NEEDS ASSESSMENT AND CONCEPTUAL DESIGN OF THE NILE BASIN DECISION SUPPORT SYSTEM CONSULTANCY

# NILE BASIN DECISION SUPPORT SYSTEM

# FINAL REQUIREMENT ANALYSIS AND DSS DESIGN REPORT

## ANNEX A: Requirements Assessment – Stakeholder Consultations

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NEEDS ASSESSMENT AND CONCEPTUAL DESIGN OF THE NILE BASIN DECISION SUPPORT SYSTEM CONSULTANCY

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## Acronyms

| | |
|---|---|
| BOD | Biological Oxygen Demand |
| DSS | Decision Support system |
| EN Region | Eastern Nile Region |
| IWRM | Integrated Water Resource Management |
| NB | Nile Basin |
| NBI | Nile Basin Initiative |
| NEL Region | Nile Equatorial Lakes Region |
| SAP | Subsidiary Action Program |
| SVP | Shared Vision Program |

# 1 Introduction

The purpose of this Annex is to describe the consultation process adopted by the consultant for the sub-regional and national stakeholder consultation workshops undertaken in November and December 2007 as a crucial component of the second, or analytical stage of the DSS conceptual design.

It continues in Chapter 2, with definitions of important concepts and terms adopted by the Consultant for reasons of consistency.

Chapter 3 presents an outline of the consultation rationale as suggested by the Terms of Reference and understood by the Consultant. The chapter includes a detailed account of the workshop process in terms of both process and the outputs achieved by it at important workshop milestones. The Chapter closes with a table comprising a generalised workshop agenda which identifies which sessions were used at the sub-regional and which at the national workshops.

Chapter 4 has three parts. The first describes how the specific water resource management and development concerns emanating from the consultation process were analysed and used, ex-post the 2nd Regional Workshop (Entebbe 28/29 January 2008), to specify overall "areas of concern". The second suggests, very concisely, sample decisions that relate to the "areas of concern" and the outputs that the DSS needs to provide in order to support the decision makers in their regard. The third simply presents the training needs assessment results (also obtained from the consultation workshops).

# 2 Definition of Terms and Concepts

The consultation process described below required a consistent understanding of terms such as objectives, criteria, outputs and the like. Yet these often prove difficult to craft by untrained stakeholders and can be ambiguous or mean different things to different people. Accordingly, it was necessary to fix the definitions of these terms for use throughout the consultative process.

The results are set out, with supporting examples, in the following table:

| Term | Short definition (NBI-DSS context) | Example 1 | Example 2 |
|---|---|---|---|
| **Concern** | Issue, domain of decision making for which the DSS shall provide support, as defined through stakeholder consultations | Floods and droughts | Irrigation |
| **Objective** | Goal of the decision making process, expressed in terms of criteria to be maximised or minimised | Minimize loss of lives and livelihoods due to flooding | Maximise agricultural production<br>Maximise efficiency of water use |
| **Intervention** | Set of actions aimed at addressing the concern; an Intervention comprises several possible Alternatives. | Investment in flood defence works and/or land use management | Expansion of irrigated area |

| Term | Short definition (NBI-DSS context) | Example 1 | Example 2 |
|---|---|---|---|
| **Alternatives** | A possible strategy (in terms of specific actions within an intervention) available to the decision-maker to achieve (or move towards) the Objective(s) | 1. Flood defence walls<br>2. Attenuation dams<br>3. Land use management<br>Implies specific values for the above (location, dimensions, material…) | 1. Sprinkler irrigation<br>2. Surface irrigation<br>3. Drip irrigation<br>Implies specific values for the above (area, lining of channels…) |
| **Output** | Performance of the system to a specific decision (Alternative) in terms of criteria | Frequency and magnitude of losses due to flooding for a given Alternative | Increase of agricultural production and water use efficiency for a given Alternative |
| **Externality** | External influence not controlled by Nile Basin decision making processes | Increase of meteorological extremes due to climate change | Trends in global terms of trade that affect crop market prices and the opportunity cost of water |
| **Criterion** | Standard of judgement to evaluate the desirability of an Alternative in relation to an objective, to be fulfilled, maximised or minimised according to the decision-makers preference | Losses of life<br>Material losses | Value of agricultural production increase<br>Cost-benefit ratio for an investment<br>Water productivity |
| **Indicator** | Indicators describe the state of the system to tell us to which extent the criteria are satisfied. Indicators can be measurable (quantitative) or descriptive (qualitative). | Probability and magnitude of losses:<br>Number of times a certain threshold of flow is exceeded in a flood prone area for the simulation period; expected losses of life and material losses corresponding to this flow | Value of additional production expected ($/year)<br>Cost-benefit ratio<br>Amount of water per 1000 calories required ($m^3$/1000 calories) |
| **Constraint** | Requirement(s) or thresholds that must be met by any acceptable (feasible) solution | Probability of loss of human lives higher than once in 100 years unacceptable | Water productivity of less than 250 $m^3$ per 1000 calories not acceptable from a policy point of view |

# 3 Rationale and Methodology of the Consultation Process

According to the Terms of Reference the consultation workshops are intended to:

*…..focus on an analysis of key decisions to be supported, and the identification of functionality and outputs of the DSS to support these decisions.*

This work package shall include the following tasks:

- *examine current and (projected) future processes and processes adopted for decision making on planning and management of water resources at regional (SVP) as well as sub-regional levels (SAPS)*
- *identify key overall decisions (policy/planning) that will be supported by the NB DSS*
- *identify specific decisions to be supported with respect to IWRM of the Nile basin water resources, focusing on the planning of sectoral projects such as*
  - *food production*
  - *energy production*
  - *navigation*
  - *watershed management*
  - *wetlands management*
  - *drought and flood management*
  - *etc*
- *this exercise shall result in clear identification of:*
  - *what the **outputs** of the DSS shall be (in order) to support investment planning*
  - *what **data/information** and **tools** the DSS needs (in order) to support the decisions etc*
- *identify a set of **core criteria and indicators** that will be used as performance measures in evaluating alternative investment/development options and hence the DSS has to deliver to support investment decisions – the indicators will have direct relevance to, and should be used to assess achievement of the NBI goals ie **to achieve sustainable socio-economic development through the equitable utilisation of, and benefit from the common Nile Basin resources** – indicators would be identified with respect to:*
  - *overall state of the system and performance in terms of water use conservation, efficiency1, sustainability and loss management*
  - *sectoral benefits: irrigation/agriculture, hydropower, flood and drought risk reduction, navigation*
  - *trade-offs: inter-sectoral and inter-regional (country)*
  - *(equitable) distribution of benefits from planned projects*
  - *economic, social and environmental sustainability of the basin sub-systems*
  - *impacts on eco-systems*
  - *social impacts*
  - *resilience to external factors, such as climate change*

## 3.1 Understanding of What Is Required

The situation analysis carried out during stage 1 of the study identified a large list of specific concerns at the national and sub-regional levels. These were studied by Working Group 5 at the

[1] It is essential that efficiency is correctly defined for the scale at which is applied, ideally physical or application efficiency at point of use; economic efficiency at the basin level and various types of distribution efficiency in between.

1st Regional Workshop which consolidated the raw list into 42 specific concerns and suggested that they could be allocated to one or more of 11 thematic categories – Table 3.1 refers.

**Table 3.1 Results from Working Group 5 at the 1st Regional Workshop**

| Thematic Categories (11) | Specific Concerns (42) | | |
|---|---|---|---|
| Climate Change and Variability | Biodiversity conservation | Intra- and inter-annual fluctuation; | Social and cultural beliefs and norms |
| Environmental Management | Conflicts in water use (pastoralists etc) | Irrigation | Socio-Economic Targets |
| Fisheries Management | Coping with droughts and floods; | Lack of capital for investment | Soil/Bank erosion |
| Floods/Droughts Management | Declining water levels in lakes and rivers | Land use, Cover change, impacts on runoff | Tourism |
| Food security | Drainage of Marshlands for agriculture; | Monitoring for hydro- meteo forecasting | Use of carbon credit to finance power project |
| Hydropower Development and Power trade | Drought Prediction | Need for improved data collection and management for fisheries development | Water Quality - agro-chemical seepage |
| Navigation | Financing mechanisms | Need for Water Resources (S & GW, others) assessment | Water Quality - eutrophication |
| River basin monitoring and Water Resources Assessment | Flood Forecasting and Preparedness | Need to improve conservation to cope with CV e.g. through Rain water harvesting | Water Quality - pollution |
| Socio-Economic issues | Floods and Droughts | Optimal utilization of available water resources | Water Quality - salinisation |
| Water Conservation and Allocation | Food Security | Population structure/settlement patterns | Water resources availability |
| Water Shed Management | Improving and developing navigation potential | Poverty Reduction | Water supply and sanitation |
| | Inadequate tools for WR planning | Rain fed agriculture | Water use efficiency, demand management |
| | Increased energy demand | Sedimentation of hydraulic infrastructure | Watershed degradation (Destruction of natural forests), |
| | Increased flow variability , | Sharing/exchange of real time data | Wetlands degradation |

Based on all this; the mandate of the Workshop in question; the instructions of the Project Management Unit (endorsed by the workshop) and the terms of reference, it is the Consultant's understanding that the following was required.

First, the eleven **"Thematic Categories"** identified by Working Group 5 were to be reduced if possible, along with their supporting concerns, into a smaller number (within which the **Specific Concerns** requiring decision support can be cross referenced with sectors – see below) . Clearly the results should be consistent with the three themes suggested by the **NBI** goals:

**Theme 1** Society
**Theme 2** Economy and
**Theme 3** Natural Resources

However, for the purpose of DSS conceptual design and at the specific request of the Client, a fourth Theme was added thus:

**Theme 4** Regional Collaboration

Since the **Thematic Categories** were essentially an Output of the Inception Phase and were effectively accepted by participants at the 1st Regional Workshop (subject to possible reduction as instructed) it was agreed with the Client that it would be neither necessary nor wise to open the subject to further consideration. Having converged on a consensual set of such categories, it would have been counterproductive to risk divergence during the analysis stage. This is particularly so given that it would be necessary to capture and consolidate possible divergences resulting from 11 consultative processes (nine country and two sub-regional workshops).

Based on all this, the Consultant concluded that the overall consultation workshop process should have seven working sessions involving between them:

- one introductory presentation about the NB DSS
- five technical presentations:
- three briefings to guide the break-out groups
- five break-out group sessions.

and

- nine plenum sessions

Opening and closing formalities were adapted in each case to suit local preference and practice.

However, although they followed the same overall logic, the sub-regional and national consultations differed slightly in scope and detail. The following section describes the overall process in detail and closes with a general workshop agenda which *inter-alia* indicates which of the steps were followed at the sub-regional and which at the national workshops.

## 3.2 General Consultation Workshop Programme and Process

### 3.2.1 Working Session 1: Presentations 1 and 2

#### 3.2.1.1 Presentation 1: What is a DSS and what can it do?

This presentation revisited, built on and disseminated more widely, but in a simple fashion, the awareness raising message delivered in the training/awareness raising workshops that preceded the consultation workshops. In doing so, it highlit the conceptual design under preparation by the Key Water Resource Modeller who was responsible for preparing the presentation material.

#### 3.2.1.2 Presentation 2: Thematic Categories, Sectors and Specific Concerns

This presentation was intended:

i) to remind participants of the NBI goal and the themes that it incorporates.
ii) Explain the derivation of the two dimensional cross reference linkage matrix[2] having for its vertical axis the Thematic Categories (by now reduced to 10) and for its horizontal

[2] Which was the approach agreed at the 1st Regional Workshop

axes, the sectors. The specific cell, or cells in which participants place a Specific Concerns is relevant to the data capture as will be made clear in sub-section 3.2.2 below.

iii) Introduce the participants to the concept of the Specific concern and explain how they had been reduced from the 42 considered necessary to carry over into this Analytical Stage by the participants at the 1st Regional Workshop to 31 for analytical purposes

iv) Guide participants in the selection, clustering and ranking of the Specific concerns relevant to the participants' constituency (sub-regional or national)

**Figure 3.1 Conceptual Hierarchy**

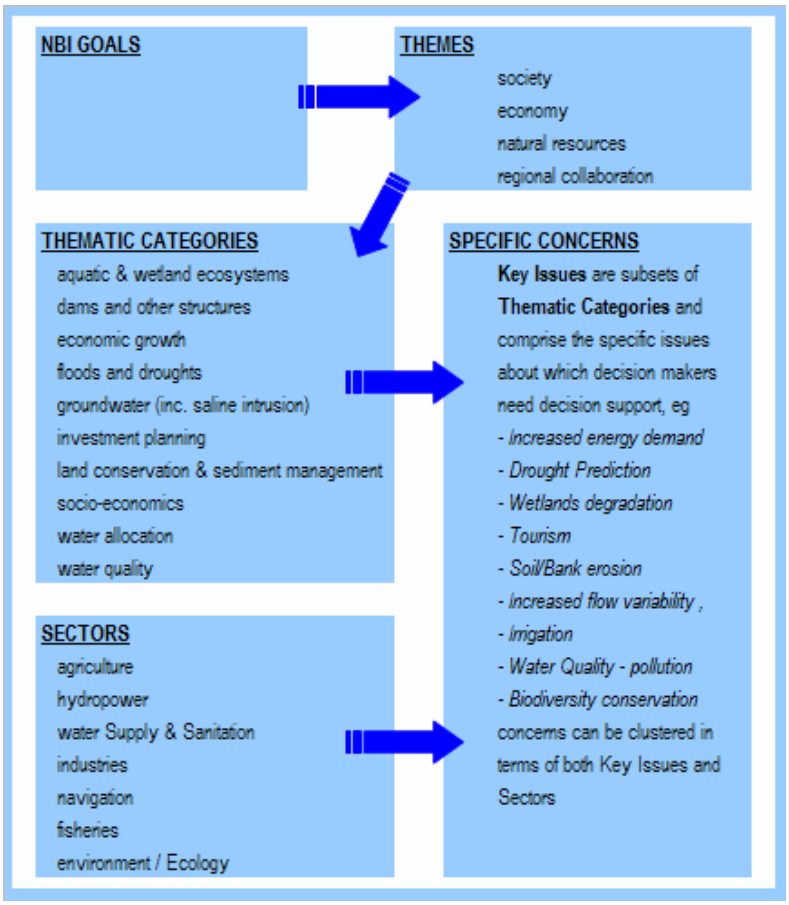


Figure 3.1 refers to the conceptual hierarchy. It specifies the 10 Thematic Categories (vertical axis of the cross reference linkage matrix) and seven Sectors (horizontal).

### 3.2.2 Working Session 2: Group Work: Selection and Clustering of Specific Concerns

After a plenum briefing the participants were divided into break out groups each of which was provided with the set of the 31 Specific Concerns developed by the consultant from from the 1st Regional Workshop – see Table 3.2. Each group was required to select (ideally) between 10 and 12 of the 31 Specific Concerns that they felt were most relevant to their interests (national or sub-regional as appropriate) and to allocate them to one (or more) cells in the cross reference linkage matrix.

When they had finished doing this, the plenum was reconvened whereupon spokespersons from each break-out group presented their group's results. Specific Concerns thereby selected were then scored based on the number of time that they had been selected. Then, by means of a facilitated plenum discussion, a final list of 10 to 12 Specific Concerns was compiled. This usually meant that the Concerns selected by each of the working groups were automatically included, with the remainder selected by consensus from the lower scoring Concerns.

**Table 3.2 Specific Concerns Carried Forward from the 1st Regional Workshop**

| | | | |
|---|---|---|---|
| Biodiversity conservation | Increased energy demand | Rain fed agriculture | Water Quality - pollution |
| Conflicts in water use (pastoralists etc) | Increased flow variability | Sedimentation of hydraulic infrastructure | Water Quality - salinisation |
| Coping with droughts and floods; | Intra- and inter-annual fluctuation; | Sharing/exchange of real time data | Water resources availability |
| Declining water levels in lakes and rivers | Irrigation | Soil/Bank erosion | Water supply and sanitation |
| Drainage of Marshlands for agriculture; | Land use, Cover change, impacts on runoff | Tourism | Water use efficiency, demand management |
| Drought Prediction | Need to improve conservation to cope with CV e.g. through Rain water harvesting | Use of carbon credit to finance power project | Watershed degradation (Destruction of natural forests), |
| Flood Forecasting and Preparedness | Optimal utilization of available water resources | Water Quality - agro-chemical seepage | Wetlands degradation |
| Improving and developing navigation potential | Population structure/settlement patterns | Water Quality - eutrophication | |

### 3.2.3 Working Session 3 Group Work: Ranking of Concerns

The output of this session comprised the first workshop result: a ranked shortlist of **Specific Concerns** as agreed by the participants. It began with a plenum briefing on the ranking process to be adopted by the break out groups, each of which worked on the agreed list of Specific Concerns resulting from the previous session.

The ranking criteria concerned the four themes suggested by the NBI goals: namely, Society, Economy, Natural Resources and Regional Collaboration, and the first step was to allocate each of these a weighting factor that reflected the importance of these themes as perceived and agreed by the group members according to the national or sub-regional imperatives (as appropriate). Weighting factors ranged from 1 to 4, but were not “either or” in that it was possible to assign the same score to more than one of the themes.

Having allocated weighting factors to each of the themes, the groups then proceeded to score the Specific Concerns, again using scores of 1 to 4 in a similar fashion, such that the score suggested the relevance of each Specific Concern to the four NBI themes. Thus if a Specific Concern was of extreme relevance to a particular theme it would be scored 4, whereas if it had no relevance, it would be scored 1. As with the weighting factors for the themes, the Specific Concern scores were again not “either or”.

By this means, each group produced weighted scores for each of the selected Specific concerns – see Appendix A1, tables A1.1, A1.2, and A1.3 which show how this was done by the working groups at the Uganda workshop.

Table values provided by each group were then averaged to produce overall weighted scores which in turn were used to produce the ranking – tables A1.4 and A1.5 refer.

### 3.2.4 Working Session 4: Group Work: Objectives, Criteria and Indicators etc

In order to support about a decision regarding options for addressing a particular **Specific Concern**, it is necessary to understand, identify or specify:

The **Objective** that the option is intended to achieve or contribute to. Thus if the Specific Concern is water pollution, then a suitable Objective could be "water pollution levels reduced to 20% of current levels by 2020".

For this a range of **interventions** might be possible. Interventions can be categorised as regulatory, institutional or infrastructural (or indeed a combination of any or all of these). Either way, the **output** for a given intervention, following the same example, will be reduced water pollution.

There are also likely to be **externalities**, which in this case could be a lack of harmonisation of water quality regulations (or their enforcement) between riparians.

Equally, for each type of intervention, there may be **alternative** approaches. The DSS in fact, is intended precisely to support decisions regarding which of the possible alternatives would be the most desirable or advantageous.

To test which of the alternatives is the most desirable or advantageous requires **criteria**, which it will be recalled are the standard of judgement to test the desirability of an alternative. In order to be tested, criteria in turn require **indicators**, which again it will be recalled tell us to which extent the criteria are satisfied.

The object of this session was to draft - for each of the selected Specific Concerns - appropriate Objectives, select interventions, identify externalities and alternatives; and to craft relevant suitable criteria and indicators that can be applied equally to each alternative. However, it has been the Consultant's experience that without adequate orientation, people find it difficult to craft criteria and indicators, often confusing them with activities or outputs. Accordingly this working session began with a briefing session provided by the consultant (Presentation 3).

Table A1.6 illustrates how this working session was completed by Uganda working group 3 which dealt with the third ranked Specific Concern "Water Quality – pollution".

### 3.2.5 Working Session 5: Group Work: Models/Tools and Data

The output of this session comprised the second workshop result. It will be seen from Table A1.6 that by the start of this working session the results capture form has two sections that have yet to be completed namely: "model category" and "data/information". In general terms, a particular kind of criteria requires a particular kind (or kinds) of model(s) to quantify the indicator(s) necessary to test the criteria. Equally, the nature of the indicator defines the nature of the data or information that the model needs in order to evaluate.

The purpose of this working session is to identify i) which models the DSS should incorporate (in its architecture) or use (via an interface to stand alone models) in order to test the criteria selected and ii) what kind of data the model needs in order to quantify the indicators.

Participants were provided with a brief presentation (Presentation 4) defining what is meant by the term "model" or "tool"; scale aspects and data/information requirements etc. After the presentation they returned to their break out groups for the purpose of completing the results capture forms.

Their results were discussed, revised and agreed en-plenum.

Table A1.7 shows the completed form for Uganda Group 3.

### 3.2.6 Working Session 6: Group Work: Institutional Arrangements

The output of this working session comprised the third workshop result in the form of a participatory training needs assessment of key DSS stakeholder institutions.

The session began with a presentation of key institutional concepts in river basin management, after which the participants were invited, en-plenum, to brainstorm the institutions that would be concerned with the DSS in the relevant country or sub-region. For this purpose, institutions were classified as follows:

- Institutions that can request demands for DSS services?
- Institutions that provide knowledge?
- Institutions that provide data?
- Institutions that enter/manage the data base?
- Institutions that could provide modelling services?

Once the list was compiled to everyone's satisfaction, the break out groups were reconvened and charged with undertaking a multi-criteria training needs assessment, again using scores from 1 to 4, Table A1.8 refers.

Results from each of the groups were consolidated (Table A1.9) and used to rank existing capacities (Table A1.10) and training priorities (Table A1.11).

### 3.2.7 Working Session 7: Workshop Conclusions

The final session of the workshop was more or less a formality. It provided an opportunity for the consultant to review - on the participants' behalf - the process followed and the corresponding results. This was usually followed by a brief closing statement either by one of the participants or a guest of honour if relevant.

### 3.2.8 Workshop Summary Outline

Table A1.12 presents a summary outline of the general consultation workshop process, it includes an indication of which steps not included in the sub-regional workshops (because considered unnecessary).

# 4 Analysis and Results

## 4.1 Executive Summary

It will be recalled from the preceding chapter that the stakeholder consultation process was intended to deliver three results:

i) a ranked shortlist of **Specific Concerns** as agreed by the participants;
ii) stakeholders' suggestions for **criteria**, **indicators** and the associated **models/tools** and **data/information** requirements necessary to support intervention decisions with respect to the Specific Concerns
iii) a **participatory training needs assessment** of key DSS stakeholder institutions

The three sections which follow present these results in the form of an analytical synthesis, supported by three appendices, the first of which comprises a summary of the rationale and methodology of the consultation process followed in the sub-regions and member countries; the second presents the raw results obtained from the workshops while the third presents the workshop minutes. It should be noted however, that the analysis - which largely involves ranking of the various concerns - could not include fully the results from the EN Sub-regional workshop. This is because the plenum could not reach consensus with respect to the ranking. Accordingly, the resulting concerns are introduced synoptically as a separate sub-section (4.2.6) at an appropriate point in the narrative.

## 4.2 Analysis

### 4.2.1 Identification and Ranking of the Specific Concerns

The process by which Specific Concerns specific to each sub-region or country was described in sub-section 3.2.2 above. The results are presented in the next sub-section. It should be noted however, that at the client's request, participants at the various consultation workshops were discouraged from introducing concerns additional to the 31 carried over from the 1st Regional Workshop (and listed in table 3.1 above). This proved to be only partially workable in most cases. In some cases participants introduced new concerns, in others they i) suggested concerns conceptually similar to, but not articulated the same as examples in the original list; ii) combined two concerns in one or iii) suggested concerns that are actually interventions or externalities etc. Even so, the Consultant applauds the valuable and enthusiastic work of the participants across the board. Accordingly the "raw" results are presented, as ranked by the various workshops, for reference and by way of acknowledgment of the participants' efforts in Table 4.1 below. Nonetheless **for analytical purposes**, it has been necessary to smooth out inconsistencies – the colour coding used in Table 4.1 identifies clearly where these are the case. New concerns have been largely retained as proposed; conceptually similar concerns have been re-articulated for consistency; "compound" concerns have been unbundled and the ranking adjusted accordingly and those concerns that are actually interventions, externalities or objectives etc have been rearticulated as concerns where it is possible and rejected where it is not. The results are set out in Tables 4.2 and 4.3; but it is stressed once again, that these modifications have been considered necessary to streamline and homogenise the analytical process.

