAR LIST

GPS

Range finder

Camera

Stream reach maps

Site Survey Form

Contact information for Facility

Bottles (one each):

- Total Chemistry +TVS

- Unfiltered Nutrients + TKN

- Filtered Nutrients

Geopump and accessories

3.0 SAMPLING PROCEDURE - DEPLOYMENT

3.1 DEPLOYMENT

- 1) Deployment should always occur during baseflow conditions with no rain events occurring within the last 24 hrs.
- 2) Sondes shall be calibrated, checked for battery power and memory space before leaving the shop according to DWQ's SOP (Appendix B). At this time sondes can be set to record water quality measurements every 5 minutes. Sondes shall be deployed for a minimum of 48 hrs. DO should always be calibrated in the shop AND on site.
- 3) To check for drift, all sondes can be placed in same location to record for ~30 min.
- 4) Data collection should begin at the downstream most station and work upstream. Data shall be collected at each station in the following order: 1) water chemistry grabs 2) sonde installation 3) flow measurements 4) physical habitat measurements (can be collected during retrieval).
- 5) Use the Field Collection Form (Appendix C) to track sample collections
- 6) At Station 2 the sonde shall be placed in the discharge or, if not possible, in the stream as close to the discharge as possible.

Water Chemistry

- 1) At each station the following bottles will be collected:
 - Bottle – State Lab
 - Total Chemistry + TVS
 - Unfiltered Nutrients + TKN
 - Filtetred Nutrients
 - Filtered Metals* (only at station 1 and most downstream station one time during study)
 - Chl a (250-500 mL)
 - SCBOD5
- 2) Each day a trip blank will be taken for Filtered Nutrients. The database manager or analyst will determine if any other trip blanks or duplicates need to be collected.

Sonde Deployment

- 1) Metal T-post shall be deployed in the thalweg in a representative stretch of stream. Never attached sondes before deploying T-posts to avoid damage to the sondes.
- 2) Deploy the YSI sondes in the water column and attach to the T-post using zip ties or plastic covered wire cable. Attach UT DWQ identification key chains to the top of the T-posts.
 - a) Note: Partial YSI sondes (600 OMS) have the conductivity probe built in above the DO probe. Be sure conductivity port is fully submerged.
- 3) Avoid placing the bottom of the probe protection cup in soft sediments or macrophytes if possible. Sondes are fully water proof and can be deployed side ways under water if necessary in shallow waters.
- 4) Sondes need to be deployed for at least 48 hours from when the last sonde was deployed.
- 5) Record probe name, time and station location on Field Collection Form (Appendix C).
- 6) Deploy a PAR sensor near Station 2 in an area that represents the canopy coverage of the stream reach.
- 7) The PAR sensor can be programmed with HOBO software. Program and deploy PAR sensor according to HOBO deployment SOPs. The PAR sensor data logger is fully weatherproof if deployed correctly, read HOHO SOP.
 - a) Note – bring extra small T-post or rebar to attach PAR sensor

Flow Measurements

- 1) Flow measurements shall be taken directly downstream of sondes
- 2) Flow should be taken with a FlowTracker Handheld ADV. Data shall be downloaded from FlowTracker at the end of each day.
 - a) Note: FlowTracker file deletion is all or none, be sure there is enough memory to store the day's data.
- 3) In the cases of larger streams the DWQ Q-boat can be used for flows. Be sure to get trained on its operation from Monitoring staff and read UT DWQ's SOP before use.
- 4) At Station 2 get discharge measures from Facility, be sure to note units.

Physical Habitat

- 1) Physical habitat shall be collected at each station (except Station 2). P-hab is collected using DWQ UCASE protocols. Field sheets for each station can be found on the Field Collection Form (Appendix C).
- 2) Benthic Chl a & AFDM will be collected at each station using a modified UCASE method. Each sample will be a composite of a minimum three (3) algal rock scrapings.
 - a) Be sure to note the number of composite samples on data sheet. This value is different than standard UCASE protocol. Be sure to use the dedicated Benthic Chl a & AFDM label for variable surface area measurements (Monitors Folder/Labels/CHBE Benthic).
- 3) At each station measure channel cross section using laser level and stadia rod using Channel Cross Section Form (Appendix D) at a minimum 10 locations.
- 4) Be sure to measure height at bankfull, water edge on each bank.

