

FIELD PROCEDURE: WATER CHEMISTRY—GENERAL GUIDELINES

Overview: Our water chemistry data are submitted to the State under the federal Clean Water Act, so our procedures evolve in line with the State's updated quality-assurance (QA) standards. For a general discussion of the role of data in implementing water cleanup, see www.ecy.wa.gov/programs/wq/303d/index.html

Where to sample: When first arriving at a site, you need to think carefully about where and when to perform each monitoring procedure. *For water chemistry measurements, you must sample an area upstream of any disturbance by your team.* Pick an area where the stream is flowing and appears to be well mixed.

Sampler's initials: For each test that you perform in this protocol, there is a "Sampler's Initials" box to the right of the data boxes. Be sure to put all the initials of one sampler taking responsibility for the data; this should be someone who has been properly trained (see "Quality Assurance" protocol).

Common sense and expected ranges: Please compare your readings with the expected ranges on the datasheet. If you're outside the expected range, consider re-sampling or troubleshooting with your fellow samplers.

Field replicates: Our quality control plan requires that at one of your team's sites (or $\geq 10\%$ of your sites if you have >10 sites), you take a second set of readings for all tests. Such field replicates give an indication of how much variability there is in the equipment, sampling techniques, and environment. To do this:

1. Assign a number to each of your team's sites *that you're sure you'll get to*.
2. Roll the die in your field kit "Treasure Box" until one of those numbers comes up.
3. At that reach, perform each test a second time, as soon as possible after the first, redipping the sample bottle for the turbidity

test. You do NOT need to recalibrate between tests.

4. Record and initial results on the replicate section of the data sheet.

Replicate deviation & QA: Our QA plan requires us to take replicates in order to check the precision (consistency) of our data. If your replicate for a given parameter differs widely enough from the original sample, we have to flag ALL the data for that parameter for your team for that season as "Estimated" or "Rejected". Here are the allowable differences between sample and replicate:

<i>Parameter</i>	<i>Acceptable difference</i>
Turbidity	± 1 NTU, or Sum \geq Difference x 30
Water temperature	$\pm 0.2^\circ\text{C}$
DO concentration	± 0.3 mg/L
Conductivity	Sum \geq Difference x 30
pH	± 0.2 pH units

If any of your sample/rep differences are beyond the acceptable limits, take further replicates until you have a pair of readings within the limits. Then label the first of the pair your "sample" and the second your "replicate." On your data sheet, note these extended replicates, as well as any explanations you may have as to why multiple replicates were needed. Depending on the circumstances, we might still have to flag the data.

Repeating measurements below or near water-quality standards thresholds:

If your measurements at any site are below or near the threshold for state water-quality standards, it's a good idea to do a replicate to confirm the possible out-of-standards reading. These replicates should agree with the samples within the "Acceptable Differences" in the table above, but the closer the better. Below is a table listing generalized water-quality standards for parameters that have been set by the state. (Exceptions for certain streams aren't mentioned here.)

Parameter	Out-of-standards threshold
Temperature	> 16° C
Dissolved oxygen	< 9.5 mg/L*
pH	> 8.5 or < 6.5 pH
Turbidity	>5 NTU higher than any site farther upstream on the same stream

*In the case of dissolved oxygen, the field readings must be corrected for pressure in the following manner:

$$DO_{\text{corrected}} = DO_{\text{field}} \times \text{pressure}/29.92$$

At a high-elevation site on a low-pressure day, the corrected reading could be 10% lower than the field reading; so if the pressure is low and the DO field reading is near the threshold, calculate the corrected reading. (And you can do the same if the field reading is below the threshold but the pressure is high.)

If the sample and replicate straddle the threshold, take a third reading, and a mean will be calculated.

If you're doing all the water-chemistry procedures yourself, the following is an efficient order in which to perform steps:

1. Check, turn on, and soak the YSI-85.
2. Check and warm up the turbidimeter.
3. Check, turn on, and soak the YSI-60.
4. Hang the air thermometer.
5. Put the YSI-85 in the copper tube and submerge to stabilize for calibration.
6. Read the air thermometer.
7. Take the water sample and do turbidity readings.
8. Calibrate the YSI-85 for dissolved oxygen and take readings with it in the stream.
9. Take pH readings with the YSI-60 in the stream.
10. Do post-check of pH calibration.
11. Do replicates if needed.

Alternative water-chemistry procedures for poor conditions: If the weather is severe and you wish to minimize your time on the creek, here are a few ideas. In each case, note your deviations from standard procedure on

your data sheet.

- Calibrate the YSI-60, YSI-85, and turbidimeter at home, and just keep them on throughout your monitoring day, so no warm-up will be needed at each site. (For dissolved oxygen, record the pressure at calibration and at each site.)
- pH meter calibration post-checks can be done in the car.
- Turbidity samples can be grabbed and taken to your car for readings; just keep the bottle wrapped well to minimize warming, and take readings as soon as possible. Note both collection and reading times. If you need to take a replicate, you can use the plastic tub.
- You may also take samples for the other parameters to the car if it's not too far away: first take a temperature reading in the stream with the YSI-85 (no calibration necessary). Then fill both the regular sampling bottle and the plastic tub, filling completely and closing the lids under water if possible. In transit, be careful not to agitate the tub. (These measures will help to avoid entraining more oxygen into the water.) Get to the car a.s.a.p. In the tub, perform the DO/temp/cond test (moving the probe back and forth at 1 ft/sec), followed by the pH test. Then use the sample bottle for the turbidity tests. In addition to the usual data, note the alternate sampling procedure, actual stream temperature, and both the sample collection and sample reading times on your data sheet.
- You may also collect samples for turbidity and pH and take them home; pH should be tested within 2 hours, and turbidity samples can be held 48 hours on ice.

These are contingency measures for poor conditions; use standard protocols if possible, because data collected using these alternative measures may have to be flagged as "estimates" or "rejected".