**Table 4.1 pt 1 Ranking of Concerns as Articulated at the Consultation Workshops**

| Rank | Burundi | DR Congo | Egypt | Ethiopia | Kenya |
|---|---|---|---|---|---|
| 1 | Efficient water management in agric. & energy | Watershed degradation (destruction of forests) | Water resources availability | Irrigation development | Declining water levels in lakes and rivers |
| 2 | Drought and flood forecasting | Land use conflicts (parks/agriculture/cattle) | Water quality | Watershed management | Biodiversity conservation |
| 3 | Optimal utilisation of available water resources | Tourism | Optimal utilisation of available water resources | Hydro-power development | Irrigation |
| 4 | Soil management and conservation | Water supply and sanitation | Agriculture & livestock production | Drought | Water supply & sanitation |
| 5 | Intra- and inter-annual climate fluctuations | Water resources availability and optimal use | Coping with droughts | Water supply and sanitation | Increased energy demand |
| 6 | Water supply and sanitation | Hydropower projects (use of carbon credits) | Coping with floods | Flood preparedness | Watershed degradation |
| 7 | Biodiversity conservation | Lake water quality (pollution, salinity) | Increased population density | Wetland management | Water conservation, rainwater harvesting |
| 8 | Water quality | Industrial development and settlement patterns | Sedimentation and erosion | | Water quality (urban and industrial pollution) |
| 9 | Equitable water distribution | Fisheries: Transboundary conflicts | Water supply and sanitation | | Coping with floods (fore-casting) and droughts |
| 10 | Increased energy demand | Biodiversity conservation (protected areas) | Navigation improvement & development | | Water quality: Agro-chemicals (eutrophic.) |
| 11 | Wetland management | Complementarity rainfed agriculture and irrigation | Investment planning | | Land use, cover charge, impacts on runoff |
| 12 | Population structure/ settlement patterns | Drawdown of lake leves, decrease of river flow | Increased energy demand | | Improving & developing navigation |
| 13 | Development of navigation and tourism | | | | |
| 14 | | | | | |
| | **colour codes**: | | | | |
| | no change required | compound issue | new issue | needs to be re-articulated for reaons of consistency | externality, intervention, objective, irrelevant as currently articulated etc |

**Table 4.1 pt 2 Ranking of Concerns as Articulated at the Consultation Workshops**

| Rank | Rwanda | Sudan | Tanzania | Uganda | Sub-region NEL |
|---|---|---|---|---|---|
| 1 | Watershed degradation (destruction of forests) | Water availability | Water resources availability | Increased energy demand | Water quality – pollution |
| 2 | Climatic change | Drought | Declining water levels in lakes and rivers | Watershed degradation (destruction of forests) | Water resources avail./ use / management |
| 3 | Increased energy demand | Access to water | Water quality - pollution | Water quality - pollution | Coping with floods and droughts |
| 4 | Water supply and sanitation | Sediment management | Optimal utilisation of avail. water resources | Water resources availability | Increased energy demand |
| 5 | Optimal utilisation of available water resources | Water quality | Water use efficiency, demand management | Rainfed agriculture | Watershed degradation, wetland degradation |
| 6 | Tourism | Water supply and sanitation | Biodiversity conservation | Biodiversity conservation | Water conservation – rainwater harvesting |
| 7 | Wetland degradation | Hydropower development | Irrigation | Water supply and sanitation | Water use efficiency demand / management |
| 8 | Flood and drought control | Water use in agriculture | Water quality - eutrophication | Wetlands degradation | Water supply and sanitation |
| 9 | Water quality – pollution | Watershed management | Water supply and sanitation | Coping with droughts and floods | Irrigation |
| 10 | Irrigation, drainage of wetlands for agriculture | Wetland management | Watershed degradation (destruction of forests) | Irrigation | Biodiversity conservation |
| 11 | | Floods | Increased energy demand | Population structure/ settlement patterns | Population structure/ settlement pattern |
| 12 | | Navigation | Wetlands degradation | Conflicts in water use (pastoralists etc) | Sedimentation of hydraulic infrastructure |
| 13 | | Aquatic weeds | | | Improving / developing navigation potential |
| 14 | | Tourism | | | |
| | **colour codes**: | | | | |
| | no change required | compound issue | new issue | needs to be re-articulated for reaons of consistency | externality, intervention, objective, irrelevant as currently articulated etc |

## Table 4.2 pt 1 Ranking of the Revised Concerns

| Rank | Burundi | DR Congo | Egypt | Ethiopia | Kenya |
|---|---|---|---|---|---|
| 1 | Water use efficiency, demand management | Watershed degradation (destruction of forests) | Water resources availability | Irrigation | Declining water levels in lakes and rivers |
| 2 | Drought Prediction | Not considered relevant | Water quality | Watershed degradation (Destruction of natural forests) | Biodiversity conservation |
| | Flood Forecasting and Preparedness | | | | |
| 3 | Optimal utilisation of available water resources | Tourism | Optimal utilisation of available water resources | Increased energy demand | Irrigation |
| 4 | Soil/Bank erosion | Water supply and sanitation | Irrigation | Drought Prediction | Water supply & sanitation |
| | | | Rainfed agriculture | Coping with droughts (and floods) | |
| | | | Livestock | | |
| 5 | Intra- and inter-annual fluctuation | Water resources availability | Coping with droughts | Water supply and sanitation | Increased energy demand |
| | | Water use efficiency, demand management | | | |
| 6 | Water supply and sanitation | Use of carbon credit to finance power project | Coping with floods | Flood Forecasting and Preparedness | Watershed degradation (Destruction of natural forests), |
| 7 | Biodiversity conservation | Water Quality - pollution | Population structure/settlement patterns | Wetlands degradation | Need to improve conservation to cope with CV e.g. through Rain water harvesting |
| | | Water Quality - salinisation | | | |
| 8 | Water quality | Population structure/settlement patterns | Soil/Bank erosion | | Water Quality - pollution |
| 9 | Water resources availability | Transboundary conflicts with respect to fisheries | Water supply and sanitation | | Flood Forecasting and Preparedness |
| | Water use efficiency, demand management - repeat | | | | Coping with droughts and floods; |
| 10 | Increased energy demand | Biodiversity conservation | Improving and developing navigation potential | | |
| 11 | Wetlands degradation | Irrigation | Investment decision support is the principle function of the DSS, investment planning is therefore a cross cutting issue | | Land use, Cover change, impacts on runoff |
| | | Rain fed agriculture | | | |
| 12 | Population structure/ settlement patterns | Declining water levels in lakes and rivers | Increased energy demand | | Improving and developing navigation potential |
| 13 | Improving and developing navigation potential | | | | |
| | Tourism | | | | |

## Table 4.2 pt 2 Ranking of the Revised Concerns

| Rank | Rwanda | Sudan | Tanzania | Uganda | Sub-region NEL |
|---|---|---|---|---|---|
| 1 | Watershed degradation (destruction of forests) | Water resources availability | Water resources availability | Increased energy demand | Water quality – pollution |
| 2 | Intra- and inter-annual fluctuation; | Coping with droughts and floods; | Declining water levels in lakes and rivers | Watershed degradation (destruction of forests) | Water resources availability |
| 3 | Increased energy demand | Water resources availability | Water quality - pollution | Water quality - pollution | Coping with floods and droughts |
| 4 | Water supply & sanitation | Soil/Bank erosion | Optimal utilization of available water resources | Water resources availability | Increased energy demand |
| 5 | Optimal utilisation of available water resources | Water quality | Water use efficiency, demand management | Rain fed agriculture | Watershed degradation (Destruction of natural forests),<br>Wetlands degradation |
| 6 | Tourism | Water supply and sanitation | Biodiversity conservation | Biodiversity conservation | Need to improve conservation to cope with CV e.g. through |
| 7 | Wetland degradation | Increased energy demand | Irrigation | Water supply and sanitation | Water use efficiency demand / management |
| 8 | Coping with droughts and floods; | Irrigation<br>Rain fed agriculture | Water Quality - eutrophication | Wetlands degradation | Water supply and sanitation |
| 9 | Water Quality - pollution | Watershed degradation (Destruction of natural forests) | Water supply and sanitation | Coping with droughts and floods | Irrigation |
| 10 | Irrigation<br>Wetlands degradation - repeat | Wetlands degradation | Watershed degradation (destruction of forests) | Irrigation | Biodiversity conservation |
| 11 | | Flood Forecasting and Preparedness | Increased energy demand | Population structure/ settlement patterns | Population structure/ settlement pattern |
| 12 | | Improving and developing navigation potential | Wetlands degradation | Conflicts in water use (pastoralists etc) | Soil/Bank erosion |
| 13 | | Aquatic weeds | | | Improving / developing navigation potential |
| 14 | | Tourism | | | |

## Table 4.3 pt 1 Revised Ranking of the Concerns Including Unbundled Compound Concerns

| Rank | Burundi | DR Congo | Egypt | Ethiopia | Kenya |
|---|---|---|---|---|---|
| 1 | Water use efficiency, demand management | Watershed degradation (destruction of forests) | Water resources availability | Irrigation | Declining water levels in lakes and rivers |
| 2 | Drought Prediction | Tourism | Water quality | Watershed degradation | Biodiversity conservation |
| | Flood Forecasting and Preparedness | | | | |
| 3 | | Water supply and sanitation | Optimal utilisation of available water resources | Increased energy demand | Irrigation |
| 4 | Optimal utilisation of available water resources | Water resources availability | Irrigation | Drought Prediction | Water supply & sanitation |
| | | Water use efficiency, demand management | Rainfed agriculture | Coping with droughts (and floods) | |
| | | | Livestock | | |
| 5 | Soil/Bank erosion | | | | Increased energy demand |
| 6 | Intra- and inter-annual fluctuation | Use of carbon credit to finance power project | | Water supply and sanitation | Watershed degradation (Destruction of natural forests), |
| 7 | Water supply and sanitation | Water Quality - pollution | Coping with droughts | Flood Forecasting and Preparedness | Need to improve conservation to cope with CV e.g. through Rain water harvesting |
| | | Water Quality - salinisation | | | |
| 8 | Biodiversity conservation | | Coping with floods | Wetlands degradation | Water Quality - pollution |
| 9 | Water quality | Population structure/settlement patterns | Population structure/settlement patterns | | Flood Forecasting and Preparedness |
| | | | | | Coping with droughts and floods; |
| 10 | Water resources availability | Transboundary conflicts with respect to fisheries | Soil/Bank erosion | | |
| 11 | Increased energy demand | Biodiversity conservation | Water supply and sanitation | | Land use, Cover change, impacts on runoff |
| 12 | Wetlands degradation | Irrigation | Improving and developing navigation potential | | Improving and developing navigation potential |
| | | Rain fed agriculture | | | |
| 13 | Population structure/ settlement patterns | | Increased energy demand | | |
| 14 | Improving and developing navigation potential | Declining water levels in lakes and rivers | | | |
| | Tourism | | | | |

## Table 4.3 pt 2 Revised Ranking of the Concerns Including Unbundled Compound Concerns

| Rank | Rwanda | Sudan | Tanzania | Uganda | Sub-region NEL |
|---|---|---|---|---|---|
| 1 | Watershed degradation (destruction of forests) | Water resources availability | Water resources availability | Increased energy demand | Water quality – pollution |
| 2 | Intra- and inter-annual fluctuation; | Coping with droughts and floods; | Declining water levels in lakes and rivers | Watershed degradation (destruction of forests) | Water resources availability |
| 3 | Increased energy demand | Soil/Bank erosion | Water quality - pollution | Water quality - pollution | Coping with floods and droughts |
| 4 | Water supply & sanitation | Water quality | Optimal utilization of available water resources | Water resources availability | Increased energy demand |
| 5 | Optimal utilisation of available water resources | Water supply and sanitation | Water use efficiency, demand management | Rain fed agriculture | Watershed degradation (Destruction of natural forests), Wetlands degradation |
| 6 | Tourism | Increased energy demand | Biodiversity conservation | Biodiversity conservation | |
| 7 | Wetland degradation | Irrigation; Rain fed agriculture | Irrigation | Water supply and sanitation | Need to improve conservation to cope with CV e.g. through Rain water harvesting |
| 8 | Coping with droughts and floods; | | Water Quality - eutrophication | Wetlands degradation | Water use efficiency demand / management |
| 9 | Water Quality - pollution | Watershed degradation (Destruction of natural forests) | Water supply and sanitation | Coping with droughts and floods | Water supply and sanitation |
| 10 | Irrigation | Wetlands degradation | Watershed degradation (destruction of forests) | Irrigation | Irrigation |
| 11 | | Flood Forecasting and Preparedness | Increased energy demand | Population structure/ settlement patterns | Biodiversity conservation |
| 12 | | Improving and developing navigation potential | Wetlands degradation | Conflicts in water use (pastoralists etc) | Population structure/ settlement pattern |
| 13 | | Aquatic weeds | | | Soil/Bank erosion |
| 14 | | Tourism | | | Improving / developing navigation potential |

### 4.2.2 General Analysis of the Ranking Results

Table 4.3 shows that in-all, 30 concerns were selected by one or more the workshops; of these however, four – namely aquatic weeds, conflicts in water use, livestock and transboundary conflicts with respect to fisheries– are new. Thus of the original 31 concerns 26 were considered relevant by one or more of the workshops. It is interesting to subject the 30 concerns to additional ranking procedures – Table 4.4 refers where the concerns are ranked according to the total number of times that they were selected, and the number of times they were ranked in the first three at the workshops. Of the 17 concerns ranked 12th or higher, 13 were also ranked in the first three by at least one of the workshops:

- **Biodiversity conservation**
- **Coping with droughts and/or floods**
- **Flood Forecasting and Preparedness**
- **Increased energy demand**
- **Irrigation**
- **Optimal utilisation of available water resources**
- **Soil/Bank erosion**
- **Tourism**
- **Water Quality - pollution**
- **Water resources availability**
- **Water supply & sanitation**
- **Water use efficiency demand / management**
- **Watershed degradation (destruction of forests)**

Similarly, of the 16 concerns ranked in the first three by at least one of the workshops, 12 were also selected by at least 4 of the workshops:

- **Biodiversity conservation**
- **Flood Forecasting and Preparedness**
- **Increased energy demand**
- **Irrigation**
- **Optimal utilisation of available water resources**
- **Soil/Bank erosion**
- **Tourism**
- **Water Quality - pollution**
- **Water resources availability**
- **Water supply & sanitation**
- **Water use efficiency demand / management**
- **Watershed degradation (destruction of forests)**

All this suggests a general consistency in the rankings, although there are some surprises. Water Supply and Sanitation was selected at all of the workshops for instance, yet only achieved a ranking of 3rd or above at one – in fact its ranking tally was 1st at one workshop, 4th at two workshops, 5th and 6th at one workshop each, 7th at two workshops, 9th at two workshops and 11th at one.

Not surprising however, are the prevailing concerns about the availability and use of water.

- **water resources availability** for instance was selected at 7 workshops and was ranked 3rd or above at 4;
- **declining water levels in lakes and rivers** was selected at 3 workshops and was ranked 3rd or above at 2;
- **water use efficiency, demand management** was selected at 4 workshops and was ranked 3rd or above at 1: and
- **optimal utilisation of available water resources** was selected at 4 workshops and was ranked 3rd or above at 1.

Similarly, environmental factors featured consistently in one way or another:

- **water quality (pollution)** for instance was selected at 6 workshops and was ranked 3rd or above at 4;
- **watershed degradation (destruction of forests)** was selected at 8 workshops and was ranked 3rd or above at 4; and
- **biodiversity conservation** was selected at 6 workshops and was ranked 3rd or above at 1

Yet surprisingly, although wetland degradation was selected at 7 workshops, its ranking tally was 5th and 7th at one workshop each, 8th at two workshops, 10th at one workshop, and 12th at two.

### 4.2.3 Analysis of the Ranking Results by NBI Theme

It is also interesting i) to cluster the concerns according to the four Nile Basin themes[3] (society, economy, natural resources and regional collaboration – Table 4.5 refers) ii) to rank them within their clusters and iii) to see which are the most important within each cluster: Tables 4.6 to 4.9 refer.

For **Society**, water supply and sanitation clearly emerges as the most pressing concern, even though with the exception of one country, it does not in the top three of any other workshop rankings. It is followed closely by increased energy demand, which was ranked 3rd or above in 3 workshops, and by irrigation which was ranked 3rd or above in 2 workshops.

For **Economy**, increased energy demand and irrigation dominate the concerns. They are followed by coping with droughts and floods which ranked 3rd or above at 2 workshops.

For **Natural Resources,** watershed degradation, which ranked 3rd or above at 4 workshops emerges as the most pressing concern. Next was water resource availability which also ranked 3rd or above at 4 workshops. Third was wetland degradation yet s we have seen it did not score 3rd or above at any workshop.

Finally, for **Regional Collaboration**, perhaps not surprisingly, the first two most pressing priorities are the same as for Economy, namely increased energy demand, irrigation while the third is coping with droughts and floods.

The thematic question is revisited below in sub-section 4.2.5 which explores thematic emphases at the sub-regional level.

[3] noting that it is possible for a particular issue to appear in more than one cluster

**Table 4.4 Consolidated Rankings**

| RANK | BY TOTAL N° OF WORKSHOPS WHERE THE CONCERN WAS SELECTED | N° | RANK | BY N° OF WORKSHOPS WHERE THE CONCERN WAS RANKED IN THE 1st 3 | N° |
|---|---|---|---|---|---|
| 1 | Water supply & sanitation | 10 | =1 | Water pollution (all kinds) | 4 |
| =2 | Increased energy demand | 9 | =1 | Water resources availability | 4 |
| =2 | Irrigation | 9 | =1 | Watershed degradation (Destruction of natural forests), | 4 |
| =4 | Coping with droughts and/or floods | 8 | =4 | Increased energy demand | 3 |
| =4 | Watershed degradation (destruction of forests) | 8 | =5 | Coping with droughts and floods | 2 |
| =6 | Water resources availability | 7 | =5 | Declining water levels in lakes and rivers | 2 |
| =6 | Wetland degradation | 7 | =5 | Irrigation | 2 |
| =8 | Biodiversity conservation | 6 | =8 | Soil/Bank erosion | 1 |
| =8 | Improving / developing navigation potential | 6 | =8 | Biodiversity conservation | 1 |
| =8 | Water Quality - pollution | 6 | =8 | Drought Prediction | 1 |
| =11 | Population structure/ settlement pattern | 5 | =8 | Flood Forecasting and Preparedness | 1 |
| =12 | Soil/Bank erosion | 4 | =8 | Intra- and inter-annual fluctuation | 1 |
| =12 | Flood Forecasting and Preparedness | 4 | =8 | Optimal utilisation of available water resources | 1 |
| =12 | Optimal utilisation of available water resources | 4 | =8 | Tourism | 1 |
| =12 | Rain fed agriculture | 4 | =8 | Water supply and sanitation | 1 |
| =12 | Tourism | 4 | =8 | Water use efficiency, demand management | 1 |
| =12 | Water use efficiency demand / management | 4 | | | |
| =18 | Declining water levels in lakes and rivers | 3 | | | |
| =18 | Water quality | 3 | | | |
| =20 | Drought Prediction | 2 | | | |
| =20 | Intra- and inter-annual fluctuation | 2 | | | |
| =20 | Need to improve conservation to cope with CV e.g. through Rain water harvesting | 2 | | | |
| =23 | Aquatic weeds | 1 | | | |
| =23 | Conflicts in water use (pastoralists etc) | 1 | | | |
| =23 | Land use, Cover change, impacts on runoff | 1 | | | |
| =23 | Livestock | 1 | | | |
| =23 | Transboundary conflicts with respect to fisheries | 1 | | | |
| =23 | Use of carbon credit to finance power project | 1 | | | |
| =23 | Water Quality - eutrophication | 1 | | | |
| =23 | Water Quality - salinisation | 1 | | | |

## Table 4.5 Clustering of Concerns According to the NBI Themes

| CONCERN | CLUSTER | | | | COMMENT/EXPLANATION |
|---|---|---|---|---|---|
| | SOCIETY | ECONOMY | NATURAL RESOURCES | REGIONAL COLLABORATION | |
| Aquatic weeds | yes | yes | yes | yes | relevant to the economy because of the affect of water hyacinth on navigation |
| Biodiversity conservation | yes | yes | yes | | relevant to the economy because of eco-tourism |
| Conflicts in water use (pastoralists etc) | yes | yes | | | |
| Coping with droughts and floods | yes | yes | | yes | |
| Declining water levels in lakes and rivers | yes | yes | yes | yes | |
| Drought Prediction | yes | yes | | yes | relevant to regional collaboration because of data sharing |
| Flood Forecasting and Preparedness | yes | yes | | yes | |
| Improving / developing navigation potential | | yes | | yes | relevant to regional collaboration because of water hyacinth |
| Increased energy demand | | yes | | yes | |
| Intra- and inter-annual fluctuation | | | yes | yes | relevant to regional collaboration because of data sharing |
| Irrigation | yes | yes | | yes | |
| Land use, Cover change, impacts on runoff | | | yes | yes | |
| Livestock | yes | yes | | | |
| Need to improve conservation to cope with CV e.g. through Rain water harvesting | yes | yes | | | |
| Optimal utilisation of available water resources | | yes | yes | | |
| Population structure/ settlement pattern | yes | yes | yes | | |
| Rain fed agriculture | yes | yes | | | |
| Soil/Bank erosion | | yes | yes | yes | |
| Tourism | | yes | | | |
| Transboundary conflicts | | | | yes | |
| Use of carbon credit to finance power project | | yes | | yes | |
| Water quality | yes | yes | yes | yes | |
| Water Quality - eutrophication | yes | yes | yes | | relevant to the economy because of the affect of water hyacinth on navigation |
| Water Quality - pollution | yes | yes | yes | yes | |
| Water Quality - salinisation | yes | yes | | yes | relevant to regional collaboration because of agricultural run-off |
| Water resources availability | yes | yes | yes | yes | |
| Water supply & sanitation | yes | | | | |
| Water use efficiency demand / management | | yes | yes | yes | |
| Watershed degradation (destruction of forests) | | | yes | yes | |
| Wetland degradation | | | yes | yes | |

**Table 4.6 Consolidated Rankings of Concerns Relevant to Society**

| RANK | BY TOTAL N° OF WORKSHOPS WHERE THE CONCERN WAS SELECTED | N° | RANK | BY N° OF WORKSHOPS WHERE THE CONCERN WAS RANKED IN THE 1st 3 | N° |
|---|---|---|---|---|---|
| 1 | Water supply & sanitation | 10 | =1 | Water quality | 4 |
| 2 | Irrigation | 9 | =1 | Water resources availability | 4 |
| 3 | Coping with droughts and/or floods | 8 | =3 | Coping with droughts and floods | 2 |
| 4 | Water resources availability | 7 | =3 | Declining water levels in lakes and rivers | 2 |
| =5 | Biodiversity conservation | 6 | =3 | Irrigation | 2 |
| =5 | Water Quality - pollution | 6 | =6 | Biodiversity conservation | 1 |
| 7 | Population structure/ settlement pattern | 5 | =6 | Drought Prediction | 1 |
| =8 | Flood Forecasting and Preparedness | 4 | =6 | Flood Forecasting and Preparedness | 1 |
| =8 | Rain fed agriculture | 4 | =6 | Water supply and sanitation | 1 |
| =10 | Declining water levels in lakes and rivers | 3 | | | |
| =10 | Water quality | 3 | | | |
| =12 | Drought Prediction | 2 | | | |
| =12 | Need to improve conservation to cope with CV e.g. through Rain water harvesting | 2 | | | |
| =14 | Aquatic weeds | 1 | | | |
| =14 | Conflicts in water use (pastoralists etc) | 1 | | | |
| =14 | Livestock | 1 | | | |
| =14 | Water Quality - eutrophication | 1 | | | |
| =14 | Water Quality - salinisation | 1 | | | |