3.2 OPTIONAL DATA COLLECTION

Water Chemistry

SCBOD5 – can be sent to American West Analytical Laboratories (AWAL). The State Lab does not accept BOD5 on Mondays and has a limit of 40 per week. DWQ Monitoring section has had contracts with AWAL for this analysis in the past. Note, AWAL's detection limit for SCBOD is 5 mg/L, often too high for meaningful measurements.

Cost ~ \$25 sample

Nutrients – Unfiltered and filtered nutrient samples can be sent to the USU Biogeochemistry Lab. The USU Biogeochemistry Lab has a much lower detection limit than the State Lab and can measure TN directly. Contact Monitoring Section Manager for current contracts with USU Biogeochemistry Lab.

Cost: ~\$60 sample

E coli

Total Residual Chlorine

Physical Habitat

Weather Station – The UT DWQ has a portable weather station (Davis Instruments) that can be deployed under analyst’s discretion. Be sure to get trained in weather station operation and programming (WeatherLink software) before deployment. If possible deploy weather station inside Facility’s fenced property to protect from damage

Organic Matter Standing Stock - Analyst may determine sites where organic matter storage is an important to measure directly. The Utah DWQ has a separate SOP for measuring organic matter that can be applied to QUAL2Kw sites.

Cost: Approx 20-40 AFDM samples to State Lab or ~\$10 per sample at USU Biogeochemistry Lab.

Time: 2 person crew ~6hrs each sample collection and processing time.

Tracer Study – A tracer study is intended to measure travel time of the receiving water. USU to provide procedures.

CNP Ratio – Analytical procedure provides the stoichiometry of carbon to nitrogen to phosphorus to Chlorophyll a in the benthic algae.

3.3 GEAR LIST

Water Chemistry

Gazeteer

GPS

Bottles (x number of stations):

-Total Chemistry +TVS

-Unfiltered Nutrients + TKN

-Filtered Nutrients

-Filtered Metals (only 2 samples)

-SCBOD5

-Chl a

Transport Bottles

Geopump & spare accessories

Chl a filter housing

Filters (fine & coarse)

Cooler with ice

DI water

Field Collection Form

Physical Habitat

Meter stick

Measuring tape (Metric Units)

Densimeter

Clinometer

Scrub brush

Delimiter

Funnel

Nalgene bottle (500 mL)

Scint vial (50 mL)

Spray bottle

Level

Tripod

Stadia rod

Range finder

Field Collection Form

Sonde Deployment

YSI data sondes (calibrated & programmed)

PDR unit

Probe cover caps

Aquarium bubbler (DO calibration)

Power inverter

5 gallon bucket

Metal T-posts

Sledge hammer or post pounder

Cinder blocks (optional)

Zip ties

Plastic coated wire

Sonde maintenance kits

PAR sensor

Flow Measurement

FlowTracker

Measuring Tape (English Units)

Q-Boat (optional)

4.0 SAMPLING PROCEDURE - RETRIEVAL

4.1 RETRIEVAL

- 1) Sondes will need to be retrieved after a minimum 48 hrs working in an upstream direction.
- 2) During sonde retrieval the following data shall be collected in order of 1) water chemistry grabs 2) flow measurements 3) probe retrieval.
 - a) Note: if physical habitat measurements were not taken during deployment be sure to take them at retrieval.
- 3) Use the Field Collection Form (Appendix C) to track all samples.

Water Chemistry

- 1) At each station one of the following bottles will be collected:

Bottle – State Lab

Total Chemistry + VSS

Unfiltered Nutrients + TKN

Filtetred Nutrients

Filtered Metals *(only at station 1 and most downstream station one time during study)

Chl a (250-500 mL)

SCBOD5

- 2) Each day a trip blank will be taken for Filtered Nutrients and Filtered Metals. The database manager or analyst will determine if any other trip blanks or duplicates need to be collected.

Sonde Retrieval

- 1) The YSI sondes and metal T-post will need to be removed from the stream.
- 2) At this time use the YSI handheld MDS to “Stop Logging” to save battery and memory space.
- 3) Full YSI sondes shall be stored with the clear storage/calibration cups attached. In each cup fill with a small amount of tap water. When sondes are stored lying flat the water in the cup should not submerge the pH probe. If it does, this will shorten the life of the pH probe.
 - a) Note: if storage cups are forgotten find some other way to keep probes moist, wrap in a wet towel or t-shirt. If probe faces must be stored in a 100% humid environment to avoid damaged.
- 4) To check for sensor drift, all probes can be left running and placed in the same section of stream for a minimum of 5 readings (~30 min). Be sure to note this procedure.

