

FIELD PROCEDURE: TURBIDITY

EQUIPMENT NEEDED:

Note: *Don't leave this equipment out in freezing temperatures unless you're using it. If air temperatures are just below freezing, keep the turbidity standards in your pocket. If the air temperature is below 23°F (-5°C), it's too cold to perform the water chemistry procedures in the field—see "Alternative Water-Chemistry Procedures for Poor Conditions".*

- Tarp
- HF-DRT 15CE turbidimeter
- watch with second hand or stopwatch
- sample collection bottle with screw top
- squirt bottle of purified water
- small spray bottle of glass-cleaning solution
- box of lint-free tissues
- data sheet, clipboard, pencil
- extra sample bottles or watertight tubs
- car cigarette-lighter adapter
- A/C transformer/battery charger

Where to sample: In this procedure, sampling consists of filling a sample bottle and then performing tests on water from that bottle. Pick an area where the stream is flowing and appears to be well mixed. **Do not sample downstream of where your team has disturbed the bottom.**

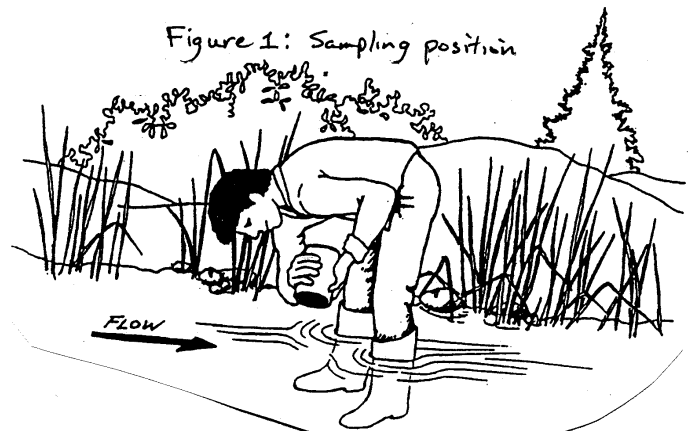
INITIAL INSTRUMENT PREPARATION:

1. The meter is water-resistant but not waterproof. If it's raining, close the cover or cover the unit with your body.
2. Turn the meter on to the lowest range to begin its 15-minute **warm-up**. If the screen reads "BAT," you must recharge the instrument or plug it into an outlet to use it; see "If Turbidimeter battery is too low" instructions at the end of this protocol.

COLLECTING A WATER SAMPLE:

1. Don't sample upstream of where your team will be taking other water-chemistry readings. Communication is key.

2. Enter the stream downstream of where you plan to sample, to avoid contaminating the sample from your boots or stirred-up sediment. Sample at a point where the stream is flowing and well mixed. (If there is no such place in your normal site area, you may go upstream or downstream, but don't pass any inflows or outflows, and note your location on the tracking sheet.) Get as far away from the banks as you can.



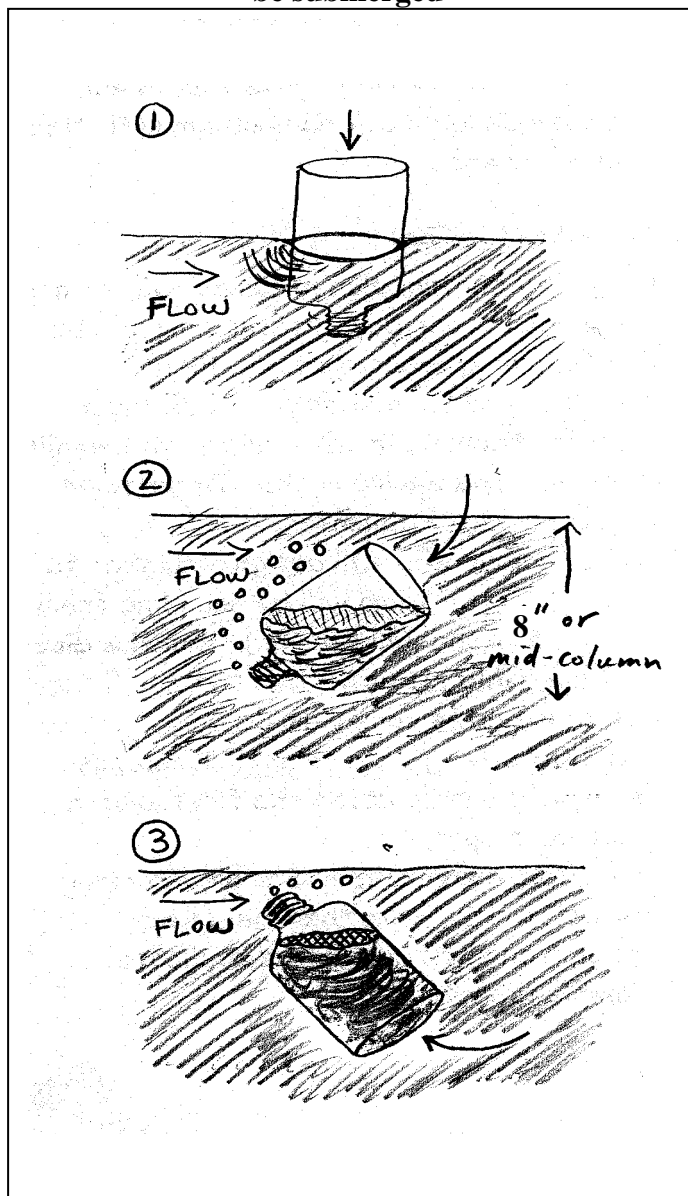
Choose a spot that appears undisturbed. (See Figure 1.)