**Table 4.7 Consolidated Rankings of Concerns Relevant to Economy**

| RANK | BY TOTAL N° OF WORKSHOPS WHERE THE CONCERN WAS SELECTED | N° | RANK | BY N° OF WORKSHOPS WHERE THE CONCERN WAS RANKED IN THE 1st 3 | N° |
|---|---|---|---|---|---|
| =1 | Increased energy demand | 9 | =1 | Water quality | 4 |
| =1 | Irrigation | 9 | =1 | Water resources availability | 4 |
| 3 | Coping with droughts and/or floods | 8 | 3 | Increased energy demand | 3 |
| =4 | Water resources availability | 7 | =4 | Coping with droughts and floods | 2 |
| =5 | Biodiversity conservation | 6 | =4 | Declining water levels in lakes and rivers | 2 |
| =5 | Improving / developing navigation potential | 6 | =4 | Irrigation | 2 |
| =5 | Water Quality - pollution | 6 | =7 | Biodiversity conservation | 1 |
| 8 | Population structure/ settlement pattern | 5 | =7 | Drought Prediction | 1 |
| =9 | Flood Forecasting and Preparedness | 4 | =7 | Flood Forecasting and Preparedness | 1 |
| =9 | Optimal utilisation of available water resources | 4 | =7 | Optimal utilisation of available water resources | 1 |
| =9 | Rain fed agriculture | 4 | =7 | Soil/Bank erosion | 1 |
| =9 | Soil/Bank erosion | 4 | =7 | Tourism | 1 |
| =9 | Tourism | 4 | =7 | Water use efficiency, demand management | 1 |
| =9 | Water use efficiency demand / management | 4 | | | |
| =15 | Declining water levels in lakes and rivers | 3 | | | |
| =15 | Water quality | 3 | | | |
| =17 | Drought Prediction | 2 | | | |
| =17 | Need to improve conservation to cope with CV e.g. through Rain water harvesting | 2 | | | |
| =19 | Aquatic weeds | 1 | | | |
| =19 | Conflicts in water use (pastoralists etc) | 1 | | | |
| =19 | Livestock | 1 | | | |
| =19 | Use of carbon credit to finance power project | 1 | | | |
| =19 | Water Quality - eutrophication | 1 | | | |
| =19 | Water Quality - salinisation | 1 | | | |

**Table 4.8 Consolidated Rankings of Concerns Relevant to Natural Resources**

| RANK | BY TOTAL N° OF WORKSHOPS WHERE THE CONCERN WAS SELECTED | N° | RANK | BY N° OF WORKSHOPS WHERE THE CONCERN WAS RANKED IN THE 1st 3 | N° |
|---|---|---|---|---|---|
| =1 | Watershed degradation (destruction of forests) | 8 | =1 | Water quality | 4 |
| =2 | Water resources availability | 7 | =1 | Water resources availability | 4 |
| =2 | Wetland degradation | 7 | =1 | Watershed degradation (Destruction of natural forests), | 4 |
| =4 | Biodiversity conservation | 6 | 4 | Declining water levels in lakes and rivers | 2 |
| =4 | Water Quality - pollution | 6 | =5 | Biodiversity conservation | 1 |
| 6 | Population structure/ settlement pattern | 5 | =5 | Intra- and inter-annual fluctuation | 1 |
| =7 | Optimal utilisation of available water resources | 4 | =5 | Optimal utilisation of available water resources | 1 |
| =7 | Soil/Bank erosion | 4 | =5 | Soil/Bank erosion | 1 |
| =7 | Water use efficiency demand / management | 4 | =5 | Water use efficiency, demand management | 1 |
| =10 | Declining water levels in lakes and rivers | 3 | | | |
| =10 | Water quality | 3 | | | |
| 12 | Intra- and inter-annual fluctuation | 2 | | | |
| =13 | Aquatic weeds | 1 | | | |
| =13 | Land use, Cover change, impacts on runoff | 1 | | | |
| =13 | Water Quality - eutrophication | 1 | | | |

**Table 4.9 Consolidated Rankings of Concerns Relevant to Regional Collaboration**

| RANK | BY TOTAL N° OF WORKSHOPS WHERE THE CONCERN WAS SELECTED | N° | RANK | BY N° OF WORKSHOPS WHERE THE CONCERN WAS RANKED IN THE 1st 3 | N° |
|---|---|---|---|---|---|
| =1 | Increased energy demand | 9 | =1 | Water quality | 4 |
| =1 | Irrigation | 9 | =1 | Water resources availability | 4 |
| =3 | Coping with droughts and/or floods | 8 | =1 | Watershed degradation (Destruction of natural forests), | 4 |
| =3 | Watershed degradation (destruction of forests) | 8 | 4 | Increased energy demand | 3 |
| =5 | Water resources availability | 7 | =5 | Coping with droughts and floods | 2 |
| =5 | Wetland degradation | 7 | =5 | Declining water levels in lakes and rivers | 2 |
| =7 | Improving / developing navigation potential | 6 | =5 | Irrigation | 2 |
| =7 | Water Quality - pollution | 6 | =7 | Drought Prediction | 1 |
| =9 | Flood Forecasting and Preparedness | 4 | =7 | Flood Forecasting and Preparedness | 1 |
| =9 | Soil/Bank erosion | 4 | =7 | Intra- and inter-annual fluctuation | 1 |
| =9 | Water use efficiency demand / management | 4 | =7 | Soil/Bank erosion | 1 |
| =12 | Declining water levels in lakes and rivers | 3 | =7 | Water use efficiency, demand management | 1 |
| =12 | Water quality | 3 | | | |
| =14 | Drought Prediction | 2 | | | |
| =14 | Intra- and inter-annual fluctuation | 2 | | | |
| =16 | Aquatic weeds | 1 | | | |
| =16 | Land use, Cover change, impacts on runoff | 1 | | | |
| =16 | Transboundary conflicts with respect to fisheries | 1 | | | |
| =16 | Use of carbon credit to finance power project | 1 | | | |
| =16 | Water Quality - salinisation | 1 | | | |

### 4.2.4 Analysis of the Workshop Results by Country and Sub-Region

Throughout the consultancy process to date, the client has repeatedly stress that the proposed DSS is intended to be client oriented facility, with the member countries being the clients. Accordingly, it is helpful to map each of the concerns onto each of the countries: Table 4.10 refers.

**Table 4.10 Concerns Mapped onto Countries**

| | NEL | | | | | | EN | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CONCERN | Burundi | Rwanda | Tanzania | Kenya | Uganda | DR Congo | Sudan | Ethiopia | Egypt | N° of Countries |
| Water supply & sanitation | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 9 |
| Increased energy demand | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | 8 |
| Irrigation | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 8 |
| Watershed degradation (destruction of forests) | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | 8 |
| Coping with droughts and floods | | ■ | | ■ | ■ | | ■ | ■ | ■ | 6 |
| Water resources availability | ■ | | ■ | | ■ | ■ | ■ | | ■ | 6 |
| Biodiversity conservation | ■ | | ■ | ■ | ■ | ■ | | | | 5 |
| Water Quality - pollution | | ■ | ■ | ■ | ■ | ■ | | | | 5 |
| Wetland degradation | | ■ | ■ | | ■ | | ■ | ■ | | 5 |
| Flood Forecasting and Preparedness | ■ | | | ■ | | | ■ | ■ | | 4 |
| Improving / developing navigation potential | ■ | | | ■ | | | ■ | | ■ | 4 |
| Optimal utilisation of available water resources | ■ | ■ | ■ | | | | | | ■ | 4 |
| Population structure/settlement pattern | ■ | | | | ■ | ■ | | | ■ | 4 |
| Rain fed agriculture | | | | | ■ | ■ | ■ | | ■ | 4 |
| Tourism | ■ | ■ | | | | ■ | ■ | | | 4 |
| Soil/Bank erosion | ■ | | | | | | ■ | | ■ | 3 |
| Declining water levels in lakes and rivers | | | ■ | ■ | | ■ | | | | 3 |
| Water quality | ■ | | | | | | ■ | | ■ | 3 |
| Water use efficiency demand / management | ■ | | ■ | | | ■ | | | | 3 |
| Drought Prediction | ■ | | | | | | | ■ | | 2 |
| Intra- and inter-annual fluctuation | ■ | ■ | | | | | | | | 2 |
| Aquatic weeds | | | | | | | ■ | | | 1 |
| Conflicts in water use (pastoralists etc) | | | | | ■ | | | | | 1 |
| Land use, Cover change, impacts on runoff | | | | ■ | | | | | | 1 |
| Livestock | | | | | | | | | ■ | 1 |
| Need to improve conservation to cope with CV e.g. through Rain water harvesting | | | | ■ | | | | | | 1 |
| Transboundary conflicts | | | | | | ■ | | | | 1 |
| Use of carbon credit to finance power project | | | | | | ■ | | | | 1 |
| Water Quality - eutrophication | | | ■ | | | | | | | 1 |
| Water Quality - salinisation | | | | | | ■ | | | | 1 |

The table confirms once again the predominating interest in water supply and sanitation, improved energy supplies, irrigation and watershed degradation.

In terms of priority, the next cluster of concerns comprises coping with floods and droughts and water resources availability which are concerns in 6 countries each.

Next comes biodiversity conservation, water quality and wetland degradation – 5 countries each, and flood forecasting/preparadness and navigation with four.

It is interesting to note however, that down to this point and with the exception of population settlement patterns there is a great commonality of interest between the NEL and EN sub-regions; but for the remaining concerns not only are they more applicable to the NEL sub-regions, but also a more sub-regional focus emerges.

### 4.2.5 Thematic Emphases at the Sub-Regional Level.

It is interesting to assess this divergence in terms of the NBI themes. Table 4.11 refers, it relates the total number of times that a concern is selected by theme in each of the two sub-regions and confirms that in each, economy is the most important theme. However, whereas society, natural resources and regional collaboration are more or less equally and significantly less important in the EN sub-regions, in the NEL sub-region, there is a clear hierarchy with natural resources coming second, regional collaboration third but closely followed by society.

### 4.2.6 Results from the Eastern Nile Sub-Regional Workshop

The results of the Eastern Nile Sub-Regional Workshop have not been included in the Analysis Report so far as the respective ranking was missing. This is why the following section now presents a separate summary.

13 concerns were raised at the EN sub-regional workshop. As with the concerns raised at the other workshops, not all were articulated as per the standard nomenclature needed for analytical purposes (as explained in section 4.2.1 above). Table 4.12 lists the concerns as articulated at the workshop and matches them with the standardised articulation. As with the results of the other workshops, the Consultant acknowledges the risk of subjectivity and inaccuracy with regards to the re-articulation, which it is stressed once again is necessary to standardise concern articulation for analytical purposes.

It will be seen that re-articulation of the concerns reduce the total number from 13 to 12.

**Table 4.11 Thematic Trends in the Sub-Regions**

| CONCERN | NEL | | | | | | EN | | | N° of SELECTIONS IN NEL | | | | N° of SELECTIONS IN EN | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Burundi | Rwanda | Tanzania | Kenya | Uganda | DR Congo | Sudan | Ethiopia | Egypt | SOCIETY | ECONOMY | NATURAL RESOURCES | REGIONAL COLLABORATION | SOCIETY | ECONOMY | NATURAL RESOURCES | REGIONAL COLLABORATION |
| Optimal utilisation of available water resources | ■ | ■ | ■ | | | | | | ■ | n/i | 3 | 3 | n/i | n/i | 1 | 1 | n/i |
| Population structure/settlement pattern | ■ | | | | ■ | ■ | | | ■ | 3 | 3 | 3 | n/i | 1 | 1 | 1 | n/i |
| Rain fed agriculture | | | | | ■ | ■ | ■ | | ■ | 2 | 2 | n/i | n/i | 2 | 2 | n/i | n/i |
| Tourism | ■ | ■ | | | | ■ | ■ | | | n/i | 3 | n/i | n/i | n/i | 1 | n/i | n/i |
| Soil/Bank erosion | ■ | | | | | | ■ | | ■ | n/i | 1 | 1 | 1 | n/i | 2 | 2 | 2 |
| Declining water levels in lakes and rivers | | | ■ | ■ | | ■ | | | | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| Water quality | ■ | | | | | | ■ | | ■ | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Water use efficiency demand / management | ■ | | ■ | | | ■ | | | | n/i | 3 | 3 | 3 | n/i | 0 | 0 | 0 |
| Drought Prediction | ■ | | | | | | | ■ | | n/i | 1 | n/i | 1 | n/i | 1 | n/i | 1 |
| Intra- and inter-annual fluctuation | ■ | ■ | | | | | | | | n/i | n/i | 2 | 2 | n/i | n/i | 0 | 0 |
| Aquatic weeds | | | | | | | ■ | | | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| Conflicts in water use (pastoralists etc) | | | | | ■ | | | | | 1 | 1 | n/i | n/i | 0 | 0 | n/i | n/i |
| Land use, Cover change, impacts on runoff | | | | ■ | | | | | | n/i | n/i | 1 | 1 | n/i | n/i | 0 | 0 |
| Livestock | | | | | | | | | ■ | 0 | 0 | n/i | n/i | 1 | 1 | n/i | n/i |
| Need to improve conservation to cope with CV e.g. through Rain water harvesting | | | | ■ | | | | | | 1 | 1 | n/i | n/i | 0 | 0 | n/i | n/i |
| Transboundary conflicts | | | | | | ■ | | | | n/i | n/i | n/i | n/i | n/i | n/i | n/i | n/i |
| Use of carbon credit to finance power project | | | | | | ■ | | | | n/i | 1 | n/i | 1 | n/i | 0 | n/i | 0 |
| Water Quality - eutrophication | | | ■ | | | | | | | 1 | 1 | 1 | n/i | 0 | 0 | 0 | n/i |
| Water Quality - salinisation | | | | | | ■ | | | | 1 | 1 | n/i | 1 | 0 | 0 | 0 | 0 |
| | | | | | | | | | TOTALS | 13 | 25 | 18 | 14 | 7 | 12 | 7 | 6 |

**Notes** "n/i" indicates that the concern was not included in the theme

**Table 4.12 Concerns Raised at the Eastern Nile Sub-regional Workshop**

| CONCERN AS ARTICULATED | STANDARD ARTICULATION(S) |
|---|---|
| increase water availability | water resource availability |
| optimise water utilisation | optimal utilisation of available water resources |
| optimise available water resources utilisation options | optimal utilisation of available water resources |
| conserve and improve water quality | water quality |
| increase agriculture and livestock production | irrigation<br>rainfed agriculture<br>livestock |
| conserve soil and water | watershed degradation (destruction of forests) |
| cope with droughts | coping with floods and/or droughts |
| contribute to meet energy demand through hydropower | increased energy demand |
| cope with floods | coping with floods and/or droughts |
| increase irrigated agriculture | irrigation |
| improve water supply and sanitation coverage | water supply and sanitation |
| reduce sedimentation of hydraulic structures | Soil/bank erosion |
| improve and develop navigation potential | Improving/developing navigation potential |

## 4.3 Results

### 4.3.1 From Ranking Results to the Identification of DSS Requirements

The foregoing analysis, although very interesting in the way that it identifies macro concerns that are relevant to the overall DSS architecture, is less easy to apply to the finer details of its conceptual design. This is because the workshop results are both weighted and representative of different countries and sub-regions where the composition, experience and vested interests of the participants varied. Accordingly, the methodology used to identify those concerns that need to be retained and prioritised for defining the DSS requirements has not been based on a strictly mathematical analysis of ranking results.

Instead, a three-step approach to concern selection was adopted:

1. ***First,*** "key trans-boundary concerns" were identified. These are concerns that were found to be i) important at more than half of the workshops; ii) high ranking in at least several countries, and iii) where a strong cause-and-effect chain (upstream-downstream) can be identified.
2. ***Secondly,*** the remaining concerns were reviewed by the Consultant in order to identify other important ones that i) are high ranking and complementary to those arising from the first step; or ii) were selected by several countries and with a clear regional aspect.

3. ***Thirdly*****,** a check was made as to whether or not there are any concerns that were raised as a high priority concern in one country but not captured by the above two categories. This was not the case.

The concerns selected by this process were then clustered into broader "areas of concern" for the purpose of DSS conceptual design.

### 4.3.2 Step 1 - Identification and Clustering of the Specific Transboundary Concerns

Specific transboundary concerns constitute the core, or irreducible skeleton of a DSS suitable for the Nile Basin. For the purpose of this exercise such concerns have been selected according to the following criteria (which are suggested by the Consultant):

- **Criteria 1:** they should have been selected at at least 1 sub-regional workshop;
- **Criteria 2:** they should have been selected at a minimum of 6 of all the workshops;
- **Criteria 3:** they should be ranked 3rd or above in at least 2 country workshops in overall terms
- **Criteria 4:** they should be ranked 3rd or above in at least 2 country workshops in terms of regional collaboration

In addition, they should be characterised by clear cause and effect (upstream/downstream) implications.

Table 4.13 refers – it is developed from Table 4.10 and identifies the relevant concerns by means of bold type. These are:

| | |
|---|---|
| • Increased energy demand | for which the cause and effect linkages concern i) strong regional links in decision making on power generation and trades, along with existing and potential transboundary grids, and ii) the impact on stream flows of storing water for hydropower generation |
| • Irrigation | for which the cause and effect linkage concerns the effect on water availability due to irrigation which is the biggest consumer of water in the NB |
| • Water quality/pollution | for which the cause and effect linkage concerns the cumulative affect of upstream pollution on downstream water bodies |
| • Water resource availability | for which the cause and effect linkage is direct because water abstraction upstream affects its availability downstream |
| • Watershed degradation | for which the cause and effect linkage concerns the erosion upstream and deposition downstream |

### 4.3.3 Step 2 - Identification of Complementary or Otherwise Significant Specific Concerns

As made clear in section 4.2.6 above, a purely ranking based selection of concerns to be addressed by the DSS is not ideal. Clearly, however, the concerns resulting from Step 1 are nonetheless based largely on the objective results of the ranking analyses described in sections 4.2.2 to 4.2.4. In order therefore to achieve a more comprehensive and representative capture of concerns for purpose of DSS conceptual design it is necessary to subject the remaining concerns to a more subjective, strategic review. It will be recalled from section 4.3.1 (second step) that the purpose of this review is to identify additional concerns that i) are complementary to those arising

from the first step; or ii) despite lower rankings were selected by several countries (4 or more for the purpose of this exercise) and with a clear regional aspect.

The results are shown in Table 4.14 (where the results of step 1 are identified by the blue highlight). The rationale behind most of the selections will be self-evident; but where this is not so, they are explained as follows:

- wetland degradation — is complementary/relevant to watershed degradation because wetlands are an important multi-function watershed component
- population structure/ settlement pattern — is complementary/relevant to coping with droughts and floods because of potential compromise of flood plain functions that can arise from human settlements
- aquatic weeds — is complementary/relevant to navigation because of the operational difficulties and disruption that they cause

**Table 4.13 Identification of Key Trans-boundary Concerns**

| CONCERN | NEL | | | | | | | EN | | | | | | 3rd+ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Burundi | Rwanda | Tanzania | Kenya | Uganda | DR Congo | Sub-regional | Sudan | Ethiopia | Egypt | Sub-regional | N° of Country workshops | N° of s/r workshops | Total N° of workshops | Workshops | Rgional Collaboration | Criteria 1 | Criteria 2 | Criteria 3 | Criteria 4 | Total Score |
| **Increased energy demand** | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | | 8 | 2 | 10 | 3 | 3 | 1 | 1 | 1 | 1 | 4 |
| **Irrigation** | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | 8 | 1 | 9 | 2 | 2 | 1 | 1 | 1 | 1 | 4 |
| **Water Quality - pollution** | | ■ | ■ | ■ | ■ | ■ | | | | | ■ | 5 | 1 | 6 | 4 | 4 | 1 | 1 | 1 | 1 | 4 |
| **Water resources availability** | ■ | | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | 6 | 2 | 8 | 4 | 4 | 1 | 1 | 1 | 1 | 4 |
| **Watershed degradation (destruction of forests)** | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | 8 | 2 | 10 | 2 | 3 | 1 | 1 | 1 | 1 | 4 |
| Coping with droughts and floods | | ■ | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | 6 | 2 | 8 | 2 | 1 | 1 | 1 | 1 | | 3 |
| Declining water levels in lakes and rivers | | | ■ | ■ | | ■ | | | | | | 3 | | 3 | 2 | 2 | 1 | | 1 | 1 | 3 |
| Soil/Bank erosion | ■ | | | | | | ■ | ■ | | ■ | ■ | 3 | 2 | 5 | 3 | 3 | 1 | | 1 | 1 | 3 |
| Biodiversity conservation | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | 5 | 1 | 6 | 1 | | 1 | 1 | | | 2 |
| Improving / developing navigation potential | ■ | | | ■ | | | ■ | ■ | | ■ | ■ | 4 | 2 | 6 | | | 1 | 1 | | | 2 |
| Water supply & sanitation | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 9 | 2 | 11 | 1 | | 1 | 1 | | | 2 |
| Water use efficiency demand / management | ■ | | ■ | | | ■ | ■ | | | | | 3 | 1 | 4 | 1 | 2 | 1 | | | 1 | 2 |
| Wetland degradation | | ■ | ■ | | ■ | | ■ | ■ | ■ | | | 5 | 1 | 6 | | | 1 | 1 | | | 2 |
| Aquatic weeds | | | | | | | | ■ | | | | 1 | | 1 | | | 1 | | | | 1 |
| Conflicts in water use (pastoralists etc) | | | | | ■ | | | | | | | 1 | | 1 | | | 1 | | | | 1 |
| Drought Prediction | ■ | | | | | | | | ■ | | | 2 | | 2 | 1 | 1 | 1 | | | | 1 |
| Flood Forecasting and Preparedness | ■ | | | ■ | | | | ■ | ■ | | | 4 | | 4 | 1 | 1 | 1 | | | | 1 |
| Intra- and inter-annual fluctuation | ■ | ■ | | | | | | | | | | 2 | | 2 | 1 | 1 | 1 | | | | 1 |
| Land use, Cover change, impacts on runoff | | | | ■ | | | | | | | | 1 | | 1 | | | 1 | | | | 1 |
| Livestock | | | | | | | | | | ■ | ■ | 1 | 1 | 2 | | | 1 | | | | 1 |
| Need to improve conservation to cope with CV e.g. through Rain water harvesting | | | | ■ | | | ■ | | | | | 1 | 1 | 2 | | | 1 | | | | 1 |
| Optimal utilisation of available water resources | ■ | ■ | ■ | | | | | | | ■ | ■ | 4 | 1 | 5 | 1 | | 1 | | | | 1 |
| Population structure/settlement pattern | ■ | | | | ■ | ■ | ■ | | | ■ | | 4 | 1 | 5 | | | 1 | | | | 1 |
| Rain fed agriculture | | | | | ■ | ■ | | ■ | | ■ | ■ | 4 | 1 | 5 | | | 1 | | | | 1 |
| Tourism | ■ | ■ | | | | ■ | | ■ | | | | 4 | | 4 | 1 | | 1 | | | | 1 |
| Transboundary conflicts | | | | | | ■ | | | | | | 1 | | 1 | | | 1 | | | | 1 |
| Use of carbon credit to finance power project | | | | | | ■ | | | | | | 1 | | 1 | | | 1 | | | | 1 |
| Water quality | ■ | | | | | | ■ | ■ | | ■ | | 3 | 1 | 4 | | | 1 | | | | 1 |
| Water Quality - eutrophication | | | ■ | | | | | | | | | 1 | | 1 | | | 1 | | | | 1 |
| Water Quality - salinisation | | | | | | ■ | | | | | | 1 | | 1 | | | 1 | | | | 1 |

