4. SECTION C: FIELD-BASED DATA FOR EACH SAMPLING VISIT

4.1 GENERAL

4.1.1 General Site Visit Information

Specified the date and time of the assessment and record the name of the assessor(s) and organisation.

Water level at time of sampling (modified from Rowntree and Ziervogel, in prep.):

- *Dry:* no water flowing.
- *Isolated pools:* pools that have a trickle of water between them, but no evident flow.
- *Low flow:* water not touching the riparian vegetation.
- *Moderate flow:* water touching riparian vegetation in places.
- *High flow:* water completely into riparian vegetation.
- *Flood:* water above active channel.

Rainfall in last four days: indicate the presence and extent of any rainfall event preceding the sampling visit. Under comments provide some indication of the level of certainty.

Water turbidity: Indicate the "colour" and degree of visibility through water column or of the riverbed (it is more difficult to assess certain factors such as substratum composition if the river is turbid).

- *Clear:* water transparent, riverbed visible.
- *Discoloured:* water clear, but with a definite tinge to it, usually brown, green or cloudy (riverbed still visible.
- *Opaque:* water cloudy, riverbed not visible.
- *Silty:* usually after a rainfall event, when silt loads are elevated.

Vegetation sampling instructions: Describe details specific to sampling the riparian vegetation.

Canopy Cover: Estimate the extent of cover of riparian vegetation over the stream.

- *Open*
- *Partially open*

- *Closed*

Impact on channel flow: Organic debris, either from upstream imported during flood events or local, can impede the flow of water in the river. Rate impacts on a scale of 0 to 3, as follows:

0 - no impact

1 - limited impact

2 - extensive impact

3 - channel blocked

4.1.2 Stream dimensions

Estimate widths, heights and depths for the main stream dimensions including:

- *Macro-channel width:* see Section A, part 2 for definition.
- *Active channel width:* see Section A, part 2 for definition.
- *Water surface width:*width of wetted section of the river from bank to bank at 90^{o} to the direction of flow (i.e. the actual water width).
- *Bank height:* height from surface of water to top of bank. Estimate left and right banks separately.
- *Deep-water physical biotope:* minimum, maximum and average depth of deep-water areas such as pools or runs. The average is a rough estimate. NB. Record the type of biotope e.g. pool, backwater etc.
- *Shallow-water physical biotope:* minimum, maximum and average depth of shallow-water areas such as riffle and rapids. The average is a rough estimate. NB. Record the type of biotope e.g. cobble riffle, bedrock rapid, cascade, etc.

4.1.3 Substratum composition

Estimate the relative percentage cover of the bed and bank by each substratum type present at the site (assess the site length as specified in Section A). Size classes for each substratum type have been modified from the Wentworth grade scale and are given below. Units are in mm.

- Bedrock
- Boulder - $x > 256$
- Cobble - $100 < x < 256$
- Pebble - $16 < x < 100$
- Gravel - $2 < x < 16$ (fine pebble or small gravel of Wentworth)

- Sand - 0.06 < x < 2
- Silt/mud/clay - x < 0.06

Degree of embeddedness: estimate the extent to which boulder/cobble/gravel particles are embedded in the surrounding fine sediments such as small gravel, sand, silt and/or mud.

4.2 INVERTEBRATES

4.2.1 Biotopes present

Biotopes have been grouped into two types, namely SASS biotopes and specific biotopes. They relate to the type of habitat available for habitation by aquatic organisms as well as the hydraulic conditions in some instances. The relative percentage of each SASS biotope at the site, and the relative percentage of each specific biotope within each SASS biotope should be estimated. Details of the biotopes are given below:

SASS biotopes include:

- stones-in-current (SIC)
- stones-out-of-current (SOOC)
- marginal vegetation (at water's edge)
- aquatic vegetation (in-channel, submerged or partially submerged)
- gravel
- sand
- silt/mud/clay

Specific biotopes provide further details of the types of biotope within each SASS biotope. Descriptions of some of these have been extracted from Rowntree and Wadeson (1999).

