Stream Physical Habitat Survey - Standard Operating Procedures
Bioassessment Surveys

Summary outline of methods: 15 transects spaced at 10 meter intervals along the 150 meter delineated reach length (starting at 0). Bank and channel features are measured (wetted perimeter width, bank cover category, bank angles, and vegetation cover (using densiometer) across each transect and at 5 equal-spaced points within each transect the depth, current velocity (60% depth), and substrate type (size class) are measured. **Location** of each site (mid-reach) is determined with a **GPS** unit, and **elevation** determined from map location (and/or barometer). Slope is measured using a hand-held leveling scope sighted on a stadia rod over a series of intervals over the 150 meter reach length. Sinuosity is determined from the ratio of reach length to minimum linear distance from the bottom to top points of the reach. Percent riparian canopy cover by type (within 1 meter on the bank) is visually estimated for the reach. Temperature, pH, conductivity and turbidity are measured using calibrated field meters. Dissolved oxygen is determined in the field using a standard test kit. Alkalinity, nitrogen, phosphate, and hardness are measured in the lab from field samples. General types of algae present are noted for each reach (algae samples from rock surfaces are also collected and preserved). **Photo** documentation of each reach is also made at 4 points: mid-stream looking upstream at 0, 50, 100, and at 150 meters looking downsteam.

Reach and Riffle-Pool Delineation

The first step in description of physical habitat is **delineation** of the 150 meter length of the stream reach along an approximation of the thalweg of the channel. To the extent possible, this measurement should be made by following along the bank contours of the channel, laying out the meter tape (50 m on a reel). This may require crossing the channel or even walking in the stream if bank vegetation cover is too dense – but this should be kept to a minimum to avoid disturbance of benthic habitat. Fish survey counting (Yosemite) should be done just ahead of the layout of the 150 meter reach. For each 25 meter length a flag should be placed to serve as a monument for marking locations and later measurement of gradient. Over the 150 meter reach delineation, the primary data to be recorded is the position along the meter tape (to the nearest meter) where erosional and depositional habitat types begin and end – **riffles and pools**, respectively. This data provides an indication of the distribution and length of these major geomorphic units within each reach. The position of these habitat features will also be used to determine where the benthic invertebrate samples are to be taken by using a random number table (0-150) to assign a riffle or pool location to be sampled. Any habitat not assigned to the riffle-pool categories may be regarded as transitional glide or run habitat type. Depending on the criteria for reach selection, the starting point of a reach may be established to maintain the reach within a certain zone defined by the problem of interest, the gradient, vegetation cover, or accessibility. Selection may also be random, using preliminary map information on the target area.

Bank and Channel Features

As outlined on the data forms and code sheet, bank features on each transect are identified according to **bank cover** categories (substrate type, vegetation present and eroded, stable or incised). The intersect of interest is between the water level and an approximation of the bank full height of the channel. **Bank angle** is also rated categorically as shallow (less than 30 degrees), moderate (30-90) or undercut (>90). Riparian **vegetation cover** over and next to the channel is determined using a concave mirror **densiometer**, taped to view the canopy in the facing direction of the measure. There are 17 grid points and vegetation reflected at those grid points is recorded at the left and right banks, and mid-stream facing up- and downstream.

Transect Measures

After measuring stream **width** (wetted perimeter), the transect is visually divided into 5 equally spaced points (visualize the mid-point as 3, and equally divide the left and right sides into points 1 and 2 and points 4 and 5). At each point, the **depth** and substrate type at the point of contact are recorded (recorder on bank) using a meter stick. **Substrate types** are grouped by size class for the mineral type, and also according to algal, vegetation or detrital components present at the point (see codes). At 60% depth the **current velocity** is also measured at each point (also record current meter type used and units). **Discharge** is calculated later for each of the 5 cells measured (current x cross-section area). Any cobble encountered is also rated according to the volume of rock **embedded** by fine / sand substrates (a visual estimate, calibrated among observers).

Overall Reach Features

The **gradient** of the channel is measured using a hand-held leveling scope (5X magnification) to sight off a 5 meter leveling rod. The observer serves as the tripod and so should find a position where both upstream and downstream position of the rod can be clearly observed without moving except to turn the upper body. Most readings will be taken over 25 meter intervals but where possible should be taken over 50 meter intervals to save time. The sum difference in up-down readings over 150 will give the percent slope or gradient. The **sinuosity** of the channel is measured as the ratio of the 150 meter thalweg stream length to the direct line distance from the top to bottom flags defining the reach. This is done by sighting to the leveling rod held at one end of the reach and walking a direct line of sight to the rod, measuring distance with a reel tape over the distance (a person to hold the tape end facilitates the several walks needed to measure the full distance). **Riparian vegetation** cover is visually estimated as morphological categories of cover (grass, bush, tree) and type (see data sheets). This provides another measure of shading, riparian development and potential inputs. **Algae** type present is also qualitatively scored. Notes should also be kept on any aquatic vegetation present.

Water Quality Measures

Using an Oakton conductivity/ pH/ temperature meter, these three measures are taken prior to any disturbance through the physical habitat surveys. In addition, LaMotte test kits are used to determine alkalinity and dissolved oxygen. Duplicate water samples are collected in acid/DI rinsed bottles, acidified for separate N, P analyses and turbidity analyses (60 ml HDPE bottles).