**Table 4.14 Identification of Complementary or Otherwise Significant Concerns**

| CONCERN | Ref | NEL | | | | | | | EN | | | | N° of Country workshops | N° of s/r workshops | Total N° of workshops | 3rd+ | | Complementary to Ref N° | Low rank but multiple selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Burundi | Rwanda | Tanzania | Kenya | Uganda | DR Congo | Sub-regional | Sudan | Ethiopia | Egypt | Sub-regional | | | | Workshops | Regional Collaboration | | |
| Increased energy demand | 1 | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | 8 | 2 | 10 | 3 | 3 | | n/a |
| Irrigation | 2 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | 8 | 1 | 9 | 2 | 2 | | n/a |
| Water Quality - pollution | 3 | | ■ | ■ | ■ | ■ | ■ | | | | | | 5 | 1 | 6 | 4 | 4 | | n/a |
| Water resources availability | 4 | ■ | | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | 6 | 2 | 8 | 4 | 4 | | n/a |
| Watershed degradation (destruction of forests) | 5 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | 8 | 2 | 10 | 2 | 3 | | n/a |
| Water supply & sanitation | 6 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | 9 | 2 | 11 | 1 | | | yes |
| Coping with droughts and floods | 7 | | ■ | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | 6 | 2 | 8 | 2 | 1 | | yes |
| Biodiversity conservation | 8 | ■ | | ■ | ■ | ■ | ■ | ■ | | | | | 5 | 1 | 6 | 1 | | | yes |
| Improving / developing navigation potential | 9 | ■ | | | ■ | | | ■ | ■ | | ■ | ■ | 4 | 2 | 6 | | | | yes |
| Wetland degradation | 10 | | ■ | ■ | | ■ | | ■ | ■ | ■ | | | 5 | 1 | 6 | | | | yes |
| Optimal utilisation of available water resources | 11 | ■ | ■ | ■ | | | | | | | ■ | ■ | 4 | 1 | 5 | 1 | | | yes |
| Population structure/settlement pattern | 12 | ■ | | | | ■ | ■ | ■ | | | ■ | | 4 | 1 | 5 | | | | yes |
| Rain fed agriculture | 13 | | | | | ■ | ■ | | ■ | | ■ | ■ | 4 | 1 | 5 | | | | yes |
| Soil/Bank erosion | 14 | ■ | | | | | | ■ | ■ | | ■ | ■ | 3 | 2 | 5 | 3 | 3 | | yes |
| Flood Forecasting and Preparedness | 15 | ■ | | | ■ | | | | ■ | ■ | | | 4 | | 4 | 1 | 1 | | yes |
| Tourism | 16 | ■ | ■ | | | | ■ | | ■ | | | | 4 | | 4 | 1 | | | yes |
| Water quality | 17 | ■ | | | | | | ■ | ■ | | ■ | | 3 | 1 | 4 | | | | yes |
| Water use efficiency demand / management | 18 | ■ | | ■ | | | ■ | ■ | | | | | 3 | 1 | 4 | 1 | 2 | | yes |
| Declining water levels in lakes and rivers | 19 | | | ■ | ■ | | ■ | | | | | | 3 | | 3 | 2 | 2 | 4 | |
| Drought Prediction | 20 | ■ | | | | | | | | ■ | | | 2 | | 2 | 1 | 1 | 7 | |
| Intra- and inter-annual fluctuation | 21 | ■ | ■ | | | | | | | | | | 2 | | 2 | 1 | 1 | | |
| Livestock | 22 | | | | | | | | | | ■ | ■ | 1 | 1 | 2 | | | | |
| Need to improve conservation to cope with CV e.g. through Rain water harvesting | 23 | | | | ■ | | | ■ | | | | | 1 | 1 | 2 | | | | |
| Aquatic weeds | 24 | | | | | | | | ■ | | | | 1 | | 1 | | | 9 | |
| Conflicts in water use (pastoralists etc) | 25 | | | | | ■ | | | | | | | 1 | | 1 | | | | |
| Land use, Cover change, impacts on runoff | 26 | | | | ■ | | | | | | | | 1 | | 1 | | | 5 | |
| Transboundary conflicts | 27 | | | | | | ■ | | | | | | 1 | | 1 | | | | |
| Use of carbon credit to finance power project | 28 | | | | | | ■ | | | | | | 1 | | 1 | | | 1 | |
| Water Quality - eutrophication | 29 | | | ■ | | | | | | | | | 1 | | 1 | | | 17 | |
| Water Quality - salinisation | 30 | | | | | | ■ | | | | | | 1 | | 1 | | | 17 | |

### 4.3.4 Specific Concerns Clustered into Areas of Concern

As a result of the foregoing analysis, we are now left with a total of 25 specific concerns. However, it was agreed at the 2nd Regional Workshop (Entebbe 28/29 January 2008) i) that some of these specific concerns are cross cutting, namely all those concerning water quality; and ii) that despite its pressing importance at the national level, water supply and sanitation has very limited significance at the basin level (at least for the time being). In addition, the workshop agreed that climate change, which is a driving force behind many of the specific concerns, is an externality which will have to be increasingly factored into the decision making process (possibly in terms of scenarios or criteria concerning both adaptation and mitigation).

Removing all references therefore to water quality and water supply/sanitation brings the total list of specific concerns down to 20:

- Aquatic weeds
- Biodiversity conservation
- Coping with droughts and floods
- Declining water levels in lakes and rivers
- Drought Prediction
- Flood Forecasting and Preparedness
- Optimal utilisation of available water resources
- Population structure/settlement pattern
- Rain fed agriculture
- Soil/Bank erosion
- Tourism
- Use of carbon credit to finance power project

- Improving / developing navigation potential
- Increased energy demand
- Irrigation
- Land use, Cover change, impacts on runoff
- Water resources availability
- Water use efficiency demand / management
- Watershed degradation (destruction of forests)
- Wetland degradation

These can be clustered into "Areas of Concern", and in some cases into several, see table 4.15.. At this stage the Consultant decided to include livestock because of i) its great economic and social significance in the basin and ii) its significant water demand as a sector. As will be seen below, Table 4.15 has been used in developing the conceptual design of the DSS. Therefore, because it is essential - in order to promote ownership and maintain momentum - that the conceptual design captures national and subregional concerns (to the greatest practical extent). Table 4.15 also provides therefore, an indication of the relevance of "Areas of Concern" to each of the national and subregional staKeholders as suggeted by the occurrence and ranking of the specific concerns associated with an "Area of Concern" by each of the consultation workshops. In more detail, the designation **"high priority"** means that the average ranking of a particular country's specific concerns that are relevant to the area of concern in question, is 7.5 or greater (analysis of the results by the Consultant showed that 50% of all specific concerns selected by the stakeholders ranked 7.5 or above, and 50% less than 7.5). Similarly **"priority"** means that the country in question selected at least one specific concern relative to the area of concern, but that the average ranking of the specific concern(s) did not equal or exceed 7.5. Blank cells signify areas of concern for which a particular country did not select any relevant specific concerns.

### 4.3.5 Comparison with Ongoing ENSAP and NELSAP Action Projects and Programmes

The NBI philosophy is that investment projects are identified and implemented at the subsidiary level, i.e. through NELSAP and ENSAP. Projects currently being implemented under the two SAPs should therefore reflect interests of the countries with respect to development of opportunities and addressing of key transboundary water concerns. It is helpful therefore at this stage to compare these areas of concern with ongoing ENSAP and NELSAP projects.

As far as NELSAP is concerned, the document "Strategy for Scaling Up NELSAP Investment Projects (endorsed March 2005) describes a three track approach. Track 1, which is intended to build on earlier results is concerned with multi-purpose development that includes: power generation and trade; irrigated agriculture, watershed management, transboundary parks and navigation. It's Development Objective, is "*Investment Projects implemented in power generation and trade and natural resources management and development delivering energy and meeting deficits for productive multipurpose use and sustainable livelihoods*".

Track 2 is intended to promote economic growth and stability through major cooperative inter-country action in new geographic areas and sectors. Its Development Objective is "*Investment projects implemented in multiple Nile water related sectors delivering benefits to ensure sustainable livelihoods*". According to the document, these water related sectors include:

- Agro-industrial production
- Re-afforestation management
- Water hyacinth control
- Large scale fishing
- Hydro-power
- Navigation for trade and tourism
- Tourism management
- Use of modern irrigation and rainwater harvesting techniques

**Table 4.15 Areas of Concern and Specific Concerns**

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| Burundi | high priority | priority | high priority | high priority | priority | high priority | priority | priority |
| Rwanda | high priority | high priority | | priority | high priority | high priority | | high priority |
| Tanzania | high priority | high priority | | high priority | priority | high priority | | priority |
| Kenya | high priority | high priority | priority | high priority | high priority | high priority | priority | high priority |
| Uganda | high priority | high priority | priority | priority | high priority | high priority | | high priority |
| DRC | high priority | priority | high priority | priority | high priority | priority | high priority | high priority |
| Sudan | priority | priority | priority | high priority | high priority | high priority | priority | priority |
| Ethiopia | high priority | high priority | high priority | high priority | high priority | high priority | | High priority |
| Egypt | high priority | high priority | priority | high priority | priority | high priority | priority | priority |
| | | | | | | | | |
| aquatic weeds | | | | | | aquatic weeds are known to thrive where fertiliser run-off is high | water hyacinth is a widespread constraint on effective navigation in the basin | |
| biodiversity conservation | | there is a nexus between biodiversity and sustainable watershed services (see Harris's melbourne festival lecture 2000) | | | | | | there is a nexus between biodiversity and sustainable watershed services (see Harris's melbourne festival lecture 2000) |

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| coping with droughts and floods | | sound water management contributes to drought mitigation | self-evident | self-evident | | | | floods can cause major morphological changes; and are themselves made worse by watershed degradation |
| declining water levels in lakes and rivers | self-evident | self-evident | | | | | | |
| drought prediction | | | | self-evident | | | | |
| flood forecasting and preparedness | | operating rules for dams can be modified as a flood preparedness measure | self-evident | | | | | |
| improving / developing navigation potential | | allocation of water for navigation purposes at the cost of other applications is a key resource management decision | | | | | self-evident | |

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| increased energy demand | hydropower development is a possible way to increase the power supply | allocation of water for hydropower reduces its availability for other uses such as irrigation because demand patterns differ significantly | | | self-evident | | | |
| irrigation | new iirrigation requires the development of new withdrawal and possibly storage infrastructure | irrigation is a large user of water, and allocation for it reduces its availability for other (possibly higher value) uses such as hydropower and industry | | irrigation is a drought mitigating strategy | | self-evident | | |
| land use, cover change, impacts on runoff | | | | | | self-evident | | self-evident |

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| livestock | | | | | | livestock is a significant economic sector in the NB, and is also an important primary livelihood for much of its population. but as well as pasture/fodder, livestock also needs drinking water, which in turn may require the development of watering points | | |
| optimal utilisation of available water resources | self-evident connections to the area of concern | self-evident connections to the area of concern | | | | the allocation of water for irrigation may affect its availability for household, or higher value uses | | |

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| population structure/settlement pattern | | | human settlements represent significant economic activities and benefits that can be compromised by floods, yet the unwise siting of such settlements can exacerbate flooding when they affect the performance of flood plains | | | | | |
| rain fed agriculture | | | | | | rainfed agriculture is a net consumer of water, and farming system diversification can change catchment characteristics | | |

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| tourism | stored water provides amenity value and water sports potential | trade-off between amenity value and productive potential in other sectors | | | | | there is a large existing and potential nexus between navigation and tourism; increased tourism may represent increased demand for navigation, or alternatively improved navigation services might catalyse increased tourism | tourists are drawn to pristine, not degraded environments |
| use of carbon credit to finance power project | | | | | self-evident connections to the area of concern | | | |
| water resources availability | | self-evident connections to the area of concern | | self-evident connections to the area of concern | | | | |

| COUNTRY/SPECIFIC CONCERNS | AREAS OF CONCERN | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water Resources Development | Optimal Water Resources Utilization | Coping with Floods | Coping with Droughts | Energy Development | Rainfed and Irrigated Agriculture | Navigation | Watershed and Sediment Management |
| water use efficiency demand / management | where water is scarce in comparison to the demands upon it, it is important to use it efficiently (in both physical and economic terms), this may require *inter-alia* the development of infrastructure to increase return flows, or to transfer water saved in one location for use in another | where water is scarce in comparison to the demands upon it, it is important manage demand rather than satisfying it. | | | | it is important to understand and apply efficiency targets that are appropriate for a particular scale (ie engineering efficiency at scheme level and economic efficiency at basin level), it is also important to provide effective mechanisms for reallocating saved water in he most advantageous fashion | | |
| watershed degradation (destruction of forests) | watershed degradation decreases the manageability of water, and hence its development potential | | | | | | | self-evident connections to the area of concern |
| wetland degradation | | if wetlands are to be sustainable, there is a maximum that can be safely withdrawn for other uses | | | | agricultural run-off can compromise the sustainability and biodiversity of wetlands | | self-evident connections to the area of concern |

Track 3 is concerned with the preparation and implementation of new consultative, in-country Nile projects. Its Development Objective is "*People centred productive and sustainable use of in-country shared Nile water resources reaching economic cooperation*". The following focal areas refer:

- Agriculture
- Re-afforestation
- Wetland conservation
- Fisheries
- Hydropower
- Watershed management
- Flood and drought control
- Tourism
- River basin planning and development

Programmes currently being implemented under this aegis include:

- Mara River Basin Project Transboundary IWRM Project (Kenya and Tanzania)
- Sio-Malaba-Malakisi Catchments Transboundary IWRM Project (Kenya and Uganda)
- Kagera River Basin Transboundary IWRM Project (Burundi/Rwanda/Uganda/Tanzania)
- Lakes Edward and Albert Fisheries Pilot Project (Uganda/DRC)
- Lake Victoria Environmental Management Project II (Burundi/Rwanda/Kenya/Ugand and Tanzania)
- Regional Rusumo Falls Hydropower and Multipurpose Project (Rwanda/Burundi/Tanzania)
- Regional Interconnection Project (Rwanda/Burundi/Kenya/Tanzania/DRC).

With the exception of transboundary parks as a specific concern, the profound nexus between the NELSAP and the areas of concern identified above is clear.

With respect to ENSAP, initiatives focus on the following areas:

- **Irrigation and drainage**, under the aegis of he Eastern Nile Irrigation and Drainage Study, which itself is targeted at the following projects:

  - Irrigation and Drainage Project for Egypt
  - Irrigation and Drainage Project for Ethiopia
  - Irrigation and Drainage Project for Sudan

- **Energy** under the aegis of the Eastern Nile Regional Power Trade Investment Program. This is intended to promote regional power trade through coordinated planning and development of power projects and transmission interconnection in the context of multi-purpose water resources development.

- **Flood forecasting and preparedness**, under the aegis of the Eastern Nile Flood Preparedness and Early Warning – Phase I. FPEW I is planned for 3 years of implementation. It comprises three key components:

  - Regional Coordination
  - Pilot Flood Preparedness and Emergency Response
  - Flood Forecasting, Warning and Communication Systems

- **Optimal water resources allocation and development** under the aegis of the Eastern Nile Joint Multipurpose Program which is targeted at:

- Improved Livelihoods & Well-being
- Accelerated economic development & growth
- Increased Regional cooperation & integration
- Improved Environment
- Increased Access to Hydro-power
- Improved management of watershed
- Productive agricultural use of water resources
- Water conservation improved
- Flood/drought preparedness improved

- **Watershed degradation** under the aegis of the Integrated Watershed Management for which expected benefits will include erosion control leading to decreased siltation and sedimentation in downstream river/reservoir reaches, which will increase reservoir life, improve hydropower production and irrigation efficiency, as well as protect critical aquatic habitats. A second important regional benefit, which the sub-project will generate, is an overall increase in land productivity, which will yield higher agricultural outputs, and thus enhance food security and alleviate poverty.

Thus, as with the NELSAP initiatives, there is also a very close conformity between the identified areas of concern and the NELSAP foci.

## 4.4 Areas of Concern, Sample Decisions and the DSS Outputs Suggested by them.

For the purpose of conceptual design of the NB DSS, it is necessary at this stage of the analysis to suggest sample decisions typical of those that are likely to be supported in respect of the eight areas of concern, and thereafter to suggest also the nature of the DSS questions and outputs necessary to support these decisions.

Table 4.16 which consequently follows has been developed in a step wise fashion, beginning with a preliminary version proposed by the consultants in the first draft of this report (issued 13th January 2008) based on the consolidated results of stakeholder consultations. A second version was begun at the 2nd Regional Workshop (by Working Group A) and completed by experts at the NBI, followed by further amendments by the consultants.

The alternatives, sample decisions, questions and DSS outputs (criteria) in table 4.16 are formulated to guide the identification of models and data required for these outputs to be calculated. In the course of DSS design they have been translated into a set of core models and evaluation routines that can, together with (geo)statistical analysis and report generation tools, describe the individual alternatives and produce the required outputs (see Annex B, summary in the Main Report). A list and description of criteria the models can directly and reliably produce is provided in Annex B, section 4.5.1.

**Table 4.16 Areas of Concern, Sample Decisions and Supporting DSS Outputs**

| Water Resources Development | | | | |
|---|---|---|---|---|
| This concern area focuses on those interventions targeted at altering the time and space distribution of water in the basin. Typical measures that are addressed are: storage reservoirs, water conservation interventions for reducing system losses, etc. Sectoral interventions, such as hydropower and irrigation are treated separately. As storage reservoirs can be part of sectoral development, some of the key questions are also relevant in those cases.<br>Relevant examples form the Nile Basin include existing and contemplated storage dams for power generation, such as the Rusumo Falls in the NEL region, the Mandaya, Karadobi, Dal 1 dams in the EN. Existing storage schemes include the Roseries and High Aswan Dams, etc. Also potential benefits and adverse impacts of interventions planned to reduce system losses shall be studied with the help of the DSS. These are few examples and over time it is anticipated that the need to develop further regulation and conservation works demands flexible DSS design to address pertinent issues.<br>The DSS shall be able to provide information required to identify potential merits and adverse impacts of such interventions. Examples of such decisions and key questions, which can be answered through the information generated by the DSS are given below. | | | | |
| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
| Increased availability of water throughout the basin | • A few, large, basin level storage structures<br>• Myriad small local level water harvesting schemes<br>• Water conservation projects (loss reduction) | • Selection of investment alternatives (e.g. small number of large, basin level storage facilities, or large number of small, local level storage facilities, or a combination of various alternatives?)<br>• Configuration of the overall (macro level) system-wide water development plan<br>• Determination of features of development schemes (location, scale of development, size of components) | • What are the magnitudes of demands that the storage alternatives could fulfil?<br>• What is the yield of the upstream catchment at the point of interest for the planned scheme at different levels of reliability?<br>• What would be the reliability of a storage reservoir to meet the demands imposed on it? How would the reliability be affected due to climate change and variability?<br>• What is the impact (+/-) of the intervention alternatives on flow: system wide water balance; peak and minimum flow at designated points?<br>• How would key environmental assets be affected due to the flow regulation resulting from each alternative? | Bio-Physical/Environment<br>Change in volume of water available:<br>1. System wide (water balance)<br>2. At designated points in the river network (such as environmental hotspots, other points of interest)<br>Impact in salt-water intrusion (as a result of flow regulation upstream)<br>Change in sediment movement downstream<br>Effect on navigable water reaches (draft, length of reaches, etc)<br>Change in annual dead storage volumes due to upstream sediment trapped<br>etc |

| | | | | |
|---|---|---|---|---|
| | | | • What are the economic impacts of the alternative schemes? How many people will be displaced due to the planned storage scheme?<br>• How would the flow regulations resulting from each alternative affect societies downstream?<br>• What is the impact of each alternative on fisheries gene pools<br>• Who is better/worse off for each alternative ? | Socio-Economic<br>Change in benefits due to upstream sediment trapped<br>Impacts on Navigation (gain/loss of revenue as a result of implementing alternative)<br>FIRR/EIRR (or B/C) of alternative; or economic and financial unit costs of increased water<br>1. No of people t o be located (from reservoir area)<br>2. Change on no of people with access to safe water |

## Optimal Water Resources Utilization

The focus here shall be those planning decisions required to enhance utilization of available water resources. It focuses on mainly non-structural interventions that would lead to more sustainable and efficient utilization of available water resources. Examples of interventions that fall under this category are joint/coordinated operation of reservoirs, demand management, modernization of agricultural practices (in subsequent phases), etc.

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Increased efficiency of water use at the basin level resulting from increased engineering efficiency at user level | • User financed water saving equipment and infrastructure<br>• Subsidised water saving equipment and infrastructure<br>• Demand management by means of a basin wide, rights based; water resource pricing mechanism<br>• Changed operating rules for large storage dams<br>• A combination of the above | • Comparison of alternative ways of increasing system efficiency, e.g.<br>– basin wide resource priced demand management mechanism<br>– investments in water saving infrastructure and equipment<br>– subsidising of increased engineering efficiency at user level<br>– introduction of penalties for wastage<br>– changes of operating rules for dams | • Where in the basin exist opportunities for enhancing the physical and/or economic efficiency of water use?<br>• Where are the major losses in the system?<br>• How would water utilization be enhanced if available storage is operated in a coordinated manner?<br><br>• Can water be allocated advantageously to high value uses without compromising access to it by the poor under the possible alternatives?<br>• What are the investment implications for making water more economically mobile?<br>• What are the economic benefits accruing to each alternative? | Bio-Physical/Environment<br>Net gain in water availability at basin and specific locations<br>Impact (+/-) of contemplated alternative on downstream water flow<br><br>Socio-Economic<br>Net financial and economic productivity of water at basin level<br>Impacts on recession agriculture downstream (reduction in grain production, etc)<br>FIRR/EIRR (or B/C) of alternative; or economic and financial unit costs of increased water |

## Coping with Floods

Priority with respect to this area of concern would be to support flood risk-management efforts in riparian countries. Main focus in the first phase of the DSS shall be to provide information on characteristics of flood prone areas, flow generation, assessing impacts of storage reservoirs on flood control, etc.

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Reduced losses of life and livelihood in flood prone areas | • Changed operating rules of large storage dams<br>• Flood management infrastructure<br>• Restored flood plain functions<br>• A combination of the above | • Determination / selection of the most feasible flood-control schemes or mechanisms, e.g.<br>– Changing operating rules of existing dams<br>– Building of new dams for flood control purposes<br>– Restoration of flood plain functions | • What would be the impact of contemplated alternatives on flood peaks and areas of inundation?<br>• What are the flood peaks at designated points of interest, with and without planned interventions?<br>• How much flood damage can be avoided if storage reservoirs can be operated differently? Which operation rule produces the least flood damage?<br>• Which parts of the basin are flood prone? What is the type of land-use practiced in these areas?<br>• What are the average annual flood damages?<br>• How would the proposed interventions affect downstream countries?<br>• What the economic costs and benefits of each alternative | Bio-Physical/Environment<br>Peak flow conditions at designated points along the river network<br>Changes to inundation patterns at designated flood prone areas<br>Flood mitigation/control benefits<br>Changes to the annual hydrograph and regime cycles that would impact capture fisheries<br>Socio-Economic<br>FIRR/EIRR (or B/C) of alternatives |

## Coping with Droughts

Priority in this area of concern shall be to support drought management efforts. Examples of areas where the DSS can contribute include identifying priority areas for interventions, evaluating degrees of vulnerability to drought impacts, evaluating performances of selected planned/implemented measures in alleviating drought impacts, etc.

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Effective drought adaptation and mitigation strategies | • Adapt to increasing drought conditions by increasing storage facilities<br>• Adapt to increasing drought conditions by increasing (conjunctive) use of groundwater<br>• Mitigate droughts by crop diversification and changing farming systems<br>• A combination of the above | • Comparison of alternative measures to enhance the resilience of the system to drought and reduce vulnerability<br>• Development of adaptation and mitigation strategies | • What are the historical patterns of drought (rainfall, flow, etc) in the basin?<br>• What are the inflow and climatic conditions in the short and medium term? (rainfall and flow forecasting)<br>• What are the degrees of vulnerability to drought (for different parts of the basin)<br>• How would performance of the system improve with respect to coping with drought if managed differently? (for example, if more flow regulation is provided?)<br>• How would the system respond to anticipated shortages<br>• How would the proposed interventions affect downstream countries?<br>• What are comparative costs and benefits of adaptation versus mitigation measures?<br>• What are the economic benefits accruing to each alternative? | Bio-Physical/Environment<br>Information on severity of drought (Drought index and comparisons with earlier events)<br>Predictions of flow conditions for short to medium term<br>Operational updates on status of water availability in the basin (reservoirs, lakes, river flows, etc)<br>Effect on availability of water during times of drought<br><br>Socio-Economic<br>FIRR/EIRR (or B/C) of alternatives |

## Energy Production

This concern area focuses on development of hydropower potentials in the basin. The DSS shall support the efforts in the planning and management of hydro schemes.

