

# 1 Introduction

The Integrated Water Quality / Limnology Study for Lake Victoria is a consultancy contract between the Lake Victoria Environment Management Project (LVEMP) and COWI Consulting Engineers and Planners AS, in association with DHI Water and Environment. The contract was signed on 23 June 2000 in Nairobi, and is financed by credits from the International Development Association (IDA) and grants from the Global Environment Facility (GEF) to the three countries, Tanzania, Kenya and Uganda.

The overall objective of the study is to provide advice and assistance to the Water Quality and Ecosystem Management Component (WQ Component) of LVEMP in the three riparian countries over a period of 18 months from 1 August 2000.

The contract requires that the Consultant prepares a Final Report detailing the progress achieved in the execution of the assignment, the results of the study and recommendations for future work. The report has been divided into two parts:

Part I: Administrative Report, with a description of the Consultant's activities and methods used in advising and assisting the WQ Components.

Part II: Technical Report, with a description of the technical methods applied in the study and the scientific results of the work of the WQ Components.

## 1.1 Objectives of the Consultancy

The objectives of the consultancy are repeated here for the sake of clarity for the reader. A brief statement of the objectives is that the Consultant should *advise and assist* the WQ Component to carry out its tasks.

In more detail, the overall objectives of the consultancy are specified in the Terms of Reference (TOR):

- "Plan and advise on the implementation of a regionally integrated, lake-wide study to address the common water quality problems confronting the Lake and the riparian countries".

- "Co-ordinate the activities of LVEMP in the three countries into a coherent, lake-wide programme".

The TOR defined the detailed duties of the Consultant in terms of three technical disciplines, Eutrophication, Sedimentation and Hydraulic Conditions. Emphasis was placed on assisting the scientific staff in analysing and understanding the physical and biological processes in the lake.

Within each of these disciplines the TOR also required the review and adjustment of on-going programmes of field data collection and laboratory analysis of samples. However, during the Inception Phase it was found that the programmes for collection of field data and laboratory analysis had not progressed as far as was anticipated in the TOR. In fact, the field data collection programmes had not started, or had only started a month previously, and, with the exception of Uganda, the laboratories were not capable of making all the required analyses of water samples.

This led to a redefinition of the priorities for the Consultant's scope of work and approach to the study, as reported in the Inception Report (October 2000). Greater effort was required for the field data collection and laboratory analysis, with the consequence that less time and resources was available for the training in the physical and biological processes.

The conclusions of the Inception Phase were that the Consultant's assistance should be divided into the following nine subjects:

- 1 Lake Monitoring
- 2 Laboratory analyses
- 3 Water Quality Database
- 4 Meteorology / Hydrology
- 5 Non-Point Pollution Loadings
- 6 Industrial and Municipal Effluents
- 7 Hydraulic Conditions
- 8 Eutrophication
- 9 Sedimentation

Subjects 1 and 2 deal with the collection of data on the current state of the lake, while subject 3 concerns a database for all the water quality data. Subjects 4, 5 and 6 are for the definition of water input and pollution loadings to the lake. Finally, subjects 7, 8 and 9 concern the analysis and understanding of the physical and biological state of the lake, including the changes over the last decades.

## **1.2 Technical / scientific approach to the study**

The integrated study of the water quality of Lake Victoria can be approached using well-established standard sequences of activities for the study of any water body. The general sequence of activities is as follows:

- Formulation of the problem. In the present case, this involves a critical examination of the postulated changes and the data on which the postulates are based, with the purpose of verifying or rejecting the actual existence of the changes.
- Establishment of hypotheses which could explain the cause/effect relationships in the observed changes in the lake. Again, for the present case, a number of hypotheses have already been put forward by local and international scientists.
- Field monitoring for use in analysing and understanding the processes, as input to the WQ model, and as calibration data for the model.
- Collection of data from other sources with the same purpose.
- Calibration of the WQ model and application of it to study the hypotheses, the cause/effect relationships, and the effect of various management scenarios.
- Using the model results in developing practical management policies for the lake.

The application of this technical / scientific approach resulted in the identification of the subjects requiring the specific attention of the Consultant (see above).

### **1.3 Technical assistance approach to the study**

The Consultant, with the approval of LVEMP, adopted the following approach to provide the technical assistance required, and to achieve the objectives of the contract:

1. Review of the present situation of the WQ Components in the three countries.
2. Formulation of recommendations with respect to monitoring and laboratory equipment, external training and additional consultancies.
3. On-the-job training in all technical issues.
4. Regional working sessions for all technical issues.
5. Ad-hoc advice and assistance.

Reference is made to Part I: Administrative Report for a detailed description and report of the technical assistance approach.

## **1.4 Report structure**

This Technical Report concerns only the technical issues of the study of the water quality and limnology of Lake Victoria. Each issue is described in a separate chapter as follows:

Chapter 3: Meteorology / Hydrology. Determination of inflows, outflows and water balance for lake Victoria.

Chapter 4: Non-Point Pollution Loadings. Determination of nutrient loadings from the catchment and atmosphere to the lake.

Chapter 5: Industrial and Municipal Effluents. Determination of loadings of nutrients and other pollutants from industrial and municipal point sources.

Chapter 6: Lake Monitoring. Description of the lake monitoring programme and methods.

Chapter 7: Laboratory Analysis. Description of the adopted analysis methods and training.

Chapter 8: Hydraulic Conditions. Analysis of the data on vertical temperature and current profiles and preliminary conclusions about the hydraulic conditions.

Chapter 9: Sedimentation. Description of the pelagic sedimentation and the importance in the eutrophication of the lake.

Chapter 10: Eutrophication. Analysis of the water quality data and conclusions about the eutrophication processes in inshore and offshore areas of the lake.

Chapter 11: Lake Victoria Framework Model Application. Results of a few sensitivity tests with the model.

Chapter 12: Regional Quality Assurance Mechanism. Description of the project methods and activities to establish the basis for regional QA/QC.