3. Unscrew the bottle cap, avoiding touching the inside of the cap or the threads. Rinse both the bottle and cap three times in the stream, facing upstream, at a place where your team has not disturbed the bottom--preferably the same spot at which you're going to collect the sample. When pouring off the rinse water, empty the bottle downstream, so as not to stir up the bottom in the sampling area.
4. If you're in water >6" deep, hold the bottle near its base and plunge it below the water surface with the opening pointing downward. Collect the sample midway between the bottom and the surface, or 8-12" below the surface if the water is deep. Turn the bottle underwater into the current and away from you (see Figure 2). In slow-moving stream reaches, push the bottle underneath the surface and away from you in an upstream direction. Collect at least a pint in the sample bottle, then cap it under

TURBIDITY

water if possible. In any case, recap the bottle carefully, without touching the inside.

Figure 2: Collection procedure when bottle can be submerged



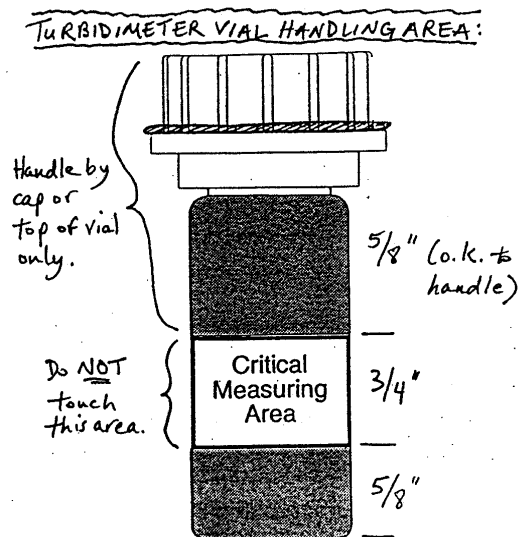
5. If the water is <6" deep, you have a couple of options:

- Sample in shallow, fast-moving water, preferably at a point where the water is forced between a couple of larger rocks. Hold the bottle facing upstream so as to catch the moving water in it. Avoid touching the bottom.
- If there is a drop-off somewhere, as from a cascade or culvert, you can sample from this drop-off so long as the bottle touches nothing but the falling water.

TURBIDITY MEASUREMENT:

Handling the vials: Inside the meter will be one sample vial and two reference vials—one marked on the cap with a number near zero, and the other at some higher number of NTU (a measure of turbidity).

- Do not ever open the reference vials or unscrew their caps.**
- Take care not to scratch or get dirt on any of the vials.** Do not put them down anywhere except inside the meter case.
- When moving closed vials, **hold by the caps only.** When opening, closing, or sampling, **hold the glass portion of the vials in the area just below the neck,** which is outside of their critical measuring area (see diagram below). When possible, hold the vial with a lint-free tissue.



Taking the readings (with meter still on after the warm-up period):

- Last calibration date:** The latest full-range calibration date should be marked on a sticker on the face of the meter. Record it on your data sheet only if you're NOT submitting your data to Clallam County.
- Zero the meter:** Take the ~zero NTU reference vial out of the trough, holding by the cap or upper part only. Clean the critical measuring area with cleaning solution and a lint-free tissue. Place this vial

in the meter-well, aligning the arrow on the cap with the plastic pin in the well collar. (The meter should still be turned to the lowest range.) Then adjust the REFERENCE ADJUST until the display reads the same as whatever the vial cap is marked as.