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Reliable power at adequate levels throughout the basin | • Regional power trading based on a common grid and existing capacity<br>• Increase the installed hydropower generating capacity<br>• Feed into a common grid<br>• Focus on national or sub-regional self sufficiency | • Selection of investment alternatives<br>• Determining scale of development for new schemes<br>• Optimisation of scheme design and operation rules to best suit emerging needs<br>• Evaluation of hydropower compared to other possible solutions to the energy problem | • How much generation capacity is available in the Nile Basin (by country)?<br>• How much energy can be generated for a given configuration (of storage and power plant)?<br>• What are the economic benefits accruing to each alternative?<br>• How would existing hydropower generation schemes be affected due to the planned alternative (energy produced, unit cost, etc)<br>• What is the overall system-wide benefit in terms of energy generation under the various alternatives?<br>• What are the tradeoffs (sectoral and by country) necessary under each alternative? | Bio-Physical/Environment<br>Increase in energy supplies (GWh/y); contemplated alternative and system wide<br><br>Socio-Economic<br>Unit costs of energy<br>FIRR/EIRR (or B/C) of alternatives including tradeoffs with other alternatives (thermal, etc) and sectors (irrigation, flood control, etc) |

## Rain fed and irrigated agriculture

This area focuses on assessing current productivity and production levels of both rain fed and irrigated agriculture, supporting efforts to increase food production through relevant interventions, etc.

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Undeveloped irrigation potential fully realised in a sustainable fashion | • Run-of-river schemes<br>• Storage based schemes<br>• Groundwater based schemes<br>• Conjunctive use schemes<br>• Supplementary irrigation schemes | • Selection of investment alternatives<br>• Prioritisation of areas for irrigation development<br>• Determining type and scale of development for new schemes<br>• Optimisation of scheme efficiency<br>• Minimisation of negative impacts | • Which parts of the basin rely on rain fed agriculture (spatial information)? And which parts rely on irrigation?<br>• What is the productivity level of agriculture in the Nile Basin? For rain fed and irrigated agriculture; what are the contributions of each to food production/security in the basin?<br>• What are the crop water requirements for major growing areas in the Nile Basin?<br>• How would rainfall variability affect crop production?<br>• What is the effect on environmental/riparian streamflows for the various alternatives? Is there a hidden economic cost?<br>• How much water is required for the specific irrigation developments in question? What is the trade-off with other uses (by sector and u/s – d/s)<br>• What are the economic benefits accruing to each alternative | Bio-Physical/Environment<br>Distribution of crop growing areas (rain fed and irrigated, spate)<br>Change (+/-) in grain production and effect on community livelihood (poverty alleviation) (comparison among alternatives);<br>Crop water requirements for selected points of interest<br>Effect in flow at designated points (environmental stream flow) and overall system water balance<br>Socio Economic<br>Impact on human livelihoods<br>Economic productivity of water at basin or sub-basin level<br>FIRR/EIRR (or B/C) of alternatives |

## Concern Area: Navigation

The focus in the first phase of DSS development would be to identify how navigation might be affected by contemplated interventions and support efforts to minimize the adverse impacts. In addition, more proactively, if required, navigation benefits can be considered in the planning and management of storage schemes. Interventions for improving channels or lake navigation may also be considered

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Navigation in the Basin not constrained by inadequate draft depths | • Increase and maintain draft depths by releases from storage dams<br>• Increase and maintain draft depths by dredging<br>• A combination of both | • Selection between alternatives<br>• Optimisation of operation rules (releases from storage dams) to minimise impacts on navigation potentials of rivers and lakes downstream | • Which parts of the river system are navigable and what are their characteristics (length of reach, width, depth, minimum depth requirements, etc)<br>• What is the likely impact of an upstream development (water abstraction, flood releases, flow regulation), etc<br>• What would be the impact of sediment transport on navigation potential?<br>• What are impacts of anticipated climatic variability on navigable reaches and lakes for each alternative? | Bio-Physical/Environment<br>Impacts on navigation potential of navigable reaches and water bodies |
| | | | • What would be the annual transport capacities of the reaches (tons) and what is their economic value for the alternative approaches?<br>• What are the economic benefits accruing to each alternative | Socio Economic<br>FIRR/EIRR (or B/C) of alternatives |

## Watershed and Sediment Management

Potential scope of DSS with respect to this area of concern would be evaluation of impacts of alternative land use/cover on hydrology of the river system, estimation of sediment yield, reservoir sedimentation, etc.

| Objective | Possible Alternatives | Sample Decisions | DSS Questions | DSS Outputs (Criteria) |
|---|---|---|---|---|
| Economic development in the basin not constrained by excessive sediment or un-natural turbidity cycles | • Large scale terracing<br>• Agroforestry<br>• Sediment interception structures | • Comparison of alternative strategies<br>• Identiification of priority areas of intervention<br>• Determining sizes of dead storage for reservoirs | • Which watersheds of the Nile Basin are most severely degraded? How does this relate to population pressure?<br>• What is the sediment yield distribution by basin/watershed?<br>• What is the expected sediment yield with/without a planned intervention? | Bio-Physical/Environment<br>Change in sediment movement (quantity)<br>Change in reservoir/canal sedimentation downstream<br>Changes in channel morphology downstream<br>Change in erosion rate<br>Effect on water availability<br>1. System wide water balance<br>2. Change in peak/minim flow downstream<br>Change in hydrology of wetland: Depth of water, areal extent, flow hydrograph, etc; |
| | | | • What are the economic benefits accruing to each alternative | Socio Economic<br>FIRR/EIRR (or B/C) of alternatives |

# Appendix A1

## Workshop Presentations and Forms

### Presentation 1: What is a DSS?

Presentation 1 deemed to be inserted (file has been submitted previously to NBI)

### Presentation 2: Issues, Themes and Decisions

Presentation 2 deemed to be inserted (file has been submitted previously to NBI)

### Table A1.1 Weighted Scores by Uganda Group 1

| | Society | Economy | Environment | Regional Collaboration | Total | Weighted total |
|---|---|---|---|---|---|---|
| **Weighting Factor** | 4 | 4 | 4 | 2 | | |
| Biodiversity conservation | 4 | 3 | 4 | 2 | 13 | 48 |
| Increased energy demand | 4 | 4 | 4 | 3 | 15 | 54 |
| Rain fed agriculture | 4 | 4 | 3 | 1 | 12 | 46 |
| Water Quality - pollution | 4 | 4 | 4 | 4 | 16 | 56 |
| Water resources availability | 4 | 4 | 3 | 1 | 12 | 46 |
| Conflicts in water use (pastoralists etc) | 3 | 3 | 3 | 4 | 13 | 44 |
| Coping with droughts and floods; | 4 | 3 | 4 | 1 | 12 | 46 |
| Population structure/settlement patterns | 4 | 2 | 3 | 1 | 10 | 38 |
| Water supply and sanitation | 4 | 4 | 3 | 1 | 12 | 46 |
| Watershed degradation (Destruction of natural forests) | 4 | 4 | 4 | 3 | 15 | 54 |
| Wetlands degradation | 2 | 3 | 4 | 1 | 10 | 38 |
| Irrigation | 3 | 4 | 3 | 4 | 14 | 48 |

### Table A1.2 Weighted Scores by Uganda Group 2

| | Society | Economy | Environment | Regional Collaboration | Total | Weighted total |
|---|---|---|---|---|---|---|
| **Weighting Factor** | 4 | 3 | 4 | 3 | | |
| Biodiversity conservation | 4 | 3 | 4 | 2 | 13 | 47 |
| Increased energy demand | 4 | 4 | 4 | 2 | 14 | 50 |
| Rain fed agriculture | 4 | 4 | 3 | 2 | 13 | 46 |
| Water Quality - pollution | 4 | 3 | 4 | 3 | 14 | 50 |
| Water resources availability | 4 | 3 | 4 | 3 | 14 | 50 |
| Conflicts in water use (pastoralists etc) | 3 | 3 | 2 | 3 | 11 | 38 |
| Coping with droughts and floods; | 4 | 3 | 3 | 2 | 12 | 43 |
| Population structure/settlement patterns | 4 | 3 | 3 | 1 | 11 | 40 |
| Water supply and sanitation | 4 | 3 | 4 | 2 | 13 | 47 |
| Watershed degradation (Destruction of natural forests) | 4 | 4 | 4 | 3 | 15 | 53 |
| Wetlands degradation | 4 | 4 | 4 | 3 | 15 | 53 |
| Irrigation | 3 | 3 | 3 | 2 | 11 | 39 |

## Table A1.3 Weighted Scores by Uganda Group 3

| | Society | Economy | Environment | Regional Collaboration | Total | Weighted total |
|---|---|---|---|---|---|---|
| **Weighting Factor** | 4 | 4 | 2 | 2 | | |
| Biodiversity conservation | 3 | 3 | 4 | 1 | 11 | 34 |
| Increased energy demand | 4 | 4 | 3 | 3 | 14 | 44 |
| Rain fed agriculture | 4 | 4 | 3 | 2 | 13 | 42 |
| Water Quality - pollution | 3 | 3 | 4 | 3 | 13 | 38 |
| Water resources availability | 4 | 4 | 4 | 3 | 15 | 46 |
| Conflicts in water use (pastoralists etc) | 3 | 2 | 2 | 3 | 10 | 30 |
| Coping with droughts and floods; | 4 | 3 | 3 | 2 | 12 | 38 |
| Population structure/settlement patterns | 4 | 4 | 3 | 1 | 12 | 40 |
| Water supply and sanitation | 4 | 3 | 3 | 1 | 11 | 36 |
| Watershed degradation (Destruction of natural forests) | 4 | 3 | 4 | 2 | 13 | 40 |
| Wetlands degradation | 3 | 3 | 4 | 2 | 12 | 36 |
| Irrigation | 3 | 4 | 2 | 2 | 11 | 36 |

## Table A1.4 Average Weighted Scores for the Uganda Specific Concerns

| | Society | Economy | Environment | Regional Collaboration | Total | Weighted total |
|---|---|---|---|---|---|---|
| **Weighting Factor** | 4.00 | 3.67 | 3.33 | 2.33 | | |
| Biodiversity conservation | 3.67 | 3.00 | 4.00 | 1.67 | 12.33 | 42.89 |
| Increased energy demand | 4.00 | 4.00 | 3.67 | 2.67 | 14.33 | 49.11 |
| Rain fed agriculture | 4.00 | 4.00 | 3.00 | 1.67 | 12.67 | 44.56 |
| Water Quality - pollution | 3.67 | 3.33 | 4.00 | 3.33 | 14.33 | 48.00 |
| Water resources availability | 4.00 | 3.67 | 3.67 | 2.33 | 13.67 | 47.11 |
| Conflicts in water use (pastoralists etc) | 3.00 | 2.67 | 2.33 | 3.33 | 11.33 | 37.33 |
| Coping with droughts and floods; | 4.00 | 3.00 | 3.33 | 1.67 | 12.00 | 42.00 |
| Population structure/settlement patterns | 4.00 | 3.00 | 3.00 | 1.00 | 11.00 | 39.33 |
| Water supply and sanitation | 4.00 | 3.33 | 3.33 | 1.33 | 12.00 | 42.44 |
| Watershed degradation (Destruction of natural forests) | 4.00 | 3.67 | 4.00 | 2.67 | 14.33 | 49.00 |
| Wetlands degradation | 3.00 | 3.33 | 4.00 | 2.00 | 12.33 | 42.22 |
| Irrigation | 3.00 | 3.67 | 2.67 | 2.67 | 12.00 | 40.56 |

## Table A1.5 Weighted Ranking of the Uganda Specific Concerns

| RANKING | |
|---|---|
| Increased energy demand | 49.11 |
| Watershed degradation (Destruction of natural forests) | 49.00 |
| Water Quality - pollution | 48.00 |
| Water resources availability | 47.11 |
| Rain fed agriculture | 44.56 |
| Biodiversity conservation | 42.89 |
| Water supply and sanitation | 42.44 |
| Wetlands degradation | 42.22 |
| Coping with droughts and floods; | 42.00 |
| Irrigation | 40.56 |
| Population structure/settlement patterns | 39.33 |
| Conflicts in water use (pastoralists etc) | 37.33 |

### Presentation 3: Criteria and Indicators

Presentation 3 deemed to be inserted (file has been submitted previously to NBI)

**Table A1.6 Working Session 4: Uganda Break Out Group 3 Results**

| | | | | |
|---|---|---|---|---|
| COUNTRY / SUB-REGION | NEL-UGANDA | | | Working Group N°. 3 |
| THEMATIC CATEGORY (SECTOR) | Water | | | |
| KEY ISSUE | Water pollution | | | |
| OBJECTIVE | Water pollution levels reduced to 20% of current levels by 2020 | | | |
| INTERVENTION | Strengthen regulatory mechanisms | | | |
| OUTPUT | Reduce water pollution | | | |
| EXTERNALITIES | Non harmonised water laws in the region | | | |
| RANKING | 3 | | | |
| ALTERNATIVES | | | | |
| 1 | Introduce incentives to encourage compliance | | | |
| 2 | Improve monitoring performance | | | |
| 3 | Involve community participation in monitoring and enforcement | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| CRITERIA | | INDICATORS | MODEL CATEGORY | DATA / INFORMATION |
| Society | | | | |
| 1 | Reduce the number of water related diseases 15/1000/year | Number of cases of water borne diseases | | |
| 2 | Number of cases of non compliance reduced by 85% | Number of cases of non compliance | | |
| | | | | |
| Economy | | | | |
| 1 | Reduction water treatment costs to x/m³ | Unit costs of water treatment | | |
| 2 | Increased fish catch per work days x% | Fish catch rates | | |
| Environment | | | | |
| 1 | Reduction N by x% | Levels of N | | |
| 2 | Reduction P by x% | Levels of P | | |
| 3 | Reduction in water hyacinth by 50% | Area of water hyacinth | | |
| | | | | |

**Presentation 4: Models and Tools**

Presentation 4 deemed to be inserted (file has been submitted previously to NBI)

**Table A1.7 Working Session 5: Uganda Break Out Group 3 Results**

| | | | | |
|---|---|---|---|---|
| COUNTRY / SUB-REGION | NEL-UGANDA | | | Working Group N°. 3 |
| THEMATIC CATEGORY (SECTOR) | Water | | | |
| KEY ISSUE | Water pollution | | | |
| OBJECTIVE | Water pollution levels reduced to 20% of current levels by 2020 | | | |
| INTERVENTION | Strengthen regulatory mechanisms | | | |
| OUTPUT | Reduce water pollution | | | |
| EXTERNALITIES | Non harmonised water laws in the region | | | |
| RANKING | 3 | | | |
| ALTERNATIVES | | | | |
| 1 | Introduce incentives to encourage compliance | | | |
| 2 | Improve monitoring performance | | | |
| 3 | Involve community participation in monitoring and enforcement | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| CRITERIA | | INDICATORS | MODEL CATEGORY | DATA / INFORMATION |
| Society | | | | |
| 1 | Reduce the number of water related diseases 15/1000/year | Number of cases of water borne diseases | Disease prevalence model | Demographic data, water use data, historic water quality data |
| 2 | Number of cases of non compliance reduced by 85% | Number of cases of non compliance | Social behaviour model | Number of potential polluters, demographic data |
| | | | | |
| Economy | | | | |
| 1 | Reduction water treatment costs to x/m³ | Unit costs of water treatment | Financial model | Unit costs of construction and operation, water quality |
| 2 | Increased fish catch per work days x% | Fish catch rates | Fish yield model | Fish population, nutrient level water quality |
| Environment | | | | |
| 1 | Reduction N by x% | Levels of N | Surface water quality | Historic N run off, stream flows |
| 2 | Reduction P by x% | Levels of P | Surface water quality | Historic P run off, stream flows |
| 3 | Reduction in water hyacinth by 50% | Area of water hyacinth | Aquatic weed model | Levels of N and P, spatial rates of hyacinth development, total water surface area, surface stream flow |
| | | | Nutrient – water hyacinth growth model | growth rate of ater hyacinth |

**Presentation 5: Institutional Options for Transboundary River Basin Planning and DSS development**

Presentation 5 deemed to be inserted (file has been submitted previously to NBI)

## Table A1.8 Training Needs Assessment Table

| Target group | Topics | Content of Possible Training Module | Relevance for DSS | Skills already available |
|---|---|---|---|---|
| | | | Score | Score |
| **Management level** | The project | Overview on the NB-DSS project, goals achieved, special problems on Basin, Regional, and Country levels, and the main strategies where to apply the DSS | | |
| | NB-DSS legal framework | Description of the NB organization, legal framework, statutory work, transboundary legal framework | | |
| | Demos | Show topics of the system operation, case studies, results, and generation of reports. | | |
| | Advantages | Summarize advantages of applying DSS for planning purposes | | |
| | Case management functionality | Detailed training course for the financial and administrative component of the DSS solution – managing of the cases. User management system functionality – user rights, roles and groups; | | |
| | System functionality overview | Other system functionalities – overview. System output | | |
| | Economic analysis | Basic theoretical background of economic models, cost -benefit analysis, long term return, payback calculations | | |
| **Operator Level** | Database installation and administration | Definition of users and rules, definition of access rights, analysis of the log file, understanding the implementation of the user administration. Data base backup, other data backup, total/incremental | | |
| | Basic GIS software installation and administration | Basic software license management. Requirements of the GIS software and administration. Managing local settings, printers, plotters etc. | | |
| | IT system solution installation & administration | Installation of the IT system, components modules and requirements. IT system solution environment – templates, fonts, localization | | |
| | Networking of the system | Network set-ups, fire walls, XML scripts for data synchronization, data base replication via network, | | |
| | Database structure, datasets, topology, topology rules | Detailed learning of the database structure and datasets. Knowledge about topology and topology levels. Topology rules and errors | | |
| | Data formats and consistency | Detailed learning about national data standards. Data transfer formats, files – structure of the records, XML and GML data exchange | | |
| | Data migration procedures | Detailed learning about data migration, process of validation, error marks, data assessment and reporting. | | |
| **Professional level (up to expert level)** | Basic GIS training course | The introduction to GIS course gives knowledge for databases, basic SQL, mapping, data editing etc | | |
| | Decision-making | Introduction in the decision-making procedure, definitions, and rules. | | |
| | DSS solution components and modules, functionality | Detailed learning about the DSS functionality. The course covers all modules of the DSS solution | | |
| | DSS outputs | Reports generating, different layout preparation, peripheral devices usage – printers, plotters etc | | |
| | Model and scenario building | The course covers all the generic modelling tools of the DSS that are needed for building a scenario and for calibrating it. The course includes multi-criteria analysis and sensitivity analysis and other group decision- | | |
| | Economic analysis | Basic theoretical background of economic models, cost -benefit analysis, long term return, payback calculations | | |
| **Decision maker level** | Basic GIS training course | The introduction to GIS course gives knowledge for databases, basic SQL, mapping, data editing etc | | |
| | Decision-making | Introduction in the decision-making procedure, definitions, and rules. | | |
| | DSS solution components and modules, functionality | Detailed learning about the DSS functionality. The course covers all modules of the DSS solution | | |
| | DSS outputs | Reports generating, different layout preparation, peripheral devices usage – printers, plotters etc | | |
| | Economic analysis | Basic theoretical background of economic models, cost -benefit analysis, long term return, payback calculations | | |
| **Data provider level** | Data sampling and delivery | On-the-Job_Training for sampling and measuring | | |
| **Preferred learning method** | | **(please indicate)** | **lectures** | **e-learning** |

## Table A1.9 Consolidated Training Needs Assessment – Uganda

| Target group | Topics | Relevance for DSS Group 1 | Skills already available Group 1 | Relevance for DSS Group 2 | Skills already available Group 2 | Relevance for DSS Group 3 | Skills already available Group 3 |
|---|---|---|---|---|---|---|---|
| **Management level** | The project | 4 | 2 | 4 | 2 | 4 | 2 |
| | NB-DSS legal framework | 4 | 2 | 4 | 2 | 4 | 2 |
| | Demos | 3 | 1 | 3 | 1 | 4 | 1 |
| | Advantages | 4 | 2 | 3 | 2 | 3 | 1 |
| | Case management functionality | 2 | 2 | 4 | 1 | 3 | 1 |
| | System functionality overview | 4 | 2 | 3 | 1 | 4 | 1 |
| | Economic analysis | 1 | 1 | 4 | 3 | 4 | 3 |
| **Operator Level** | Database installation and administration | 4 | 1 | 4 | 3 | 4 | 3 |
| | Basic GIS software installation and administration | 4 | 4 | 4 | 3 | 4 | 3 |
| | IT system solution installation and administration | 4 | 1 | 3 | 4 | 4 | 3 |
| | Networking of the system | 4 | 4 | 4 | 3 | 4 | 2 |
| | Database structure, datasets, topology, topology rules | 4 | 4 | 3 | 3 | 4 | 1 |
| | Data formats and consistency | 4 | 4 | 4 | 2 | 4 | 2 |
| | Data migration procedures | 4 | 4 | 4 | 2 | 3 | 2 |
| **Professional level (up to expert level)** | Basic GIS training course | 4 | 4 | 4 | 3 | 4 | 3 |
| | Decision-making | 4 | 4 | 4 | 2 | 4 | 2 |
| | DSS solution components and modules, functionality | 4 | 1 | 4 | 2 | 4 | 1 |
| | DSS outputs | 4 | 1 | 4 | 2 | 4 | 1 |
| | Model and scenario building | 4 | 1 | 4 | 1 | 4 | 1 |
| | Economic analysis | 4 | 4 | 3 | 3 | 4 | 2 |
| **Decision maker level** | Basic GIS training course | 4 | 4 | 3 | 3 | 4 | 2 |
| | Decision-making | 2 | 4 | 4 | 3 | 4 | 1 |
| | DSS solution components and modules, functionality | 4 | 1 | 4 | 1 | 3 | 1 |
| | DSS outputs | 4 | 1 | 4 | 1 | 4 | 1 |
| | Economic analysis | 4 | 4 | 2 | 3 | 3 | 2 |
| **Data provider level** | Data sampling and delivery | 4 | 1 | 4 | 2 | 4 | 3 |
| **Preferred learning method** | | lectures | | lectures | | lectures | |

## Table A1.10 Existing Capacaties Ranked for Uganda

| Table 3.11 Existing Capacities Ranked for Uganda | |
|---|---|
| **Topics** | **Score** |
| Basic GIS training course (professional level) | 3,33 |
| Basic GIS software installation and administration | 3,33 |
| Economic analysis (professional level) | 3,00 |
| Networking of the system | 3,00 |
| Economic analysis (decision maker level) | 3,00 |
| Basic GIS training course (decision maker level) | 3,00 |
| Data migration procedures | 2,67 |
| Database structure, datasets, topology, topology rules | 2,67 |
| Data formats and consistency | 2,67 |
| IT system solution installation and administration | 2,67 |
| Decision-making (professional level) | 2,67 |
| Decision-making (decision maker level) | 2,67 |
| Database installation and administration | 2,33 |
| Economic analysis (management level) | 2,33 |
| Data sampling and delivery | 2,00 |
| The project | 2,00 |
| NB-DSS legal framework | 2,00 |
| Advantages | 1,67 |
| DSS solution components and modules, functionality (prof. level) | 1,33 |
| System functionality overview | 1,33 |
| DSS outputs (professional level) | 1,33 |
| Case management functionality | 1,33 |
| Demos | 1,00 |
| Model and scenario building | 1,00 |
| DSS outputs (decision maker level) | 1,00 |
| DSS solution components and modules, functionality (DM level) | 1,00 |

## Table A1.11 Relevance of Training Topics in Uganda

| Table 3.12 Relevance of Training Topics in Uganda | |
|---|---|
| **Topics** | **Score** |
| Networking of the system | 4,00 |
| Decision-making (professional level) | 4,00 |
| DSS solution components and modules, functionality (prof. level) | 4,00 |
| Data formats and consistency | 4,00 |
| Model and scenario building | 4,00 |
| DSS outputs (professional level) | 4,00 |
| Basic GIS training course (professional level) | 4,00 |
| Data sampling and delivery | 4,00 |
| DSS outputs (decision maker level) | 4,00 |
| Database installation and administration | 4,00 |
| NB-DSS legal framework | 4,00 |
| The project | 4,00 |
| Basic GIS software installation and administration | 4,00 |
| Basic GIS training course (decision maker level) | 3,67 |
| Economic analysis (professional level) | 3,67 |
| DSS solution components and modules, functionality (DM level) | 3,67 |
| IT system solution installation and administration | 3,67 |
| System functionality overview | 3,67 |
| Data migration procedures | 3,67 |
| Database structure, datasets, topology, topology rules | 3,67 |
| Demos | 3,33 |
| Advantages | 3,33 |
| Decision-making (decision maker level) | 3,33 |
| Case management functionality | 3,00 |
| Economic analysis (management level) | 3,00 |
| Economic analysis (decision maker level) | 3,00 |

**Table A1.12 General Consultation Workshop Process**

| SESSION | | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| Sub-Reg'l | National | | |
| Included | Included | Registration | NBI |
| **Opening Session** | | | |
| Included | Included | Welcome Speech | |
| Included | Not included | Official Opening Presentation NB-DSS | Country PMC Member |
| **Working Session 1: Presentations 1 and 2: Introductory Matters** | | | |
| Included | Not included | **Presentation 1** - What is a DSS and What Can it Do? | Consultant |
| Included | Not included | **Plenum** – Questions and Discussions | Consultant |
| Included | Not included | **Presentation 2** - Thematic and Specific Concerns | Consultant |
| Included | Not included | **Plenum** - Question and Discussions | Consultant |
| **Working Session 2: Group Work: Selection and clustering of Specific Concerns** | | | |
| Included | Included | **Briefing** on clustering and pre-selection of concerns | Consultant |
| Included | Included | **Group Work** – Clustering and pre-selections | Break-out Group |
| Included | Included | **Plenum** – Presentations by groups – Clustering/pre-selection | Break-out Group spokesperson |
| Included | Included | **Plenum**- Final-selection of concerns | Facilitated by Consultant |
| **Working Session 3 Group Work: Ranking of the Specific Concerns** | | | |
| Included | Included | **Briefing**- Criteria for ranking the Specific Concerns | Consultant |
| Included | Included | **Group Work** – Ranking the Concerns | Break-out Group |
| Included | Included | **Plenum**- Consolidation of Group rankings | Facilitated by Consultant |
| Included | Included | **Plenum** - Final approval of country level ranking | Facilitated by Consultant |
| **Working Session 4: Group Work: Objectives, Criteria and Indicators etc** | | | |
| Included | Included | **Presentation 3** - Objectives, Alternatives, Criteria and Indicators etc | Consultant |
| Included | Included | **Group Work** –Alternatives criteria and Indicators | Break-out Group |
| Included | Included | **Plenum-** Alternatives criteria and Indicators | Facilitated by Consultant |
| **Working Session 5: Group Work: Models/Tools and Data** | | | |
| Included | Not included | **Presentation 4** – Possible Models/tools | Consultant |

| SESSION | | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| Sub-Reg'l | National | | |
| Included | Not included | **Group Work** – What are the tools (criteria) and data/information requirements (indicators) | Break-out Group |
| Included | Not included | **Plenum** - Discussion | Facilitated by Consultant |
| **Working Session 6: Group Work: Institutional Arrangements** | | | |
| Included | Included | **Presentation 5** – Institutional Concepts | Consultant |
| Included | Included | **Briefing** institutional and human capacity building for DSS | Consultant |
| Included | Included | **Group Work** Capacity building for DSS development | Break-out Group |
| Included | Included | **Analysis** Capacity building for DSS development | Consultant |
| **Working Session 7: Workshop Conclusions** | | | |
| Included | Included | Summary of the Workshop Findings | Consultant |
| Included | Included | Closing Remarks | Guest of Honour or Participant |

# Appendix A2

## Consultation Workshop Results

The table which follows comprises the results of the consultation workshops. It is based on the actual results emanating from the workshops, the contents have not been revised by the Consultant. Any gaps arise because the forms were not fully completed at the workshops.