Flow Measurements

- 1) Flow measurements shall be taken directly downstream of sondes
- 2) Flow should be taken with a FlowTracker Handheld ADV. Data shall be downloaded from FlowTracker at the end of each day.
 - a) Note: FlowTracker file deletion is all or none, be sure there is enough file memory to store the day’s data.
- 3) In the cases of larger streams the DWQ Q-boat can be used for flows. Be sure to get trained on its operation from Monitoring staff and read UT DWQ’s SOP before use
- 4) At Station 2 get discharge measures from Facility, be sure to note units.

Physical Habitat

- 1) At this time any physical habitat measurements that were not taken day one can be taken now.
- 2) Be sure to collect PAR sensor (and weather station if deployed) and download data.
 - a) Note: download data from weather station immediately upon return to the office. Logger will continue to write data and overwrite any wanted data when storage is full.

4.2 GEAR LIST

Water Chemistry

GPS

Bottles (x number of stations):

-Total Chemistry +TVS

-Unfiltered Nutrients + TKN

-Filtered Nutrients

- Filtered Metals (only 2 samples on one day during deployment)

-SCBOD5

-Chl a

Transport Bottles

Geopump & spare accessories

Chl a filter housing

Filters (fine & coarse)

Cooler with ice

DI water

Field Collection Form

Sonde Retrieval

YSI data sondes storage cups/caps

PDR unit

Scissors

Flow Measurement

FlowTracker

Measuring Tape (English Units)

Q-Boat (optional)

5.0 POST SAMPLING ACTIVITIES

5.1 RESPONSIBILITIES

- 1) Post sampling activities consist of equipment maintenance and data storage after a sampling event. This SOP assumes field leaders are trained and aware of procedures for delivering samples to specified laboratories.
- 2) For any assistance contacting the State Lab or any private laboratories contact the database manager.
- 3) It is the field leader's responsibility to see that all data collected are accounted for in the appropriate QUAL2Kw folder. Contact analyst or database manager with any data storage or formatting issues.
- 4) Data will be stored under the shared "N" drive at Monitors under the "QUAL2Kw/WLA" folder. Create a new folder for each unique sampling site and make a unique copy of the Data Tracking Template.

5.2 EQUIPMENT MAINTENANCE

- 1) The field leader shall be responsible for all post sampling equipment maintenance. If any equipment is damaged, lost or needs replacement contact the database manager or monitoring section manager.
- 2) YSI sondes need minimal maintenance after deployment. Wash any debris from sonde and probe bodies with warm water and a stiff bristle brush. Be ware not to scrub sensor heads.
- 3) Visually inspect wipers, wiper pads and copper tape. Replace any that appear damaged or past useful life according to YSI SOPs. Log any maintenance in each sonde's three ring binder.
- 4) Visually inspect all other equipment used for sampling. Report any equipment issues that cannot be repaired immediately to the monitoring section manager.

5.3 DATA DOWNLOAD & STORAGE

Ecowatch software, used to download YSI's, is loaded on the shop computer. Ecowatch is a freeware that can be installed on any Division computer.

- 1) Data from all YSI sondes shall be downloaded and saved according to YSI SOPs (Appendix B). YSI data files should be stored as the original .dat file and exported as a .csv file and named appropriately and stored in appropriate shared folder. Always download and save original YSI .dat file, it will record all data and diagnostic information that not be exported as a .csv.
- 2) Download data from FlowTracker (or Q-boat) according to instrument specific SOPs. FlowTracker software is installed on the shop computer. Files can be saved and stored in appropriate shared folder.
- 3) All field sheets shall be scanned and stored as one .pdf document in the shared "QUAL2Kw/WLA" folder.
- 4) All data collected must be recorded in the Data Tracking Template located in the shared folder.
- 5) Data storage from the State Lab and outside laboratories will be the responsibility of the database manager. Coordinate with the database manager as to what samples will be received from outside labs.