- 3) **Check calibration:** Take the higher-number sealed reference vial out of the trough, holding by the cap or upper part only. In the space marked "Field Calibration Check," record the # of NTUs listed on the vial and its expiration date. Clean the critical measuring area with cleaning solution and a lint-free tissue. Place this vial in the meter-well, aligning the arrow on the cap with the white plastic pin in the well collar. The meter should be set to its lowest range. Record the reading on the meter to the nearest 0.01 NTU.
- 4) **Calibration check problems:** If the above reading differs from what's written on the vial by more than 10%, try to improve the reading by cleaning the vial again, warming it if it keeps fogging up, or drying the meter-well if it's wet. If reading is still more than 10% off, continue with the following steps—the data you collect may still be useable.
- 5) **Fill the sample vial (remember to hold by the upper part only):**
 - a) Thoroughly agitate the sample in the collection bottle—but avoid introducing bubbles by shaking. Immediately fill the sample vial 1/4-1/3 full and shake with the cap on loosely. Empty the sample vial. Repeat this rinse. Then agitate the collection bottle and fill the vial to just below the bottom of the threads. Retighten the vial's cap.
 - b) Holding the sample vial **by the cap**, spray cleaning solution on the outside of the glass and wipe it dry with a lint-free tissue.
- 6) **Take the readings:**
 - a) Gently invert the vial several times to mix—be careful not to create bubbles.
 - b) Quickly insert the sample vial in the meter well, aligning the arrow on the vial's cap with the white pin on the well's collar ring. The readings will change rapidly, then probably slow down after a few seconds. Watch the meter for 30 seconds, then record the **whole** number (or zero) to which the readings tend most closely during those 30 seconds. (For example, you would record "1" if most readings fall between 0.5 and 1.5.)
 - c) If the meter displays " Δ ~1 .", with a space between the 1 and the decimal point, move to the next higher range. If the meter shows a similar display at its highest range, record ">200" for the model 15C or ">1000" for the 15CE.
 - d) Repeat steps 5 & 6 twice more, for a total of three readings. If readings vary greatly, take more readings until you have three that are close (one unit or 10%, whichever is greater). Record these three readings and the sampler's initials.
- 7) **Clean and store:**
 - a) Turn off the meter until you get to your next reach.
 - e) If you are collecting replicates at this site, gather another sample in the sample bottle and repeat this procedure; recalibration not needed. Then see the "Water Chemistry—General" protocol to see if your pairs of readings are within the acceptable precision limits, and resample as needed.
 - f) If the battery goes dead while you're sampling, see the "If the battery is too low" procedure at the end of this protocol.

SAMPLER'S INITIALS

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).

TURBIDITY

- b) Holding the sample vial by the portion just below the neck, rinse it as follows:
 - i) Pour out the sample water.
 - ii) Fill 1/4-1/3 full with purified water.
 - iii) Screw the cap on loosely.
 - iv) Shake upside down.
 - v) Empty the vial, twisting so that water rinses the sides.
 - vi) Repeat this rinsing one more time.
 - vii) Empty the vial and recap it.
- c) Place the .02 reference vial in the measuring well, and put the empty sample vial in the trough on the right side of the meter, along with the higher-number reference vial.
- d) Close the meter.
- e) Empty the plastic sample collection bottle, recap and store.

IF THE TURBIDIMETER BATTERY IS TOO LOW TO USE IN THE FIELD:

1. You can take your sample to the car, plug the adapter included in your kit into the car's cigarette lighter, and plug the other end into the turbidimeter's power port on the left side of the vials-trough nearest to the front. (Take out or depress the foam to see it.) Then run your tests.
2. You can collect a samples in clean jars, at least pint-sized. Using duct tape, label them with the site and time of collection. If possible, keep samples on ice and in the dark. Then at the end of the day, bring samples and meter home, plug in the meter using the A/C adapter, and take readings as you would in the field, while the meter is charging (see charging directions below). Samples can be held 48 hours if kept at 4°C (40°F) in the dark; otherwise, the data will be flagged as an "estimate". If samples are iced, you can let them return to room temperature (in air or a lukewarm bath) to avoid condensation on cold sample vials. On the data sheet, record collection and reading times, as well as holding temperatures and light-exposure. Then continue to charge the meter so you or some other team won't have trouble the next time!

TURBIDIMETER BATTERY CHARGERS are in marked ziplock bags in the field kit “clean bags”; the power port is the front hole on the left side of the vials-trough (take out the vials and foam to see it). The unit does not need to be fully discharged before charging. Turn the meter on, then plug in the charger; you should see a “~” in the upper-left of the window. Then you can turn the meter off and let it charge. A full charge takes up to 12 hours but it's okay to partially recharge it. The fully charged meter should be good for at least 5 hours of continuous operation.

ALTERNATIVE PROCEDURE FOR POOR CONDITIONS: If the weather is severe and you wish to minimize your time on the creek, you may warm up the turbidimeter at home and do the zeroing and calibration check there, and just keep it on throughout your monitoring day and do a final calibration check at the end of the day. Or you may take turbidity samples to your car or home—see previous section.