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| EN | Area of Concern:<br>All Sectors<br>Specific Concern:<br>Droughts | | | Objective:<br>Cope with droughts<br>Externalities:<br>- | 1. Improve reliability of forecast<br>2. Increase watre storage<br>3. Use other potential water resources such as groundwater<br>4. Increase vegetative cover<br>5. Re-allocation of water at times of drought | Society | Reduced loss of life | Lives lost per year | | |
| | | | | | | | Reduced livestock losses | Livestock lost per year | | |
| | | | | | | | Reduced displacement | N° of people displaced | | |
| | | | | | | | Reduced social conflicts | | | |
| | | | | | | | Employment | Jobs lost | | |
| | | | | | | | Reduce health hazarda | | | |
| | | | | | | Economy | Reduced agriculture | Agricultural area lost | | |
| | | | | | | | Impact on hydropower | | | |
| | | | | | | | Reduced national food price | | | |
| | | | | | | | Impact on downstream flows for other countries | Flow volume per year to downstream countries | | |
| EN | Area of Concern:<br>Agriculture and Livestock, Navigation, Energy and Hydropower, Environment and Ecology<br>Specific Concern:<br>Sedimentation of hydraulic structures | | | Objective:<br>Reduce sedimentation of hydraulic structures<br>Externalities:<br>- | 1. Develop efficient dredging and desilting tecnologies<br>2. Afforestation<br>3. Develop alternative energy sources<br>4. Improve land use practices<br>5. Implement soil protection strategy | Society | Reduced land availability | Land area | | |
| | | | | | | Economy | Improved storage capacity | Reservoir volume | | |
| | | | | | | | Reduced canal sediment | Avergae TDS/year | | |
| | | | | | | | Reduced brick industry | | | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 6. Protect vulnerable lands<br>7. Implement physical, biological and social measures<br>8. Develop sediment control structures | | Improved hydropower | GW/year | | |
| | | | | | | Environment | Downstream Sediment load | Tons/year | | |
| | | | | | | | River morphology | River cross section | | |
| | | | | | | | Increased use of fertilisers | Tons/year | | |
| EN | Area of Concern:<br>All Sectors<br>Specific Concern:<br>Water quality deterioration | | | Objective:<br>Conserve & improve water quality<br>Externalities:<br>- | 1. Control of point source pollution<br>2. Implement waste water treatment plants<br>3. Improvement in legislation & enforcement<br>4. Implement public awareness programs | | | | | |
| EN | Area of Concern:<br>Agriculture & livestock<br>Specific Concern:<br>Watershed degradation | | | Objective:<br>Conservation of soil and water<br>Externalities:<br>- | 1. Afforestation<br>2. Develop alternative energy sources<br>3. Improve land use practices<br>4. Implement soil protection strategy<br>5. Protect vulnerable lands<br>6. Implement physical, biological & social measures | | | | | |
| EN | Area of Concern:<br><br>Specific Concern:<br>Low water supply and sanitation coverage | | | Objective:<br>Conserve & improve water quality<br>Externalities:<br>- | 1. Expand infrastructure<br>2. Improve services | | | | | |
| EN | Area of Concern:<br>All Sectors<br>Specific Concern:<br>Floods | | | Objective:<br>Cope with floods<br>Externalities:<br>- | 1. Develop flood mitigation measures<br>2. Improve flood forecasting & preparedness | | | | | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 3. Relocation/ resettlement | | | | | |
| EN | Area of Concern:<br>All Sectors<br>Specific Concern:<br>Inefficient use of water resources | | | Objective:<br>Optimize available water resources utilization options<br>Externalities:<br>- | 1. Implement water efficiency technologies<br>2. Demand management<br>3. Reuse and recycling<br>4. Allocate appropriate water resource and appropriate quality water to different uses and locations | | | | | |
| EN | Area of Concern:<br>All Sectors<br>Specific Concern:<br>Conflicts among water uses | | | Objective:<br>Optimize water utilization<br>Externalities:<br>- | 1. Study current water use<br>2. Increase water availability<br>3. Enhance stakeholder cooperation | | | | | |
| EN | Area of Concern:<br>All Sectors<br>Specific Concern:<br>Water scarcity | | | Objective:<br>Increase water availability<br>Externalities:<br>- | 1. Water conservation projects<br>2. Demand management<br>3. Reuse of water<br>4. Reduction of evaporation<br>5. Develop potential water resources (rainfall harvesting, groundwater)<br>6. Improve irrigation efficiency | Society | Reduced conflicts per country | | | |
| | | | | | | Economy | Volume of additional water conserved for each country | Volume (m3)/ year / country | | |
| | | | | | | | Increased Agriculture Land/ country | Agriculture land (acre)/ country | | |
| | | | | | | | Increased energy/ country | Gega Watt/ year/country | | |
| | | | | | | | Decrease in consumptive use | | | |
| | | | | | | | Increased drinking water supply/country | | | |
| | | | | | | | Improved navigation / country | Reduced bottlenecks | | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Increased fish production | | | |
| | | | | | | | Increased industrial development/ country | | | |
| | | | | | | Environment | Improve water quality | | | |
| | | | | | | | Reduce salt water intrusion | | | |
| | | | | | | | Environmental impact on wetlands & micro climate) | Area of wetlands | | |
| EN | Area of Concern: Agriculture & livestock Specific Concern: Low agriculture & livestock productivity | | | Objective: Increase agriculture & livestock productivity Externalities: - | 1. Irrigation development 2. Rainfall harvesting 3. Ground water development 4. Best agriculture practices/ technologies 5. Soil and Water conservation | | | | | |
| EN | Area of Concern: Energy and hydropower Specific Concern: Increased energy demand | | | Objective: Contribute to meet energy demand through developing hydropower potential Externalities: - | 1. Construct (large-small) hydropower plants transmission networks 2. Explore alternative potentials 3. Power trade | | | | | |
| EN | Area of Concern: Agriculture & livestock Specific Concern: Underdevelopment of irrigation potential | | | Objective: Increase irrigated agriculture Externalities: - | 1. Develop irrigation potentials (new water resources and infra-structure) 2. Increase water use efficiency | | | | | |
| EN | Area of Concern: Navigation Specific Concern: Underdevelopment of navigation potential | | | Objective: Improve and develop navigation potential Externalities: - | 1. Maintain reasonable sink levels 2. Infrastructure development adjusted to navigation needs | | | | | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| NEL | Area of Concern: Environment and ecology<br>Specific Concern: Water Quality – Pollution | Prevent effluents flowing into water bodies , Enforce water quality standards | Clean water and environment – Reach international water standards in the Nile Basin | Objective: Minimize water pollution and maximize water quality<br>Externalities: Climate change, geological factors on soil formation, disasters (disasters on industries)<br>Rank: 1 | 1. Enforcements of laws and regulations<br>2. Increase awareness to the communities<br>3. Construct water treatment plants<br>4. Implement monitoring and warning systems for control of water quality<br>5. Improve storm drainage systems and solid waste management<br>6. Provide waste water treatment for main polluters | Society | Improvement of Public health | % of diseases reduced | Water quality models | Water quality data |
| | | | | | | | | | Rainfall-runoff model | Rainfall, river flow, quality transport data, etc. |
| | | | | | | | | | Groundwater model | |
| | | | | | | Economy | | | | |
| | | | | | | Environment | Improvements of surface water quality | Number of law abiding industries | | |
| | | | | | | | | Quality of outflow water of WWTP | | |
| NEL | Area of Concern: -<br>Specific Concern: Water resources availability - Optimal use of available water | Water conservation – Efficient water supply & irrigation systems | Available and efficiently used water for all stakeholders | Objective: Maximize water availability – Maximize the use of available water – Minimize water losses<br>Externalities: Rainfall variability – Climate Change<br>Rank: 2 | 1. Good water management for available water resources<br>2. Rainwater harvesting<br>3. Reservoir building<br>4. Provide good maintenance of distribution networks<br>5. Use of modern irrigation systems | Society | Public health | Reduced disease incidences | | |
| | | | | | | | Increased income *(better in economy)* | Increased GPD | | |
| | | | | | | | Food production | Reduced number of malnutrition cases | | |
| | | | | | | Economy | Cost efficiency | | | |
| | | | | | | | Households revenues | | | |
| | | | | | | Environment | Harmless for the environment | | | |
| | | | | | | | Reverse environmental degradation | | | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| NEL | Area of Concern: Environment and ecology - navigation<br>Specific Concern: Coping with floods and Droughts | Structural and non-structural works | Safety | Objective: Reduce flood peaks + reduce flood damages + reduce losses of life<br>Externalities: Climate changes<br>Rank: 3 | 1. Structures and dykes<br>2. Early warning system<br>3. Re-planning of the floodplains to avoid risks of farms and buildings<br>4. Insurance for farms and buildings and Crop (non-structural measures) | Society | Risks on houses and buildings | Number of buildings and houses | Data analysis model | 100 year flood for design |
| | | | | | | | Losses of life | Number of persons lost by death | Hydrographical model | Topographic maps |
| | | | | | | | | Number of persons affected | Water flow model | Satellite imageries of flood plains |
| | | | | | | | | | Morphology model | Survey of population and buildings and infrastructures |
| | | | | | | | | | Climate change model | Hydrographs |
| | | | | | | Economy | flood prone infrastructures | Costs of damages | | |
| | | | | | | | risks on agricultural production | Changes of river morphology | | |
| | | | | | | | | WHO measures | | |
| | | | | | | Environment | Pollution of water | | | |
| | | | | | | | Sediment transport | | | |
| | | | | | | | Pest and diseases | | | |
| NEL | Area of Concern: -<br>Specific Concern: Increased energy demand | Build hydropower plants | Cost / benefits effect | Objective: To produce more hydropower to meet the growing energy demand<br>Externalities: | 1. Big dams<br>2. Small dams - Runoff-the-river power plants<br>3. Pumped storage | Society | Resettlements | Number of displaced people | DEM, reservoir operation model | Topography, satellite imagery, |
| | | | | | | | Tourism | Number of tourists | Tourist forecasting models | Number of tourists / year / season |
| | | | | Oil price variations, price of imported | | Economy | Cost-benefits | Cost – benefits ratio | Economic model | Costs of building the system |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | energy<br>Rank:<br>4 | | | Energy prices | Lost of kWh | Economic model | Costs of energy |
| | | | | | | | Tourism | Number of tourists | Forecast model for tourism | Number of tourists / year / season |
| | | | | | | Environment | Flooded areas | Km² | Backwater effects model | Topography, hydrology, values of Water quality parameters |
| | | | | | | | Water quality | Water quality y parameters | Water quality models | Satellite imagery, |
| | | | | | | | Deforestation | Km² | Backwater effects model | |
| | | | | | | | Biodiversity | Number of species | Population dynamics models | Existing data on biodiversity |
| Burundi | Area of Concern:<br>Rationale Management of the water resources for Agriculture and Energy Production<br>Specific Concern:<br>Economic growth and Investment Planning | Planning and Rationale Management Water resources | Economic growth and the well being of the population | Objective:<br>To Satisfy the Basic Needs of the Population<br>Externalities:<br>Climatic variability and the mismanagement of the water resources<br>Rank:<br>1 | 1. Protect the soil against evaporation (It is understood to apply measures like Conservation Agriculture or Mulching techniques)<br>2. Implementation of erosion protection measures (It is understood as the construction of terraces and covering the soil with diversified crops of different types)<br>3. River training and correction of river bed profile (not really comparable | Society | Agriculture production | Increase of 25% within 5 years | Crop optimization models | Demographic data |
| | | | | | | | Farm income | Trend in farm income | Economic model | Socio—economic data |
| | | | | | | | (Improvement of food) | | Statistical tools | Hydro-climatic data |
| | | | | | | | | | | Framers income |
| | | | | | | Economy | Economic growth at the intervention areas | Improvement of 5% within the next 10 years | Statistical packages using trend analysis | Baseline data |
| | | | | | | | Reduction of poverty in the intervention areas | Reduction of the poverty index by 5% | Socio-economic models | Socio-economic data |
| | | | | | | Environment | Soil properties and natural resources | Number of days//a that soil has | Remote sensing (satellite images) | Satellite images |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | alternative)<br>4. Rationale development of wetlands (Area of Concerns another Specific Concern) | | | vegetation cover | Interferometry | |
| | | | | | | | | | Digital elevation models (DEM) | |
| | | | | | | | | | GIS Tools | |
| | | | | | | Regional Collaboration | Good management of common resources | Sediment transport to downstream | Erosion and Sediment transport models | Sediment load |
| | | | | | | | | | | Water quality data (turbidity<) |
| Burundi | Area of Concern:<br>Flood and drought preparedness<br>Specific Concern:<br>Floods & Droughts | Support the responsible water resource services in the forecasting and prevention of floods (& droughts) | Economic growth and increase of the standard of living of the population (well being) | Objective:<br>To contribute to the poverty reduction<br><br>Externalities:<br>Mismanagement or poor agricultural planning policies; unexpected and uncontrolled demographic growth<br>Rank:<br>2 | Sensitization and mobilization of the Communities towards implementation of following protective measures:<br>1. Systematic implementation of flood prevention measures in the catchment areas – hillside terracing applying contour lines<br>2. Restoration of the environment (installation of rural nurseries for soil restoration plant materials; construction of flood protection dams and longitudinal walls (gabion)<br>3. Soil conservation measures, crop rotation or let the | Society | Agricultural production | Income from agricult production | Economic models | Agro-statistical data base |
| | | | | | | | Reduction of endemic diseases | Water quality (coliforms / 100ml) | Estimation through statistical tools | Information on production factors (socio-econ.) |
| | | | | | | | | | | Baseline study (for comparison) |
| | | | | | | | | | | Socio-economic survey data |
| | | | | | | Economy | Poverty reduction | Poverty index | Sustainability analysis through adequate models | Socio-economic survey data |
| | | | | | | | Agricultural production | Income from agricult. production | Cost / benefit analysis models | (See above) |
| | | | | | | | Reduction of the emergency budgetary allocation | Expenditures on emergency actions | Estimation model | Household budget data |
| | | | | | | Environment | Reduction of natural catastrophes | Flooded areas / costs of damages | Floodplain models and flood forecasting models | Hydrometeo data / Digital elevation models |
| | | | | | | | Rehabilitation of the biodiversity | Number of farms under environmental managmt. | Estimation | Value of damaged objects / probability analysis |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | fields lie fallow | | | | | Filed survey data / soil type / land use / Nr. farms |
| | | | | | | | | | | Groundwater level data and groundwater quality |
| | | | | | | Regional Collaboration | Improvement of the water quality at downstream | Sediment transport (water quality – turbidity) | Sediment transport models | Water quality samples (Lab. Aanalysis) |
| | | | | | | | Exchange of production models | Number of farmers participating to exchange progr. | Estimation | Protocols of programs, list of presence |
| Burundi | Area of Concern: Optimal utilisation of available water resources<br>Specific Concern: Water allocation | Integrated water resources management | Basis for a good planning<br>the water resources are well known<br>a coordination unit is installed<br>capacity building needs<br>population sensitization | Objective: Rationale allocation of the water resources<br>Externalities: Climate variability effects, unexpected war<br>Rank: 3 | 1. Construction of agro-storage reservoirs<br>2. Integrated river basin management<br>3. Installation of water harvesting measures (cisterns and artificial recharge wells)<br>4. River training measures for the protection of the river bed | Society | Resettlement of population | Number of households to be resettled | Digital Elevation Model – GIS | Demographic data |
| | | | | | | | Tourism development | Number of tourists per year | Statistical tools (trends in tourism) | Tourism statistics |
| | | | | | | | Aquaculture (fish industry) | Annual fish production | Estimation upon experience with fish ponds | Data from the Fishery Department of the Ministry |
| | | | | | | | Urban development | Number of urbanised areas | Urban planning | Urbanisation planning (Ministry of Urban Development) |
| | | | | | | Economy | Operational costs | Cost / benefit ratio | Economic models | Socio-economic data |
| | | | | | | | Implementation costs | | | |
| | | | | | | Environment | Environmental protection | Number of env. protection measures implemented | GIS maps build upon planned measures | Digitalised maps and Satellite images |
| | | | | | | | Sustainable development | Proportion of land covered by plants | Satellite images – GIS digitalised maps | |
| | | | | | | | | Ratio of area protected to maintain biological | | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Biodiversity to surface area | | |
| | | | | | | Regional Collaboration | Improvement of water quality downstream | Water quality index (turbidity) | Surface Water quality models | Water quality parameters |
| | | | | | | | | | | Flow data observed in the river cross sections |
| | | | | | | | Improvement of water quality downstream | Water quality index (turbidity) | Surface Water quality models | Water quality parameters |
| Burundi | Area of Concern:<br>Soil management and conservation<br>Specific Concern:<br>Land conservation & sediment management | Anti erosion measures | 1. Agri-production improved<br>2. Environment protected<br>3. Soil fertility imroved<br>4. Water quality improved | Objective:<br>Soil restoration and improvement of soil quality<br>Externalities:<br>Causal fire during drought periods<br>Demographic pressure<br>Mining activities<br>Rank:<br>4 | 1. Construction of terraces and anti erosion pits<br>2. Reforestation measures (choice of different species and using contour lines to limit erosion)<br>3. Adapted agricultural practices (management of fertilisers, animal tractors, crop rotation, adapted cultures)<br>4. Capacity building and sensitization of all participants (also policy makers) | Society | Reducing the endemic diseases | Number of malaria and diarrheic diseases | Evaluation with regard to reduction of disease incidences | Malaria monitoring and water quality analysis |
| | | | | | | | | | | Total and fecal Coliform concentration (E.col/100 ml) |
| | | | | | | | Reducing hunger through food security | Food availability for number of households | Estimation of food production for own consumption | Food consumption per capita (socio-economic data) |
| | | | | | | | Poverty alleviation | Poverty index | Estimation of poverty reduction | Poverty index (baseline) |
| | | | | | | Economy | Reducing the accidents (Flooded areas, losses of life) | Number of accidents and houses destroyed | Hydrodynamic reach and floodplain model | Statistical data about flood damages, DEM, Satellite |
| | | | | | | | Increased agricultural production | Farm income | Crop optimization model | Crop data, seas. water demand, soil type |
| | | | | | | | | | Economic model | Type of irrigation, land cover and use, production/ha |
| | | | | | | | | | | Monthly precipitation, sunshine, evapotransp. |
| | | | | | | Environment | Soil vegetation cover (biodiversity) | Increase of soil surface covered with plants | Estimation of plant erosion-resistance | Flood statistics, flood frequency, sat. Images |
| | | | | | | | Improvement of groundwater recharge | Increase in groundwater level and volume ($m^3$) | Water balance model | Hydro-meteorological and climatological data |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | (infiltration) | | | |
| | | | | | | | Water quality | Sediment contents (suspended solids, turbidity) | Sediment transport model | Sediment data´, transport parameters |
| | | | | | | Regional Collaboration | Sediment transport to downstream | Sediment contents (suspended solids, turbidity) | Sediment transport model | Suspended solids in different river stretches |
| | | | | | | | | | River regime analysis model | River network data, GIS maps, Satellite data |
| | | | | | | | | | Water balance | Hydrometeorological data, Flow meter. data, |
| | | | | | | | | | | Rating curves, climatological data |
| DRC | Area of Concern:<br>-<br>Specific Concern:<br>Soim erosion and watershed degradation | | Soil loss less than x mm per yes | Objective:<br>Soil conservation and utilisation without loss<br>Externalities:<br>Climate change, forced migration, illegal forestry<br>Rank:<br>1 | 1. Legislative/regulatory measures and levels, enforcement and payment of compensation<br>2. Technicam measure to mimimise the effects of run-off ( terraces, infilration wells)<br>3. Reforestation<br>4. Alternative sources of energy | Society | Availabilty of energy sources | Cost of energy by household | | |
| | | | | | | | | Distance involved | | |
| | | | | | | Economy | Investment costs | $ per year | | |
| | | | | | | | Reduced infrastructure damage | $ per ha | Probability model that asseses damage | Rainfall intensity, friability of soils and slopes |
| | | | | | | Environmen | Quantity of soil saved | Soil loss in tons/ha | Universal Soil Loss Equation (Wischmeier) | Rainfall intensity, slopes, soil types, vegetative cover |
| | | | | | | | | Area of usable soil that is degraded | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Quality of soil saved | Organic content | | |
| DRC | Area of Concern:<br>-<br>Specific Concern:<br>Provisin of water supply and sanitation facilities | | 49% of the population have access to potable water and 27% to sanitation | Objective:<br>Provide water supply and sanitation facilities<br>Externalities:<br>Finances, political stability and security<br>Rank:<br>4 | 1. Water abstraction infrastructure<br>2. Better managed of water sources and well drilling<br>3. Rainwater harvesting<br>4. Provide individual latrines and public facilities at institutions and public places<br>5. Construction of sewerage systems | Society | Number of benefitting households | Number of benefitting households | Sampling extrapolation | Survey and demographic data |
| | | | | | | | Service level | Distance involved | Sampling extrapolation | Location of villages and water points |
| | | | | | | | | Time taken to collect water | Sampling extrapolation | Survey and demographic data |
| | | | | | | Economy | Investment costs | $ per beneficiaty | | Unit costs |
| | | | | | | | Service costs | Costs per M3 | | |
| | | | | | | Environment | Pollution risks | Coliform counts in well water | Correlation models | Sampling |
| | | | | | | | Risques de pollution des cours d'eau et lacs | Presence of untreated effluence | | |
| | | | | | | Regional Collaboration | Epidemic prevention | | Correlation models | Epidemiological Sampling |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Water Resources Availability | Increase Nile Basin water yield through water conservation projects | | Objective:<br>Increase Water Resources Availability<br><br>Externalities:<br>Climate Change, land cover change<br>Rank:<br>1 | 1. Increase Nile yield through projects for reduction of water losses<br>2. Rainfall harvesting<br>3. Aquatic weed control<br>4. Development of renewable Groundwater resources | Society | Change in available water/capita | M3/ person/ year, and | GCM/ Reg CM/LAM | Satellite, GIS,RADAR, flow meas. |
| | | | | | | | Change in available water/country | M3/country/year | Water balance | Rainfall, Water demand |
| | | | | | | | Increase Living Standard | Income/ Person | Rainfall- Runoff | Land use, topography |
| | | | | | | | Reduce conflict between users | Water conflict (case/ year) | Hydrologic routing | flow measurements |
| | | | | | | | Population Affected | M3/country/year | | |
| | | | | | | Economy | Impact on Agriculture / country | Hectare | | evaporation , evapotranspiration |