Appendix A

Site Reconnaissance Form

Qual2k/WLA Site Survey Form

Site: _____

Date: _____

Start Location: _____

Crew: _____

Coordinates: _____

Direction of Survey

_____ of _____

US

DS

Landmark

1 Coordinates: _____

Description: _____

2 Coordinates: _____

Description: _____

3 Coordinates: _____

Description: _____

4 Coordinates: _____

Description: _____

5 Coordinates: _____

Description: _____

6 Coordinates: _____

Description: _____

7 Coordinates: _____

Description of feature: _____

8 Coordinates: _____

Description of feature: _____

9 Coordinates: _____

Description of feature: _____

10 Coordinates: _____

Description of feature: _____

11 Coordinates: _____

Description of feature: _____

12 Coordinates: _____

Description of feature: _____

End Location: _____

Coordinates (DD): _____

What to record:

Tributaries, diversions, impoundments or any other flow manipulation.

Note magnitude (i.e. 10% of stream flow diverted)

Major changes in slope, sinuosity, confinement, land use, shading, stream substrate, etc.

All anecdotal and BPJ

At each feature take one or more pictures.

Appendix B

YSI Protocols

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Calibration Order: sp. Cond/thermistor → pH → Chlorophyll a → turbidity → optical D.O.

- Run the aerator in tap water, must be done 5 minutes before DO calibration.
- **Thermistor:** Verify the accuracy of the temperature probe with a traceable thermometer or another known reference once a year.
- Record all calibration information in the calibration three ring binder. There is a unique binder for each sonde.
- **For Conductivity, pH, Chlorophyll a and Turbidity** Pre-rinse the calibration cup and sensors 3X with a small amount of calibration standard / rinse standard and wait 30 sec for reading to stabilize.
- If calibrating multiple sondes have a calibration cup dedicated to one calibration solution that can be conserved for all sondes. Be sure to triple rinse sondes over sink before using each dedicated calibration cup.
- Visually inspect that all probes and wipers are clean and free of debris. **Never manually rotate wipers.** Replace wipers, wiper pads and copper tape as needed and record in maintenance log.
- Do not use a probe that has “calibration Error” or “Out of Range” warnings.
- **Conductivity:** **1.** For your calibration, make sure the sensor is completely submerged and that there are no trapped bubbles in the cells. **2.** Select “Cond” for calibration type **3.** Always use a 2-point calibration procedure with higher conductivity standards. There is no need to bracket the conductivity values you expect to have in the field. **4.** When entering you conductivity values for calibration units must be entered as **mS/cm** although DWQ standards are recorded in uS/cm. **5.** Start calibration with the lowest conductivity standard and work up to the highest standard.
- **pH:** **1.** Use a 2 pt calibration and start all calibrations in a pH 7 buffer then a pH 10 buffer. Only use pH 4 buffer if it is known that you are sampling a low pH environment. **2.** Enter the pH value based on the solution & record the pH mV for each calibration pt. (record mV values when pH value is stable). **3.** A difference of below 155 mV between 7 and 10 buffers indicates the sensor needs to be replaced. **4.** Some pH probes do not have a plastic guard and the bulbs break easily, use caution when handling.
- **Chlorophyll:** **1.** Use DI water for a 1 point calibration at a value of “0” for Chlorophyll ug/L. Be sure to use the black bottomed calibration cup to calibrate. **2.** If the sensor will not calibrate make sure the calibration cup is clean, run the wipers (“clean optics”) and wait 30 sec for the reading to stabilize. **3.** The Chlorophyll sensor measures in RFUs and translates those in ug/L.

Always take at least 2 grab samples for Chl a when deploying and retrieving sondes to compare accuracy of sensor.