SIC:

- *Cobble riffle* - occur over coarse alluvial substrates from gravel to cobble; undular standing waves or breaking standing waves.
- *Run* - occur over any substrate e.g. gravel, cobble, boulder; ripple flow but surface of water not broken.
- *Bedrock rapid* - occur over a fixed substrate such as boulder or bedrock; undular standing waves or breaking standing waves.
- *Chute* - typically occur in boulder or bedrock channels where flow is being funneled between macro bed elements; smooth boundary turbulent flow exhibiting flow acceleration.

- *Cascade* - occur over a substrate of boulder or bedrock. Small cascades may occur in cobble where the bed has a stepped structure due to cobble accumulations. Free-falling flow, contact with substrate largely maintained.
- *Waterfall* - associated with bedrock steps, cliff like features or large channel spanning boulders. Face near vertical or overhanging. Free-falling flow, generally separated from substrate.

SOOC:

- *Backwater* - a morphologically defined area along-side but physically separated from the channel, connected to it at its downstream end; barely perceptible or no flow.
- *Slackwater* - an area of no perceptible flow which is hydraulically detached from the main flow but is within the main channel; barely perceptible or no flow.
- *Pool* - has direct hydraulic contact with upstream and downstream water; barely perceptible flow.

Marginal vegetation:

- grasses, reeds, shrubs, palmiet (*Prionium serratum*), sedges, etc. Also includes floating macrophytes such as water hyacinth, parrot's feather, etc. that are adjacent to the river bank.

Aquatic vegetation:

- sedges, *Isolepis*, trailing grasses, etc. Vegetation is in-channel, submerged or partially submerged.

Gravel, sand and silt/mud/clay:

- specify if present in backwater, slackwater and/or in-channel, i.e. in main flowing part of the channel.

4.2.2 SASS4 Assessment

The standard sampling protocol is to be used, except SASS biotopes are to be sampled separately as follows:

- SIC (**SI**): riffle and run, sample for 2 min if all kickable, otherwise for a maximum of 5 min
- SOOC (**SO**): backwater and pool, kick ∓ 1 m^2
- Marginal Vegetation (**M**): back and forward sweep - 2 m
- Instream/aquatic vegetation (**A**),
- Gravel, sand and mud (**G**): stir with feet and sweep net over disturbed area for 0.5 minute

For each, tip net contents into tray, remove leaves and twigs, check taxa present on list for the lesser of 15 minutes or 5 minutes since the last taxon was found. Estimate abundances using the following scale:

- 1: 1
- A: 2 - 10
- B: 10 - 100
- C: 100 - 1000
- D: >1000

Collect the invertebrate sample from each biotope in benthic jar and preserve with alcohol (70%). Label jar inside and outside and repeat for other biotopes. It is important to adhere to the time limits specified in the protocol. * indicate that the taxon or the adult life-stage of the taxon (A*) are air-breathers.

4.2.3 Habitat Assessment : Invertebrate habitat assessment system (IHAS)

IHAS attempts to account for the variability in the amount and quality of habitats or biotopes available for habitation by aquatic biota. It is related to SASS4 in that the IHAS scores may be used to adjust the SASS4 scores. This habitat scoring system is based on 100 points and is split into two sections: the habitat sampled and the stream characteristics. The sampling section is further broken down into three sub-sections: stones-in-current, vegetation and other habitat or general. The method is currently under further development and details are given in McMillan (1998).

4.3 WATER CHEMISTRY

4.3.1 General

Instrument positioning: Instruments should be positioned in clearly-flowing points of the river where possible, otherwise location of meter and hydraulic biotope type (e.g. riffle, run, rapid, pool, etc.) should be specified.

Samples collected? Details of the filtering, freezing, preservation and analysis method should be recorded.

Macrophytes and algae: The presence of macrophytes (e.g. water hyacinth, Kariba weed, etc.) and algae should be recorded and their percentage cover estimated. Species details should be recorded if known and an indication given if an algal sample was collected.

4.3.2 Data

Variables measured: It is important to measure the system (temperature, dissolved

oxygen, pH) and non-toxic inorganic (conductivity or total dissolved solids, turbidity or total suspended solids) variables. If possible the concentrations of alkalinity, total inorganic nitrogen, total inorganic phosphorus, orthophosphate, ammonia or ammonium should also be measured.