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| | | | | | | | Impact on Navigation / country | No. of trip | | Channel cross section |
| | | | | | | | Impact on Industrial Development / country | Income/ person | | |
| | | | | | | | Impact on Energy development / country | GWH/year | | |
| | | | | | | Environment | Impact on Water Quality / country | Water quality Index | Water Quality Models | Hydrological mapping |
| | | | | | | | Impact on Salt Water Intrusion | Productivity of land | Hydrodynamic Models | |
| | | | | | | | Impact on natural wetland / country | Fish productivity | | |
| | | | | | | | Impact on Land degradation | Area km2 | | |
| Egypt | Area of Concern: - Specific Concern: Water Quality | Implement projects to improve and protect water quality | | Objective: Protect and Improve water quality<br>Externalities: Climate Change, demographic change, accidental spillage / and urban, industrial, Agricultural wastewater from other countries<br>Rank: 2 | 1. Water and wastewater treatment projects 2. Pesticides and fertilizers control 3. Public awareness 4. Prohibit the use of POPs 5. Economic Instruments for Pollution Control 6. Pollution control programs for lakes | Society | Impact on health. | Water Born Diseases | Water Quality Models | River flow, WQ parameters, heavy metals |
| | | | | | | | Epidemic diseases | Loss of lives | Statistical analysis, Minitab, etc.. | Death- diseases records |
| | | | | | | Economy | Impact on Standard of life | Income/ person | | On- line Data |
| | | | | | | | Impact on fish production | Income/ person | | |
| | | | | | | | Impact on land Productivity | Income/ person | | |
| | | | | | | | Impact on life stock | Live stock/ person | | |
| | | | | | | Environment | Impact on water quality | Water Quality Index | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Optimal utilization of water resources | Implement projects for optimization of water use | | Objective:<br>Increase water efficiency and productivity<br><br>Externalities:<br>Climate Change, Population<br>Rank:<br>3 | 1. Irrigation improvement projects<br>2. Optimal cropping patterns<br>3. Water re-use<br>4. Water demand management<br>5. Use of appropriate resources for the appropriate use and location | Society | Impact on per capita share of water | M3/person/year | | Consumption/ capita |
| | | | | | | | Effect on downstream flows | M3/year | Nile DST FAO | All data available for Nile basin |
| | | | | | | | Impact on conflict between users | Conflict/water case/person | | |
| | | | | | | Economy | Impact on Agriculture | Income/person | GIS based models and simulation models for flow- Nov.- etc | Cropping patterns- yield |
| | | | | | | | Impact on Navigation | Income/ person | | Climate- system information - data |
| | | | | | | | Impact on industrial Development | Income/ person | | |
| | | | | | | | Impact on Energy development | Income/ person | | |
| | | | | | | | Economic return per unit of water | Income/person | | |
| | | | | | | Environment | Impact on Water Quality | Water quality standards | Optimization model | Water quality data |
| | | | | | | | Impact on Salt Water Intrusion | WQ index | WQ Models | Soil quality data |
| | | | | | | | Impact on natural wetlands | WQ index | | Topographic Maps |
| | | | | | | | Impact on Health | Water born diseases | | |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Agriculture and livestock production | Implement projects to maximize economic return from Agriculture and livestock production | | Objective:<br>Maximize Agriculture and livestock production<br>Externalities: | 1. Improve Rainfed Agriculture<br>2. Supplementary Irrigation<br>3. Groundwater | Society | Food security | Production requirements | Water requirements simulation model | Copping patterns |
| | | | | | | | Employment | Job opportunities | Optimization models | Climate land, etc |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | -<br>Rank:<br>4 | Utilization<br>4. Improve Agriculture and livestock extension services<br>5. Improve regional trade in Agriculture and livestock products | | Development of New communities | Number of new communities | | |
| | | | | | | Economy | Income increase | Increase in GDP | GW monitoring and sanitation | Water consumption |
| | | | | | | | Regional collaboration in agriculture sector | Trading volume in agriculture sector | Conjunctive use models (optimization) | Digital maps |
| | | | | | | | Impact on import/export ratio | Trade balance | Rain fall- run off | |
| | | | | | | | Impact on river flows / country | M3/year/country | | |
| | | | | | | | Impact on livestock | Change of number of heads | | |
| | | | | | | Environment | Health | heavy metals and chemicals | | Metrological data |
| | | | | | | | Impact on water quality / country | WQ index | | |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Droughts | Implement plans & projects to cope with droughts | | Objective:<br>Coping with droughts<br>Externalities:<br>Climate Change<br>Rank:<br>5 | 1. Drought mitigation plans<br>2. Plans for groundwater utilization during droughts<br>3. Increase seasonal storage capacity<br>4. Drought water allocation plans | Society | Employment | Number of jobs | Simulation model | Historical rain falls data |
| | | | | | | | Resettlement | Number of people affected | Climate forecast tools | Historical flow data |
| | | | | | | | Conflicts between sectors | Amount of reduced water per sector | DSS based on environmental balance | Historical temperature data |
| | | | | | | | Conflicts between countries | Amount of reduced water per country | River simulation models | Soil moisture data |
| | | | | | | Economy | Loss of Land | Loss of land/ hectare, agricultural land / capita | | |
| | | | | | | | Impact on hydropower | GWH | | |
| | | | | | | | Navigation | Number of trips per year | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Impact on downstream flows | M3/year/country | | |
| | | | | | | Environment | Impact on downstream water quality | Water Quality Index | | |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Floods | Implement projects to decrease vulnerability to floods | | Objective:<br>Coping with floods<br>Externalities:<br>Climate change, demographics change, land use change<br>Rank:<br>6 | 1. Improve spillway operation<br>2. Groundwater recharge<br>3. Resettlement<br>4. Off stream storage | Society | Employment | Reduce employment losses | Simulation model | Temp (Historical) |
| | | | | | | | Number of affected people | Reduce life losses | Climate forecast tools | Rainfall (Historical) |
| | | | | | | | | | DSS based on environmental balance (SRU) | Soil Moist (Historical) |
| | | | | | | | | | | SST (Sea Surface Temp) |
| | | | | | | Economy | Risk of infrastructure | Efficiency of infrastructure | Hydro-dynamic Model | Water flow levels |
| | | | | | | | Impact on downstream flows / country | M3/year/country | | Cross section |
| | | | | | | Environment | Impact on water quality / country | WQ index | Geomorphologic analysis | Digital Maps, topographic maps |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Increased Population Density | Implement Project to establish new communities | | Objective:<br>Increase the Quality of the life<br>Externalities:<br>Climate Change, Demographic changes<br>Rank:<br>7 | 1. Resettlement<br>2. Horizontal expansion<br>3. Establishing new urban, agricultural, and industrial communities<br>4. Develop new water resources | Society | Improved quality of life | Services coverage | Demographic model | Topographic Maps |
| | | | | | | | Unemployment rate change | Unemployment rate | | Population - % educated population for each country |
| | | | | | | Economy | Increase the income | Income/capita | Socio- economic model | GDP |
| | | | | | | | Protected agriculture land | Area protected / country | | |
| | | | | | | Environment | Impact on Water Quality | Water Quality Index | Water quality model | WQ parameters |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Reduced pollution | Air Quality Index | Air Quality Model | Air quality parameters |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Sedimentation and erosion | Implement project to reduce sedimentation & erosion | | Objective:<br>To reduce sedimentation and erosion<br>Externalities:<br>Climate change, land use partners<br>Rank:<br>8 | 1. Dredging<br>2. Forestation<br>3. Bank Protection<br>4. Protection against sand encroachment | Society | Land availability | Land area/ m2 | Surveying models | Network characteristics |
| | | | | | | | Resettlements | Number of resettled persons | River network analysis | |
| | | | | | | Economy | Impact on storage capacity | Reservoir volume | Reservoir water balance | Reservoir capacity / time |
| | | | | | | | Impact on canal sedimentations | Average TDS/year | Water quality model | Hydropower capacity/ energy capacity |
| | | | | | | | Impact on brick production industry | Brick production | | |
| | | | | | | | Impact on Hydropower | GWH | | |
| | | | | | | Environment | Downstream Sediment load | Tons/ year | | |
| | | | | | | | River morphology | River cross section/morphology | River regime analysis | DEM |
| | | | | | | | Impact on water Quality | WQ Index, heavy metals | Hydrodynamics models | Sedimentation data, water flow data, WQ data |
| | | | | | | | Increase use of fertilizers | Tons/year | Agro-economic model | Topographic Maps |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Water Supply and Sanitation | Implement project to improve Water Supply and Sanitation coverage & services | | Objective:<br>Increase coverage of WS and S<br>Externalities:<br>Demographics<br>Rank:<br>9 | Water Supply<br>1. use of groundwater<br>2. Desalination<br>3. Allocate Financial Resources<br>4. PPP<br>Sanitation<br>1. PPP | Society | Health | No of death and illness/ year | | |
| | | | | | | | People complaints | Water supply capacity (coverage area of supply and sanitation water) | Med. Flow (GW) | |
| | | | | | | | Water supply capacity | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2. Low cost sanitation, environmentally sound technologies | Economy | Health care cost | Budget allocated for health care | | |
| | | | | | | Environment | Reduce surface water pollution | Water quality index | Water quality model | GW Data |
| | | | | | | | Reduce ground water pollution | Water quality index | | Digital maps |
| Egypt | Area of Concern: - Specific Concern: Navigation Potential | Implement navigation improvement projects | | Objective: Navigation improvement and d Development Externalities: - Rank: 10 | 1. Improve navigation channels 2. Develop and improve navigation infrastructure and services | Society | job opportunities created | No. of Employees / year | Economic model | Vessel size/ number/ capacity |
| | | | | | | | Relieve pressure on other transportation means | No. of trips/year | Planning Model | Digital mps |
| | | | | | | | | No. of beneficiaries / year | Hydrodynamic model | Topographic maps |
| | | | | | | Economy | Improved GDP | GDP | | |
| | | | | | | | Increase Trade | Collected taxes $ / year | | |
| | | | | | | | Enhance Tourism | Change in No. of Nile cruises tourists/ year | | |
| | | | | | | Environment | Impact on Water quality | Water quality increments | | |
| | | | | | | | Impact on Biodiversity | Fish Production | | |
| Egypt | Area of Concern: - Specific Concern: Investment Planning | Implement investment projects to maximize socio-economic benefits in the Nile Basin Countries | | Objective: Maximizing socio-economic benefits through multi purpose investment projects/ | 1. Livestock trade 2. Agricultural production and trade 3. Hydropower trade 4. Fisheries | Society | Impact on water quality downstream | Water quality index | Economic model-cost benefit analysis | Economic data (GNP-GDP) |
| | | | | | | | Impact on water quantity downstream | Flow m3/D | Economic sustainability analysis | Live Production |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximize benefits from Investment projects<br>Externalities:<br>International Markets, Climate Change, Population Demand<br>Rank:<br>11 | production<br>5. Navigation projects<br>6. Industrial projects | | Job opportunities | No. of jobs/year | | |
| | | | | | | | Exchange of experts and know how | | | Demographic Data |
| | | | | | | Economy | Hydropower capacity | MW/Day | Hydraulic simulation | |
| | | | | | | | Economic return | GDP $/ year | Water balance | |
| | | | | | | | Quality of life | | Dam operation and simulation | |
| | | | | | | | Impact on river flows pounding | | | |
| | | | | | | Environment | Impact on Water quality / Country | Water quality index | | |
| | | | | | | | Impact on River regime (level/discharge) | Water quality parameter M&m3/day | | |
| | | | | | | | Impact on Pollution (air & soil) | Air & Soil Quality Index | | |
| Egypt | Area of Concern:<br>-<br>Specific Concern:<br>Increased Energy demand | Implement Projects to increase energy production to meet increasing demand | | Objective:<br>Increase energy availability at suitable price<br>Externalities:<br>Climate change, International markets for energyin the region, oil prices<br>Rank:<br>12 | 1. Hydropower plant project<br>2. Bio- mass energy<br>3. Wind energy & solar energy<br>4. Inter connection power trade<br>5. Gas and thernal power plants | Society | Meeting Energy demands | Kwh/ capita | Simulation model | New settlements |
| | | | | | | | Impact on River flows downstream | | Optimization model | |
| | | | | | | Economy | Impact on Energy price | | Hydrodynamic model | |
| | | | | | | | Impact on River flows downstream | | | |
| | | | | | | | Energy benefits / Country | Investment costs – Price of Energy Benefit/Country | | |
| | | | | | | Environment | Impact on Emissions | Air Quality Index | | |

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| | | | | | | | Impact on water quality downstream | Water Quality Index | | |
| Ethiopia | Area of Concern:<br>Irrigation Development<br>Specific Concern:<br>Underveloped irrigation potential | Increase the area of land under irrigation<br>Use of water efficient irrigation technology<br>Increase the area of land under irrigation<br>Use of water efficient irrigation technology | Improved food supply | Objective:<br>Increase agricultural production through irrigation<br>Externalities:<br>Climate change<br>Rank:<br>1 | 1. Intervention 1<br>2. Storage of water (dams/reservoirs)<br>3. Pumping water from reservoirs<br>4. Pumped water from ground water<br>5. Intervention 2<br>6. Drip irrigation<br>7. Sprinkler irrigation<br>8. Sub-surface irrigation | Society | Availability of irrigation water | Amount of water stored/pumped from surface water/pumped from ground water | Water allocation model, Reservoir simulation model | Meteorological , hydrological data, topographic data, water quality data |
| | | | | | | | Efficiency in water utilization | Amount of water used per hectare | Crop Model (Crop-Water Relationship, Yield, fertilization) | Soil map, crop data (water demand, yield/ha, vulnerability) |
| | | | | | | | Reduction in prevalence of water borne diseases | Number of people affected by water borne diseases | Health risk models | Public health data |
| | | | | | | | Increase in rural food supply | Agricultural production | Agronomic model | Socio economic data (sectoral, demographic), |
| | | | | | | Economy | Economic criteria like B-C ratio | Unit costs and benefits per hectare | Economic models (B/C ratio, Internal rate of return, at the project scale) | Information on existing technologies (inv. costs, operation costs, efficiency, ease of operation, |
| | | | | | | | Total power demand | Energy consumptions (KWh per hectare) | | Information on existing technologies (inv. |

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| | | | | | | | | | | costs, operation costs, efficiency, ease of operation, required skills for application (**+2)** |
| | | | | | | Environment | Minimum soil losses (erosion, fertility) | Change in physical and chemical property of soil used | Environmental impacts assessment tools | Soil maps, land use maps, erodibility maps |
| | | | | | | | Thresholds of minimum groundwater level | Decrease of groundwater level | Groundwater models | Groundwater data |
| | | | | | | | Minimum lake levels | Changes in lake and reservoir levels | | Water levels and fluctuations |
| Ethiopia | Area of Concern: Watershed degradation Specific Concern: Destruction of natural forest and soil resources | Increase the area under soil conservation, improved land use practice, preservation of the forest cover and afforestation | Preservation of soil fertility and agricultural productivity | Objective: Preservation of forested areas and increased productivity through increased soil fertility Externalities: Climatic and demographic changes Rank: 2 | 1. Soil erosion protection mechanisms (terracing & check dams) 2. Appropriate land use (crop rotations, mixed farming) 3. Water harvesting mechanisms 4. Afforestation measures 5. Alternative energy sources | Society | Increase in rural food supply | Agricultural production | Agronomic model | Socio economic data (sectoral, demographic), |
| | | | | | | | Increased drinking water availability | M3/person and year | | Groundwater levels and quality |
| | | | | | | Economy | Increase in yields (crops & grazing) | Yield per hectare | Socio-economic model | Farming practice and socio-economic data |
| | | | | | | | Reduced vulnerability of local food supply | Temporal variability in production | production models | Land use data, hydro-meteorological data |
| | | | | | | Environment | Increase vegetation cover | Leaf area index | Land use model, forest management model (could be different because one refers to land use while the other refers to environment preservation), | Soil map, land use and land cover map |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | Decrease in soil erosion | Erosion and sedimentation per unit area | Erosion model (plot and catchment scale), | Sediment measurements |
| | | | | | | | | Increased groundwater recharge | Watershed models (rainfall-runoff, sediment delivery water quality) | Hydro-meteorological data |

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| Ethiopia | Area of Concern: Increased energy demand<br>Specific Concern: Matching supply with demand for electricity | Develop hydropower infrastructure (dams, powerhouses and transmission structures) | | Objective: Increase Hydropower production<br>Externalities: -<br>Rank: 3 | 1. Storage Scheme<br>2. Run of River Scheme | Society | Power consumption per capita | Installed capacity (MW) | Rainfall-runoff model, | Topographic data, hydro-meteorological data, demand data, reservoir characteristics (cross sections, flow velocity, stage-runoff relation), electromechanical characteristics (turbines, types, capacity), |
| | | | | | | | Reliability of power generation | # of shut down days | reservoir simulation model | Demographic data |
| | | | | | | | % of people connected to the grid | | | Energy consumption data and demand |
| | | | | | | | Equity in access to electric energy | # of people affected by reservoir development | Social impact models | Social impact data (local and national) affected or displaced people (local), no of people benefiting connected to grid (national) |
| | | | | | | Economy | Benefits from savings in energy import/increase in energy export | Annual Energy Production | Macroeconomic model (B/C ratio, internal interest rate) and demand forecast model | Investment, operation and maintenance costs, energy production and economic value of energy output |

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| | | | | | | | | | Economic model, economic growth model | Economic data sectoral or macro economic data (contribution to economic growth), |
| | | | | | | | Multipurpose benefits from reservoirs (agriculture, fisheries, navigation) | Annual fish catch (t/a) | Reservoir management model | Hydro-meteorological data, water quality data, fishing yields, transportation data |
| | | | | | | | | Amount of water for irrigation (m3/a) | Water allocation model | |
| | | | | | | | | People/goods transported | Fish production model | |
| | | | | | | | Capacity/generation costs | $/unit power/energy | Reservoir management model | Investment, operation and maintenance costs, energy production and economic value of energy output |
| | | | | | | | | | power production model | |
| | | | | | | | | | micro-economic model | |
| | | | | | | Environment | Carbon credit (GHG reduction) | Amount of fuel saved | | Energy consumption data |
| | | | | | | | | | | Energy balances |
| | | | | | | | | | | Energy equivalence tables |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | environmental quality | Losses in aquatic habitats | Environmental impacts assessment tools | Biodiversity data, water quality data, delineation of wetlands, sensible, and protected areas |
| | | | | | | | | Changes in fish biomass | environmental flows | |
| | | | | | | | | Sedimentation in reservoirs ($10^x$ m3/a) | sediment transport model and sedimentation model for reservoirs | sediment delivery and sedimentation rate, reservoir characteristics (cross sections, flow velocity, stage-runoff relation), |
| Ethiopia | Area of Concern: Drought<br>Specific Concern: Poor preparedness to cope with droughts | 1: Implement drought mitigation and adaptation measures<br>2: Develop water storage facilities | Reduced vulnerability of population to droughts | Objective: Minimize the adverse effects of drought<br>Externalities: Climate change, demographic changes (population growth, migration)<br>Rank: 4 | | Society | Ensured minimum water availability | # of affected people | Reservoir simulation model | Meteorological forecasts, hydro-meteorological data, water quality, demographic data, spatial distribution of population |
| | | | | | | | Health risks | Availability of water per capita | Water balance/allocation model | |
| | | | | | | | Minimum food supply at the local scale | Agricultural production | Agronomic models | Meteorological forecasts and hydro-geological data Agronomic data, |
| | | | | | | | | Losses in lifestock | | |
| | | | | | | Economy | Impacts at the national/provincial level | Losses in agricultural production (t/capita) | Socio-economic impact models | Hydro-meteorological data, |

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| Ethiopia | Area of Concern: Water supply and Sanitation (Sector) Specific Concern: Low level of coverage of water supply and sanitation | Develop infrastructure for water supply Develop infrastructure for sanitation | Improvement in public health | Objective: Increase the coverage of water supply and sanitation Externalities: - Rank: 5 | Intervention 1 1. Shallow wells 2. Spring development 3. Bore hole development 4. Surface water with storage 5. Surface water without storage 6. Hand-dug well Intervention 2 1. Pit latrine 2. Septic tank 3. Sewerage system | Society | Health Improvement | Number of people served | Demand forecasting model Sanitation-hygiene model | Socio-economic data (demographic, demand, health, coverage) |
| | | | | | | | Decrease in mortality rate | Water quality | | Water quality and hydrological data |
| | | | | | | | | Per capita consumptions | | Costs for supply and sanitation systems |
| | | | | | | Economy | Total costs (investment and operation) | Cost/beneficiary | Hydrological model and ground water model | Hydro-meteorological data, hydro-geological data, reservoir characteristics (topographic data, stage-discharge relationship, flow velocity), |
| | | | | | | | | Project costs | Surface and groundwater pollution model | Costs for supply and sanitation systems |
| | | | | | | | | O&M costs | Water quality model, reservoir simulation model, economic model, | Electro-mechanical information (type, investment- O&M costs) |
| | | | | | | | | Cost/year | | |

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| | | | | | | | Reliability | % of failure to meet demand | Water balance and simulation models | Hydro-meteorological models, technical information, water quality, demographic data |
| | | | | | | | | | Plant reliability models | |
| Kenya | Area of Concern:<br>-<br>Specific Concern:<br>Declining Water levels in lakes and rivers | IWRM | Institutional specification | Objective:<br>Raise water levels in lakes and rivers by 30% in 5 years<br>Externalities:<br>Climate variability & Change, Natural disaster, global economy<br>Rank:<br>1 | 1. Participatory Water Mgt.<br>2. PPP<br>3. Strengthened regulatory frameworks<br>4. Water allocation mechanisms<br>5. Recurrent cost recovery | Society | Minimum access to water 100 l/c/d | Consumption figures | Water balance | Population, hydrological data, land cover and climate |
| | | | | | | | Minimum Number of operational WUA at x | Number of operational WUAs | Institutional Model | Legal and regulatory information, demographic and socio-economic data |
| | | | | | | Economy | X % of OPEX fully recovered | % of OPEX recovered | Business Plan | Operational costs |
| | | | | | | Environment | Minimum downstream flows satisfied | Flow rates | Catchment model | Land cover, climate, hydrological data, crop data |
| Kenya | Area of Concern:<br>-<br>Specific Concern: | Reduce chemical pollution | Increased varieties/yields | Objective:<br>Sustainable Aquatic Biodiversity | 1. Centralised WWTW<br>2. Localised WWTW | Society | To stay within nat. standards | Number of water borne diseases | Disease model | Demografie and public health statistics |