- **Turbidity:** *For a 2 point calibration always use YSI standards for the non-zero calibration. If zero values are important for regulatory purposes use a zero conductivity standard from YSI and follow special SOP.* **1.** For a 1 point calibration use DI water as the “0” value solution **2.** The calibration must be run in the calibration cup or with the sensor guard on. If the reading won’t stabilize manually raise the height of the probe from the bottom of the cal cup until you get the lowest reading **3.** Run the wiper at least once and wait for the probe’s sampling period to end before accepting the first calibration pt. **4.** If Calibrating a second point be sure to use YSI manufactured standard, typically 126 NTU. **5.** Be sure not to agitate the standard while handling. Pour the 126 NTU standard into the calibration cup, like a beer, to avoid introducing air bubbles. **6.** Calibration standards can be saved in the marked rinse bottle for rinsing next time.
- **Dissolved Oxygen:** **1.** Turn off the aerator that has been running for a min 5 minutes and immediately place the sonde in bubbled water. **2.** Select ODO%, enter the barometric pressure in mm hg (the YSI PDAs have barometric pressure built in) and press Enter. **3.** After the sonde does a 4 sec countdown, wait 15 sec before you press Enter again. **4.** YSI sondes report %DO as a function of that value at sea level. At the shop elevation %DO at 100% saturation will calibrate to ~86%. **5.** If sampling is to occur at a different elevation than the shop it is suggested that you re-calibrate DO on site. You will need an aquarium bubbler, power inverter and 5 gallon bucket. Follow same protocol as above.
- **Post Calibration:** **1.** After calibration be sure to enter calibration constants located under >Advanced Menu > Cal Constants. **2.** Record the DO Gain (acceptable range is 0.7 to 1.4). **3.** Record the conductivity cell constant (Acceptable ranges are 5.0 +/- 0.45). **4.** If either value is out of range there was an error with the calibration standard or the probe needs to be replaced. For replacement parts contact the YSI vendor located on calibration binder.
- **Transportation of Sonde:** Transport larger sondes with cal cup on (and with just a skosh of tap water in the calibration cup, never leave the pH probe submerged for long term storage). For smaller sondes transport with the black cap and damp sponge on.
- **Post Sampling Activities:** After probes are retrieved sondes may be compared for drift by placing all sondes at the same location and recording ~5 measurements. Sondes can also be checked at the shop against calibrations standards. Record any post sample measurements taken in the sonde’s three ring binder.

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(For regulatory purposes / when low turbidity readings are expected)

Pre-rinse the calibration cup and sensor 3X with a small amount of calibration standard / rinse standard and wait 1 minute for reading to stabilize.

Visually inspect that the probes and wipers are clean and free of debris. Never manually rotate wipers.

- Only use a darkened plastic or glass container for your calibration. Use of the supplied calibration/storage cup with its black end cap is essential.
- If zero values are important for regulatory purposes, use a zero turbidity standard from YSI and calibrate with the lights off.
- Pour a zero conductivity standard from YSI into the calibration cup (pour down the side so you do not aerate the sample). Secure the sonde into the calibration cup. (For deployments where low turbidity readings are expected, the sonde should be spaced off the cal cup ~2.5 inches to avoid negative calibration readings). Adjust the height of the probe from the bottom of the cal cup until you get the lowest reading.
- Verify that there are no air bubbles on the probe face, run the wiper at least once, and wait a minimum 30 seconds before accepting the first calibration point.
- Calibrate the second pt, typically 126 NTU using the same steps above.
- Save the calibration standard in the marked rinse bottle for rinsing next time.

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The YSI sondes can be programmed for unattended sampling run from the 650 MDS or a PC. The following steps will be for using the MDS handheld with the modifications for using a PC at the conclusion. To check for probe drift all sondes can be deployed at same location for ~5 samples before and after deployment.

- **Calibration:** The YSI probes should be calibrated before programming an unattended sampling run. If calculating DO on site, wait until after final calibration to start a sampling run.
- **Programming:**
 - Turn on the MDS handheld and select “Sonde Menu” from the Main Menu. “Sonde Menu” accesses the sondes interface. If the MDS does not show a “connected” on the screen then the MDS cannot communicate with the sonde. This usually occurs when the cable connections are not secure or the batteries that power the sonde need to be replaced.
 - From the Sonde Main Menu select “Run” then “Unattended Sample”.
- **Unattended Setup:** From this menu you have several options to choose from to customize your sampling run.
 - Interval: controls the amount of time between samples
 - Start Date: Runs can either be started immediately or delayed to a specified date.
 - Start Time: Runs can either be started immediately or delayed to a specified time. *Note: Sondes with 3 optical probes and 1 optical probe will sample ~1:10 and 0:32 seconds after the specified start time.
 - Duration: The number of days the sonde is going to record can be set.
 - File: The file name the downloaded data will be given. It is recommended that you use a STORET number or the probe name and date and record probe location in field notebook.
 - Site: Additional information about sonde location. Other important information can be recorded such as sonde name or site descriptor.
 - Battery Life: Battery life is a function of the sampling interval and battery volts. Battery Life will adjust on the fly as sampling interval is changed.

