

SOP-4.1.1.4 Stream Flow Using Meters to Measure Velocity

Coastal Watershed Council has written two forms of this SOP, depending on the type of current meter used.

Background Information

During the dry season, substantial streamflow is essential for fish rearing and passage. Basically, the more water within the channel, the more biological habitat available. Streamflow monitoring allows us to:

- 1) Determine baseline flow
- 2) Better understand local geology
- 3) Determine whether or not streamflow is sufficient for fish
- 4) Analyze legal water diversions that may affect surface flow or subsurface flow
- 5) Determine whether illegal water diversions are present or are impacting flow

Monitoring streamflow during the dry season is a safe and relatively simple parameter for volunteer groups. The streamflow data can be extremely useful to water districts, the California Department of Fish and Game, fisheries biologists, and hydrologists.

Low flow monitoring generally means that streamflow levels are 10 cubic feet per second (cfs) or less. For this document, the low flow monitoring protocols will focus on surveying in areas with stream depths less than 2 feet. Although there are other streamflow monitoring techniques, we will only discuss the Six-tenth Monitoring Method because it is the appropriate method for stream depths less than 2 feet. The six-tenths Method refers to where the reading is taken in the water column; six tenths from the surface, or four-tenths from the stream bottom.

Generally, streamflow monitoring occurs during the summer and early fall when water levels are lowest. It should be noted that "Low Flow Monitoring" should be conducted when the water levels are low enough to ensure not only accurate data, but more importantly, volunteer safety during monitoring. Abandon streamflow monitoring during stormy/rainy periods or when water levels exceed 2 feet.

Several meters are available for use and can be obtained through scientific supply companies. A popular, relatively inexpensive (~\$1000.00) yet accurate meter available is the bucket wheel or "pygmy meter." Although this device provides accurate data, it requires a good deal of maintenance and can be more difficult for volunteers to use. Another type of meter that is easier for volunteer to use but more expensive (~\$2000.00-\$3000.00) and not necessarily more accurate is the current meter. Current meters allow easier data collection and some also come with data loggers so that data can be quickly downloaded directly onto your computer.

Important Resources and References: USBR 1997, Harrelson et. al. 1994.

For historical information or assistance, contact your local California Department of Fish and Game fisheries biologist, water districts, and/or State Water Resources Control Board. Contacting a local hydrologist can also be extremely useful.

SOP-4.1.1.4a 0.6 Foot Streamflow Protocol - Current Meter

For use with a Marsh McBirney Portable Current Analog or Digital Meter (model 201) and a 4' topsetting wading rod.

Equipment Needed:

4' top setting rod	100' tape measure that reads in tenths
flow meter	data sheets
thermometer	2-3 people
watch w/second hand	flathead screwdriver
"D" size batteries	rubber boots or hip waders (if available)

Number of Volunteers Needed:

- 1) Top-setting rodperson
- 2) Timer
- 3) Data recorder

1) Choose a point on the creek that is:

- wadable (less than 2 feet);
- lacks obstructions (such as logs, rocks, human structures or anything else that significantly affects the creek flow) within 15 feet up- or downstream of the site;
- at least 10 feet in width (if this isn't possible, take more readings);
- has a depth greater than 0.2 feet

2) Carefully **attach the flow meter to the topsetting rod**. Loosen the screw on the end of the meter and fit it onto the base of the rod. The meter should fit flush with the rod. Tighten the screw.

3) **Extend the tape measure across the section of creek to be measured. Make sure you use the side of the tape that measures feet in tenths, not inches.** The tape must be held in place firmly during all measurements and not moved. Measure the total width of the creek. If the creek width is 20' or greater, take measurements at 1' intervals. If the creek is less than 20' wide, take measurements at 0.5' increments. Make sure to take at least 20 measurements.

4) **Calibrate the meter** by turning it from "Off" to "Cal". The meter needle should hit the black "Cal" box. If it does not, insert new 6 "D" batteries by unscrewing the back plate of the meter with a flathead screwdriver.

After calibrating, **switch the setting to "2.5" to read streamflow measurements.** "2.5" refers to 2.5 feet per second, indicating that you are estimating the flow within that range. If the meter is maxed out when you set it to the 2.5 setting you will have to change the setting to the 5 or 10 feet per second scale, depending on the streamflow. Read all measurements from the appropriate setting. The **Time Con. should be set at "2."**

5) Place the top-setting rod in the water so that the meter bulb faces upstream. Make sure the rod sits flat, stands upright, and there are no rocks, sticks, etc. obstructing the meter bulb. Hold the cord straight up from the meter bulb so that there is no slack in the cord.

