## 6. CONCLUSIONS AND RECOMMENDATIONS

This document has briefly outlined the characteristics of flow regimes of rivers and how they can be described using both qualitative and quantitative decsriptors. It has been explained that, in order to develop appropriate indices of streamflow behaviour, some method, or model, has to be used to derive representative time series of daily flows and that there are several possible options. The most appropriate option to follow will depend upon the availability of data and its quality and there is no universal recommendation that can be made that will apply to all rivers and all biomonitoring sites. This, unfortunately, means that the services of a hydrologist will usually be required to advise on the best approach to setting up the 'hydrological calibration' of a specific site and training the biomonitoring team in the on-going application of the methodology. In some cases, this may mean a relatively small amount of work, while in others (particularly data poor regions, or areas heavily impacted by abstractions, return flows or use changes), the situation may be quite complex and involve more hydrological work. Fortunately, techniques are beginning to emerge (see Smakhtin, 2000) that can be considered to address these issues. However, many have not been very thoroughly tested in all areas of South Africa and a degree of specialist (hydrology) assessment is still required. It is therefore difficult to make clear recommendations and provide easy to follow guidelines based on advantages and disadvantages, as these will vary from site to site.

Very much the same problem lies in specifying the exact form of the indices. It does seem logical and sensible that the three components covered by the suggested indices (measures of antecedent general and flood flow conditions and of current flow conditions) and are the correct ones to cover, given our current understanding of bio-hydrological interactions. However, the exact form of those indices (e.g. what should be the antecedent period?) and how to interpret them are questions that remain largely unanswered at this stage of our understanding. The biomonitoring programme itself will provide a stronger base upon which to revise the approach to hydrological indices, as will current work on biological stress in response to changing hydraulic (and therefore hydrologic) conditions that is being carried out as part of the Water Research Commission's Ecological Reserve Programme.

## 6.1 Development of suitable software

All of the techniques referred to have been coded, in one form or another, and have already been in use by some hydrologists. However, they may not necessarily be in a form suitable for use by non-hydrologists and this development still needs to take place. It is not suggested that nonhydrologists carry out the site calibrations and establish the techniques for ongoing use; it is recommended that this activity be undertaken by someone who is reasonably familiar with the application of whichever approach is to be used. However, it is assumed that the ongoing use of the calibrated technique or model will be carried out by the biomonitoring team and it is in this area that new, and user friendly software tools are required.

Some developments are taking place in terms of a Water Research Commission project (3 years

duration 2000 to 2002, being carried out by the Institute for Water Research at Rhodes University) to develop decision support tools for quantifying the Ecological Reserve. The concept is to use a spatial information (GIS maps of catchment areas, channel networks and observation points) interface to access a wide variety of data types (including time series data and tabular information) and to run models, data display and data analysis tools. The basic framework has already been developed and it is expected that some of the more widely used tools will be added in the near future. As these tools will have to include many of the models and techniques for estimating daily flows already referred to, as well as procedures for updating information and data (such as observed rainfall and streamflow), the developments should be appropriate to the National Biomonitoring Programme.