- Free Memory: This value represents how many days the sonde can record at the current sampling interval. Free memory will adjust on the fly as sampling interval is changed.
- Start Logging: Selecting this will save the sampling information and begins the logging process. If a delayed start has been selected above the sonde will automatically start logging at the start date and time.
- **Programming with PC:**
 - Need to have Ecowatch software installed on your computer.
 - Need connector “Y” cable to connect sonde cord to a 9 prong connection
 - Once Ecowatch is open and you select your port, look at the toolbar and select the dynamite icon (It’s actually a sonde but really looks like dynamite).
 - At the main menu of Ecowatch you should see a “#” sign. This indicates that software is connected to the sonde.
 - Type “menu” after the “#” sign to communicate with the sonde main menu. From here all steps are the same as above.

<6,# °-°# 1Ö 1 1 ° .# 131-1 "1 °

- Must have Ecowatch software downloaded on computer. Ecowatch is on the shop computer or you can install the software on any other computer.
- Plug YSI into computer port using the adaptor cord. Ecowatch gives you the option to select any port on the computer.
- On the Once Ecowatch is open and you select your port, look at the toolbar and select the dynamite icon (It's actually a sonde but really looks like dynamite).
- If the program reads the sonde the pound “#” sign will appear.
- If the “#” sign does not appear check the following:
 - All connections from the sonde to the computer are secure
 - That you have selected the right port that the sonde is plugged into
 - The sonde may be out of battery. There is an adapter to attach to the computer cord that you can plug into the wall.
- Type “menu” after the “#” sign. This will connect you to the sondes menu. This is analogous to selecting “sonde menu” on the MDS.
- Select option 3 (file) and choose “Upload” (to choose file to upload) or “Quick Upload” (to upload the last file).
- Select PC6000 as download format. This will download as an Ecowatch .dat file. The advantage of this file is that it will download all of the data stored on the sonde including diagnostic information. **It is highly recommended you download and save this file.**
- Save the .dat file as a unique name (most likely STORET & Date).
- Open the file you just downloaded.
- Select the spreadsheet tab from the toolbar. This will allow you to see all of the data that will be exported on your final file
- To modify parameters you want to export go to setup>parameters>add/remove. Add or remove any parameters you want to export.
- Go to file>export>CDF/WMF to export as a comma delimited file. Name the file accordingly.
 - Be sure to save and transfer the .dat and the .cdf file.

Appendix C

Field Collection Form

WLA/Qual2k Field Collection Form

STORET: _____

Date: _____

Site Name: _____

Station: _____

GPS Coordinates: _____

Day 1	Collected	Day 2	Day 1	Optional	Day 2
<input type="checkbox"/>	Unfiltered Nutrient (State Lab)	<input type="checkbox"/>	<input type="checkbox"/>	Unfiltered Nutrient Trip Blank (State Lab)	<input type="checkbox"/>
<input type="checkbox"/>	Filtered Nutrient (State Lab)	<input type="checkbox"/>	<input type="checkbox"/>	Filtered Nutrient Trip Blank (State Lab)	<input type="checkbox"/>
<input type="checkbox"/>	Total Chem + VSS (State Lab)	<input type="checkbox"/>	<input type="checkbox"/>	SCBOD5 (AWAL)	<input type="checkbox"/>
<input type="checkbox"/>	WC Chl a (State Lab)	<input type="checkbox"/>	<input type="checkbox"/>	Unfiltered Nutrient (Baker Lab)	<input type="checkbox"/>
<input type="checkbox"/>	SCBOD5 (State Lab)	<input type="checkbox"/>	<input type="checkbox"/>	Filtered Nutrient (Baker Lab)	<input type="checkbox"/>
<input type="checkbox"/>	Filtered Metals (State Lab)	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>

Probe Deployed Time: _____ Name: _____

Probe Retrieved Time: _____ Date: _____ (Day 2 for above)

Flow Measured 1 Q: _____ (cfs) File Name: _____

Flow Measured 2* Q: _____ (cfs) File Name: _____

* Same date as Probe Retrieved

UCASE Completed (reverse side) Date (if different): _____

Slope: _____ (cm/m) Distance: _____ (m)
 Height 1 _____ (cm) Height 2 _____ (cm) Difference _____ (cm)