6) Begin on the right bank (when facing downstream) of the creek and measure across to the left bank. You may be unable to obtain a reading at depths <0.2'. At least 20 readings must be taken.

To set the top setting rod, visually measure the depth of the creek using the graduation lines on the hexagonal rod. One line = 0.1', Two lines = 0.5', Three lines = 1.0'.

Once you've determined the depth, set the rod to the 6/10 reading. To do this, press the trigger (see diagram) to slide the smaller rod up or down. This will change the setting within the "vernier" located at the top of the rod. The smaller rod has graduations marked in feet starting with "0" for depths less than 1 foot. For example, if the creek depth at a certain point is 1 foot, move the rod so that the 1 foot graduation lines up with the "0" on the vernier. If the creek depth is 1.4 feet, raise the rod to the 1 foot graduation and align it with the "4" on the vernier.

To measure the stream flow, have one person holding the rod. **This person should stand downstream and to the side of the top-setting rod.** Once the rod is set for the proper depth, let the flow meter **equilibrate for 20 seconds** in the creek. After 20 seconds, average the meter reading **for 40 seconds** and record on the data sheet provided. The data recorder should repeat the information back to the rod person to ensure correct data recording.

Repeat this process for all points.

SOP-4.1.1.4b 0.6 Foot Streamflow Protocol - Bucket Wheel Meter

For use with a Scientific Instruments "mini" current meter (model 1205) and a topsetting wading rod.

Equipment Needed:

4' top setting rod	100' tape measure that reads in tenths
flow meter	data sheets
headphones	calculator
thermometer	2-3 people
watch w/second hand	flathead screwdriver
"D" size batteries	rubber boots or hip waders (if available)

Number of Volunteers Needed:

- 1) Top-setting rod person and "click" counter
- 2) Timer
- 3) Data recorder

1) Choose a point on the creek that is:

- _ wadable (less than 2 feet);
- _ lacks obstructions (such as logs, rocks, human structures or anything else that significantly affects the creek flow) within 15 feet up- or downstream of the site;
- _ at least 10 feet in width (if this isn't possible, take more readings)

2) Carefully attach the flow meter to the topsetting rod. Loosen the screw on the end of the meter and fit it onto the base of the rod. The meter should fit flush with the rod. Tighten the screw.

Attach the connecting wire from the top setting rod onto the meter by loosening the screw above the bucket wheel. Slide the connecting wire into the base of this screw and tighten.

Plug the headphones into the connection at the top of the top setting rod.
The meter is now ready to collect readings.

3) Extend the tape measure across the section of creek to be measured. **Make sure you use the side of the tape that measures feet in tenths not inches.** The tape must be held in place firmly during all measurements and not moved. Measure the total width of the creek. If the creek width

is 20' or greater, take measurements at 1' intervals. If the creek is less than 20' wide, take measurements at 0.5' increments.

4) Begin on the right bank of the creek and measure across to the left bank (right and left banks when facing downstream). You may be unable to obtain a reading at depths <0.4'.

At least 20 readings should be taken.

To set the top setting rod, visually measure the depth of the creek using the graduation lines on the hexagonal rod. One line = 0.1', Two lines = 0.5', Three lines = 1.0'.

Once you've determined the depth, set the rod to the 6/10 reading. To do this, press the trigger on top of the rod to slide the smaller rod up or down. This will change the setting within the "vernier" located at the top of the rod. The smaller rod has graduations marked in feet starting with "0" for depths less than 1 foot. For example, if the creek depth at a certain point is 1 foot, move the rod so that the 1 foot graduation lines up with the "0" on the vernier. If the creek depth is 1.4 feet, raise the rod to the 1 foot graduation and align it with the "4" on the vernier.

5) To measure the stream flow, have one person holding the rod and wearing the headphones. Once the rod is set for the proper depth, let the flow meter calibrate for 20 seconds in the creek. After 20 seconds, count the number of "clicks" or revolutions (these will sound like static blips in the headphones) **for 40 seconds** in the headphones and record on the data sheet provided. You can determine the velocity by consulting a rating table for your meter that determines velocity (one should be provided in your meter's manual).

Repeat this process for all points.