Benthic Chl a (State) _____ ml composite _____ mL subsample

Samples _____ (this x 12 = total sample area as cm²) Area (cm²): _____

Benthic AFDM (State) _____ ml composite _____ mL subsample

Organic Matter Survey Completed (attach paper work) Date (if different): _____

Total Number of Samples: _____

If Station 2, deploy Weather Station and PAR Sensor

Comments:

PHab: CHANNEL/RIPARIAN CROSS-SECTION FORM - STREAMS

Reviewed by (Initials):

STORET / SITE ID: _____ DATE: / / 20 _____ TRANSECT: A B C D E F X-tra Side Channel O G H I J K L M N O P Q R S T U V W X Y Z

SUBSTRATE CROSS-SECTIONAL INFORMATION			
Dist LB XX.XX m	Depth XXX cm	Size Class Code	Embed. (%) Flag
Left			
Lctr			
Ctr			
RCtr			
Right			
SUBSTRATE SIZE CLASS CODES			
RS = Bedrock (Smooth) - (Larger than a car)			
RR = Bedrock (Rough) - (Larger than a car)			
RC = Concrete/Asphalt			
XB = Large Boulder (1000 to 4000 mm) - (Meterstick to car)			
SB = Small Boulder (250 to 1000 mm) - (Basketball to meterstick)			
CB = Cobble (64 to 250 mm) - (Tennis ball to Basketball)			
GC = Coarse Gravel (16 to 64 mm) - (Marble to Tennis ball)			
GF = Fine Gravel (2 to 16 mm) - (Ladybug to marble)			
SA = Sand (0.06 to 2 mm) - (Gritty - up to Ladybug size)			
FN = Silt / Clay / Muck - (Not Gritty)			
HP = Hardpan - (Firm, Consolidated Fine Substrate)			
WD = Wood - (Any Size)			
OT = Other (Write comment below)			

FISH COVER/ OTHER	Cover in Channel				Flag
	0	1	2	3	
Filamentous Algae	0	1	2	3	4
Macrophytes	0	1	2	3	4
Woody Debris >0.3 m (BIG)	0	1	2	3	4
Brush/Woody Debris <0.3 m (SMALL)	0	1	2	3	4
Live Trees or Roots	0	1	2	3	4
Overhanging Veg. =<1 m of Surface	0	1	2	3	4
Undercut Banks	0	1	2	3	4
Boulders	0	1	2	3	4
Artificial Structures	0	1	2	3	4
Filamentous Algae Presence					Flag
Present coverage	0	1	2	3	4
Potential for colonization	0	1	2	3	4

VISUAL RIPARIAN ESTIMATES			
VEGETATION COVER	Left Bank	Right Bank	Flag
Vegetation Type	Canopy (>5 m high)		
BIG Trees (Trunk >0.3 m DBH)	D C E M N	D C E M N	
SMALL Trees (Trunk <0.3 m DBH)	0 1 2 3 4	0 1 2 3 4	
Understory (0.5 to 5 m high)			
Vegetation Type	D C E M N	D C E M N	
Woody Shrubs & Saplings	0 1 2 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses, & Forbs	0 1 2 3 4	0 1 2 3 4	
Ground Cover (<0.5 m high)			
Woody Shrubs & Saplings	0 1 2 3 4	0 1 2 3 4	
Non-Woody Herbs, Grasses and Forbs	0 1 2 3 4	0 1 2 3 4	
Barren, Bare Dirt or Duif	0 1 2 3 4	0 1 2 3 4	

BANK MEASUREMENTS	
Bank Angle	Undercut
Left	
Right	
Wetted Width XXX.X m	
Bar Width XX.X m	
Bankfull Width XXX.X m	
Bankfull Height XX.X m	
Incised Height XX.X m	

CANOPY COVER MEASUREMENTS			
DENSIOMETER (0-17Max)			
Flag	Flag		
CenUp			
CenL			
CenDwn			

Flag codes: K = Sample not collected; U = Suspect sample; F1, F2, etc. = misc. flag assigned by field crew. Explain all flags in comment sections.

Comments	
Flag	

Appendix D

Channel Cross Section Form