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|---|---|---|---|---|---|---|---|---|---|---|
| | Biodiversity Conservation | | | Externalities: Export market standards, climate change<br>Rank:<br>2 | 3. Artificial Wetlands<br>4. Pollution Fines | Economy | CAPEX not to exceed x | CAPEX | Cost estimate | Unit costs |
| | | | | | | | OPEX per year not to exceed y | OPEX per year | Business Plan | Operational costs |
| | | | | | | Environment | Non exceedence of a specified BOD linit | BOD | Surface water quality model | Hydro-meteorological data |
| | | | | | | | | | | Land use/Soil Soil/Geology |
| | | | | | | | Non exceedence of a specified faecal coliforms | Counts per ml | Surface water quality model | Historical on BOD, coliform/heavy metals |
| | | | | | | | Non exceedence of a specified amount of heavy metals | Mg per liter | Surface water quality model | Chemical use and its properties |
| | | | | | | Society | 50% of the population as irrigators | Head count | Socio-economic/demographic model | Population statistics, temporal and spatial |
| Kenya | Area of Concern:<br>-<br>Specific Concern:<br>Irrigation | Investment in Agricultural Water Mgt. | Increased food supply, income levels | Objective:<br>Irrigated agriculture provides x% of agricultural GDP<br>Externalities:<br>Transboundary treaties, policy matters & political will<br>Rank:<br>3 | 1. Storage Based Agricultural Water Mgt. incl. Surface irrigation promotion<br>2. Storage Based Agricultural Water Mgt. incl. Drip irrigation promotion<br>3. Storage Based Agricultural Water Mgt. incl. Sprinkler irrigation promotion<br>4. Run off river Based Agricultural Water Mgt. incl. Surface irrigation promotion<br>5. Run off river Based Agricultural | Economy | Minimum % of agricultural GDP from irrigation | Economic figures (GDP as calculated) | Macro-economic sector model | Economic data and statistics |
| | | | | | | | CAPEX not to exceed x | CAPEX | Cost estimate | Unit costs |
| | | | | | | | OPEX per year not to exceed | OPEX | Business Plan | Operational costs |
| | | | | | | | x cm of water per 1.000 Cal | Water use per 1.000 Cal | Yield response to water model | Climate data, crop data |
| | | | | | | Environment | Minimum downstream flows satisfied | Flow rates | Catchment model | Land cover, climate, hydrological data, crop data |
| | | | | | | | Water borne diseases not to exceed x/1,000 per year | Number of cases | Epidemiological Model | Human Health statistics |

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| | | | | | Water Mgt. incl. Drip irrigation promotion<br>6. Run off river Based Agricultural Water Mgt. incl. Sprinkler irrigation promotion | | Capture fishery depletion no more than 5% | Fish catch | Ecological models (fish population) | Types of fish, fish population, nutrient status of the water, fishery statistics |
| Rwanda | Area of Concern:<br>Soil & Bank Erosion<br>Specific Concern:<br>Land conservation and sediment management | Integrated Watershed Management | Top soil maintained, improved agricultural productivity, River bank stabilized, increased groundwater recharge | Objective:<br>To reduce losses of soil<br>Externalities:<br>Climate changes<br>Rank:<br>1 | 1. Forestation<br>2. Implementation of hillside Terraces<br>3. Rain water harvesting practices (check dams, valley dams) – (not comparable as an alternative)<br>4. Appropriate agriculture practices (Soil cover, mix cropping) | Society | Improved green areas for recreation | Number of managed green areas | Satellite images, remote sensing | Satellite data and maps |
| | | | | | | | Food availability and security | Number of farms with improved production | Estimation of food availability | Socio-economic survey – baseline study |
| | | | | | | Economy | Changes in GDP | Increase in % in the next 5 years | Economic model | Unit costs, implementation and planning costs |
| | | | | | | | Implementation and maintenance costs | Cost / benefit ratio | Economic model | Financial planning data |
| | | | | | | | Reduction of the Import of food | Import of food in to / year | Statistical tools for import estimation | Import / export data |
| | | | | | | Environment | Green areas | Number of plants introduced in the areas | Estimation through statistical analysis | Satellite data and images, |
| | | | | | | | | Number of areas managed | | GIS data |
| | | | | | | Regional Collaboration | Reduction of sediments transport to downstream | Sediment transport to downstream | Erosion and Sediment transport models | Sediment load |
| | | | | | | | Land changes through sedimentation | Water quality (suspended solids in mg/l) | River regime analysis | Water quality data (turbidity<) |
| | | | | | | | | Sediment transport in to/year | Water allocation model | |
| | | | | | | | | | River network analysis | |
| Rwanda | Area of Concern:<br>Environment and ecology | To establish weather monitoring stations / | Reduction of damages and losses of lives | Objective:<br>To predict weather so | 1. Use of conventional | Society | Impacts of climatic change on population | Number of measures in practice | Meteorological forecasting and warning systems | Global weather data |

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|---|---|---|---|---|---|---|---|---|---|---|
| | Specific Concern: Floods and Droughts | qualified technicians, transmission of information | | as to reduce impacts of extreme climatic events<br>Externalities: Non predicted climatic events (extreme floods, droughts, strong winds)<br>Rank: 2 | instruments for measuring weather parameters<br>2. Satellite instruments for catering all weather parameters<br>3. Weather radar<br>4. International collaboration in exchange of weather information parameters | | Regulation setting for meteo information services | Number of regulations taking Climate Change Into consideration | | Rainfall – runoff data |
| | | | | | | | | | | Use of knowledge base |
| | | | | | | Economy | Increased production in the agriculture | Increase in GDP | Economic models | Socio-economic baseline data |
| | | | | | | | Reduction of losses | Number of losses and damages | Statistical data on vulnerability of objects in | Statistical data and knowledge base |
| | | | | | | | | | floodplains | DEM and floodplain cross-section data |
| | | | | | | | | | | Satellite images |
| | | | | | | Environment | Impact of climate change on environment – | Observed effects of measures adopted | Ecological model | GIS and satellite imagery, |
| | | | | | | | Low destruction rates | | | Vulnerability maps |
| | | | | | | | | | | Monetary value of objects located in hazard Zones (floodplains) |
| | | | | | | Regional Collaboration | Exchange of experience at institutional level. | Number of events for exchange of information | | |
| | | | | | | | Exchange of products | | | |
| Rwanda | Area of Concern: Hydropower<br>Specific Concern: Socio-economics, economic growth | Construction of hydropower | Energy available and economic growth | Objective: Increase energy availability to cover energy demand<br>Externalities: Drought, sediments, and floods due to climate changes<br>Rank: | 1. Construction of big dams<br>2. Construction off medium dams<br>3. Construction of mini hydropowers (Micro centrals) | Society | Improved livelihoods through access to energy | Number of connected households | Statistical tools (estimation) | Data about connection demand |
| | | | | | | | Regional impact on households due to resettlement | Number of displaced households | GIS tools | Number of households and communities addressed |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3 | | Economy | GDP | Increased by % in 5 years | Economic models | Socio-economic data (baseline survey) |
| | | | | | | | Different cost / benefits | Cost / benefits ratio | Reservoir optimization (optimal production) | Key data on reservoir, historical hydrographs |
| | | | | | | | Changes in Tourism | Number of tourists per year | Tourism model | Rainfall data, hydrological data |
| | | | | | | | Fishery | Amount of fishes produced (to/year) | Estimation by means of statistics | Fish population (survey data) |
| | | | | | | Environment | Resettlement | See above | | |
| | | | | | | | Water pollution due to backwater | Water quality parameter (eutrophication) | Water quality model | Water quality parameters (lab analysis) |
| | | | | | | | Flooded area (reservoir area) | Area in km² | GIS tools | DEM, GIS data and maps |
| | | | | | | Regional Collaboration | Advantages of export of energy | kWh / year of energy export | Estimation by means of energy demand models | Energy distribution and market data |
| Rwanda | Area of Concern: Water supply and sanitation<br>Specific Concern: Water allocation and water quality | Installation of water distribution systems | Number of people having access to good quality water increased | Objective: Reduction of transmission of diseases and increase the quality of life of the population<br>Externalities: Accidents, breakdowns of the distribution network, accidental pollution of sources of water<br>Rank: 4 | 1. Using boreholes for catching underground water<br>2. Using rain water harvesting systems<br>3. Transport of water by trucks<br>4. Construction of reservoirs of water for multi usage | Society | Health of supplied population | Water quality, maximum acceptable coliform contents | Water quality model and water distribution | Water quality data from lab analysis |
| | | | | | | | Affordable water tariffs | Water prices increased | Water allocation model | Water distribution parameters |
| | | | | | | | | | Rainfall runoff model | Precipitation, source production capacity, |
| | | | | | | | | | Ecological and economic model | Well parameters and productivity |
| | | | | | | Economy | Costs of implementation and operation | Total cost and benefits ratio | Economic model | Water prices, network costs, unit costs, |

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| | | | | | | | Subsidies from the government (real cost of water) | Amount of subsidies – cost of water – paid tariffs | | Maintenance costs |
| | | | | | | | | | | Pumping costs, fuel costs, energy costs |
| | | | | | | | | | | Energy consumption |
| | | | | | | Environment | Degradation of the environment due to construction of necessary infrastructure. | Number of trees cut | Satellite images using GIS tools | Satellite maps and on site data (Survey) |
| | | | | | | | | | Socio-economic impacts data on deforestation | |
| | | | | | | Regional Collaboratio | Downstream water quality | Water quality parameter changes | Water quality model | Main parameters for water quality simulation |
| | | | | | | | Exchange of experiences | | | biological oxygen demand, biochemical oxygen demand |
| | | | | | | | Agreement on water quality standards | | | N, P, concentration |
| | | | | | | | | | | Bacteriological components |
| Sudan | Area of Concern: Drought Specific Concern: Poor preparedness in dealing with droughts | Develop drought mitigating measures Improve reliability of drought forecasts Introduce adaptive agricultural and livestock technologies and practices | Reduced vulnerability of society | Objective: Minimize the adverse effects of droughts Externalities: Climate change Rank: 2 | Intervention 1 1. Construction of large storage dams (dams 2. Increase exploitation of ground water 3. Intervention 2 4. Increase the capacity of the Meteorological organization 5. Improve forecasts at the (sub-)regional | Society | Minimum availability of water (drinking, irrigation, livestock) | Amount of stored water in Million m3/year | River basin model | Topographical data |
| | | | | | | | | | Water balance models | Hydro-meteorological data |
| | | | | | | | | | Reservoir operation model | Water demand data |
| | | | | | | | Minimum availability of pumped groundwater | Pumped groundwater in Million m3/year Amount | Groundwater model | Ground water data, recharge data, |
| | | | | | | | | | | aquifer depth, groundwater abstraction |

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| | | | | | level<br>Intervention 3<br>1. Develop drought resistant crops<br>2. Enhance route changes | | Accuracy of hydrological forecasts | of available surface water in Million m3/year | Forecasting river flow model | Hydro-meteorological data |
| | | | | | | | | | Rainfall runoff models | Mid- to long term weather forecasts |
| | | | | | | | Secured food availability (kg/capita/a) | food production (kg/capita/a) | Agricultural models | Soil maps, land use practice and pattern, hydro-meteorological data, demographic data |
| | | | | | | Economy | Economic efficiency of reservoirs | Costs and benefits of increased food production and water availability ($/m3; $/t agricultural products) | Agronomic models | Hydro-meteorological data, soil maps, land use pattern, spatial distribution of water resources, spatial distribution of population |
| | | | | | | Environment | Sustainable storage volume ($10^x$ $m^3$) | Accumulation of sediments in reservoirs ($10^x$ t/a) | Sediment transport and deposition model | Hydrological data, land use data, land cover data, digital terrain data, river network, hydraulic infrastructure, Inflow sediment load |
| | | | | | | | | | Environment impact model | |
| | | | | | | | Water use efficiency | Amount of water saved due to drought resistant plants ($10^x$ m3/a) | Agronomic models | Agricultural data, meteorological data, soil map, |
| | | | | | | | | | SVAT models | Population data |
| | | | | | | | | | Socio-economic model | |
| Sudan | Area of Concern:<br>Sediment management<br>Specific Concern:<br>Sedimentation of hydraulic structures | Develop efficient dredging and desilting technologies<br>Improve soil conservation | Sustained storage capacity | Objective:<br>Improve sediment control and management<br>Externalities: | | Society | Sustained storage volume ($10^x$ m3) | Losses in storage capacity ($10^x$ m3/a) | Surface erosion model | Digital terrain model |
| | | | | | | | | | Reservoir sedimentation model | Hydrological data |

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| | | measures<br>Develop sediment control structures<br>Develop river bank stabilization measures | | -<br>Rank:<br>4 | | | | | Reservoir operation model | Soil maps, land cover and land use data, |
| | | | | | | | | | | Sediment concentration (bed load, suspended load) |
| | | | | | | | | | | Sediment sinks/sources |
| | | | | | | | | | | River network geometry, |
| | | | | | | Economy | Total costs for maintaining the functions of hydraulic structures | Maintenance costs ($/a) dredging costs (reservoirs, channels) | Flood sediment model | Bed load and suspended load |
| | | | | | | | | | Reservoir sedimentation model | River geometry data |
| | | | | | | | | | | Hydrological data |
| | | | | | | | | | | Specific costs for bank protection, dredging, and monitoring systems |
| | | | | | | | Total losses in agricultural productivity | Soil losses (m3/a/ha) and ($10^x$ m3/a) | Catchment run-off model | Digital terrain model |
| | | | | | | | | | Rainfall runoff model | Hydrological data |
| | | | | | | | | | Agronomic model | Soil maps, land cover and land use data, |
| | | | | | | Environment | | Losses of fertile soils (t/a/ha) or (mm/a) | Surface erosion model | Digital terrain model |
| | | | | | | | | | | Hydrological data |
| | | | | | | | | | | Soil maps, digital terrain model, rainfall intensity, |

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| | | | | | | | | | | land cover, land use pattern |
| | | | | | | | | | | Suspended sediment concentration |
| | | | | | | | Preservation of river morphology and river dynamics | changes in river bed (length and m/a) | River flow sediment model | Characteristic of the catchment area |
| Sudan | Area of Concern: Water quality Specific Concern: Deterioration of water quality | Development of water quality monitoring system Development and enforcement of water quality monitoring (standards and regulations) Control of point source pollution (industry/agriculture/navigation Expand waste water treatment plants/solid waste disposal systems | | Objective: Improvement of water quality Externalities: - Rank: 5 | 1. Institutional and human capacity building (not relevant for the DSS design) 2. Revision of legislation (not relevant for the DSS design) 3. Revision of existing legislation (not relevant for the DSS design) 4. Specification of standards (not relevant for the DSS design) 5. Reduce pollution sources | Society | Reduced # of water related diseases | # of hot spots | Water quality model | Ambient water quality, quality of effluents, (Hygienic and chemical data) |
| | | | | | | | Frequency of violation of standards | # of people affected by water quality | Water flow model (surface and groundwater) | Inventory of pollution sources |
| | | | | | | | | Amount of major pollutants released to the environment (water bodies) | | Flow paths of pollution |
| | | | | | | | | | | Location of water intakes and major supply sources |
| | | | | | | Economy | Total costs and benefits from reduced pollution | treated pollution sites (#/a) | Investment model, impact models | Site specific costs for pollution reduction |
| | | | | | | Environment | Environmental quality | Environmental damages (€/a) | Water quality model | Water quality standards |
| | | | | | | | achievement of standards | | EIA tools | Sediment load |
| Sudan | Area of Concern: Water supply and Sanitation Specific Concern: Low level of coverage of water supply and sanitation | Expand Water supply and sanitation infrastructure Improve local water harvesting techniques | Improved public health | Objective: Increase the coverage of water supply and sanitation Externalities: 1. Planned municipalities, 2. Improved WSS facilities, 3. Affordable/ locally | 1. Rehabilitation and expansion of old supply networks 2. Construction of new supply networks 3. Enhance institutional and human capacity (not relevant for the DSS design) | Society | Reduced # of water related diseases | km/annual | Water supply model | water demand, hydrological data, water quality data, Demographic data, specific costs for supply schemes |
| | | | | | | | Frequency of violation of standards in drinking water | costs/capita | River Flow runoff model | Soil and land use data, Topography |

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| | | | | manufactured utilities,<br>4. Maintained, upgraded and expanded networks,<br>5. Improved water quality and sanitation,<br>6. Develop conventional water sources,<br>7. Improved water availability,<br>8. Costs and Benefits.<br><u>Rank</u>:<br>6 | 4. Construction of purification stations<br>5. Construction of waste water treatment schemes (WWTP)<br>6. Implementation of local water harvesting schemes | | | # of people having access to drinking water | Groundwater models | |
| | | | | | | | | | SWAT model | |
| | | | | | | | Professional capacity | Trained professionals/annual | | Inventory of staff qualification |
| | | | | | | Economy | Total investment costs | m3/annual (supplied or treated) | Water supply models | Water quality data, water demand, water availability, Specific costs of WSS |
| | | | | | | | | $/m3 | Ground water models | |
| | | | | | | | | $/capita | Socio-economic impact model | |
| | | | | | | | Total investment costs | benefitting rural population (# and %) | | Water resources data, hydrological data, demographic data, |
| | | | | | | Environment | Meeting water quality standards in water resources (surface and groundwater) | M3/annually treated by WWTP | Water quality model | Water quality data, hydrological data, |
| | | | | | | | | | Environmental impact assessment tools | |
| Sudan | <u>Area of Concern:</u><br>Hydropower<br><u>Specific Concern:</u><br>Under utilization hydropower potentials | Construction of reservoirs<br>Installation of plants (large-small scale)<br>Extension of the power grids | Improved access otoelectric energy | <u>Objective</u>:<br>Increase utilization of hydropower potentials<br><u>Externalities</u>:<br>-<br><u>Rank</u>:<br>7 | 1. Construction of large scale dams including multi-purpose dams<br>2. Construction of (large scale) Hydropower plants (run-off)<br>3. Installation of Matrix tribunes “low heads”<br>4. Extension of power grids (local | Society | % of people connected to the grid | Storage volume (m3) | Reservoir water balance model | Stream flows and stream (Reservoir DS and US level) |
| | | | | | | | Reliability of Generation | Installed capacity (MW) | Reservoir operation model | Storage capacity |
| | | | | | | | | | Reservoir and power station operation (RAPSO) | Evaporation, seepage, and abstraction |

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| | | | | | and trans-national grids) | | | | | Downstream release requirements |
| | | | | | | | | | | Power demand and plant capacity |
| | | | | | | | Local grids (% of rural population connected) | International exchange (import, export) | Energy infrastructure models | Demographic data, inventory of power supply infrastructure |
| | | | | | | | % of urban population connected | Long distance grids (km) | | |
| | | | | | | Economy | Revenues increase, net benefit | Annual energy output (MWh/a) | Socio-economic impact models (hydropower) | Power demand, demographic data, sub-regional economy data, construction and maintenance costs for reservoirs and hydropower schemes |
| | | | | | | | | Production costs ($/a) | | |
| | | | | | | | | Revenues ($/a) | | |
| | | | | | | | | Exported/imported electric energy (MWh/a, $/a) | Power trade model | Energy prices, production costs |
| | | | | | | | Revenues increase, net benefits | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Environment | Preservation of environmental quality (threshold levels) | Area of affected wetlands (ha) | Environmental impacts assessment tools | Water quality, hydrological data, reservoir geometry data, sediment transport, sensible riverine areas, endangered species |
| | | | | | | | | Bio-diversity indicator | | |
| | | | | | | | | Remaining untouched wetlands (ha) | | |
| Sudan | Area of Concern:<br>Water use in Agriculture<br>Specific Concern:<br>Inefficient use of water resources in agricultural sector | Expansion of irrigated area<br><br>Improve water used efficiency<br><br>Improvement of irrigation services<br>Water harvesting | Intervention 1<br>Irrigated area increased<br>Productivity increased<br>Intervention 2<br>Water saved<br>Water use efficiency increased | Objective:<br>Increase water use efficiency<br>Externalities:<br>-<br>Rank:<br>8 | 1. Rehabilitation of existing irrigation schemes<br>2. Expanding irrigated area<br>3. Improved irrigation technology<br>4. Use of water saving technologies<br>5. Training of irrigation services (is not relevant for the design of the DSS)<br>6. Improved utilisation of local water resources by water harvesting | Society | Agricultural productivity level | Rehabilitated areas (ha/a) | Supply and demand model | Hydro-meteorological data, digital terrain model, land use pattern, soil map. demographic data, Reservoir capacity and operation procedures |
| | | | | | | | | | Water allocation model | |
| | | | | | | | | | SWAT models | |
| | | | | | | | Specific water consumption/crop yield (m3/t crop) | Newly developed irrigation areas (ha/a) | Crop yield (irrigation performance model) | Hydro-meteorological data, digital terrain model, land use pattern, soil map. demographic data, |
| | | | | | | | | Water savings in (%/annual consumption, (%/ha) | water distribution model | Crop water requirements |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Economy | Total investment ($) | Cost/beneficiary | Optimisation model Socio/economic model | Hydro-meteorological data, digital terrain model, land use pattern, soil map, crop yields, |
| | | | | | | | | Operation and maintenance costs | | |
| | | | | | | | Increased water use efficiency (factor) | Water savings in (%/annual consumption, (%/ha), costs ($/ha/a) | Crop yield (irrigation performance model) | Hydro-meteorological data, digital terrain model, land use pattern, soil map, crop yields, |
| | | | | | | | % of rural population benefiting from water harvesting | Water savings (%), | Small scale hydrological balances | Hydro-meteorological data, digital terrain model, land use pattern, soil map, crop yields, |
| | | | | | | | | | Unsaturated/saturated soil model | |
| | | | | | | Environment | Environmental quality | Preservation of soil and water resources | Environmental impacts assessment tools | Hydro-meteorological data, digital terrain model, land use pattern, soil map, crop yield |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | water consumption (m3/a); (% of available resources) | Soil erosion model | |
| | | | | | | | | area endangered by soil erosion (ha) | Water balance model | |
| Sudan | Area of Concern: Watershed management Specific Concern: Watershed degradation | Afforestation Development of legislation Soil conservation measures Improve water harvesting | sustainable use of biomass conversion land cover changes | Objective: Improve land and water conservation Externalities: Climatic and demographic changes Rank: 9 | 1. Afforestation programs 2. Alternative energy supply (gas for households) 3. Enforce/enact legislation`(not relevant for the DSS design) 4. Changing the land use practice and pattern 5. Micro and macro water harvesting | Society | Consumed biomass (t/capita) | Increase in forested area (ha year) | Watershed modell | Digital terrain data, hydro-meteorological data, soil, land-use, land-cover, river networks, catchment boundaries |
| | | | | | | | | | Rainfall runoff model | |
| | | | | | | | | | Water balance models | |
| | | | | | | | Consumed biomass (t/capita) | Increase in forested area (ha year) | Energy demand model | Meteorological and hydrological data |
| | | | | | | | | | | Energy demand data |
| | | | | | | Economy | Total costs for imported energy | # of people using alternative energy sources | Socio-economic model | Demographical and economic data |
| | | | | | | | | | Energy demand model | |
| | | | | | | | Sustainable use of land and water resources | Losses in fertile soils (t/ha/a) | Precipitation distribution model | Digital terrain data, soil maps, land use pattern, hydro-meteorological data |
| | | | | | | | | | | |
| | | | | | | | | | Soil erosion model | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Environment | Level of preservation of soil and water resources | Water and land use efficiency (m3/capita/a), (ha/capita/a) | Erosion model | Hydro-meteorological data, digital terrain data, soil map, land use pattern, Sediment measurements |
| | | | | | | | | | Water balance model | |
| Sudan | Area of Concern: Wetland management Specific Concern: Wetland degradation | Improve institutional and regulatory framework for wetlands Monitoring of production and development activities Development of facilities for tourism and recreation Development of sustainable livelihood strategies by indigenous communities Maintain environmental flow | | Objective: Improve wetland management Externalities: Climatic and demographic changes Rank: 10 | | Society | % of local expenditures of tourists ($/visitor) | # of visitors/a (soft tourism) | Water lands/lakes models | Hydrological data, Hydro-geological data |
| | | | | | | | | Investment costs ($) | Wetland models | Meteorological data, Hydro-chemical data, water quality data, touristic infrastructure data |
| | | | | | | | | ($/visitor) spent | Infrastructural development tools | |
| | | | | | | | % of migrating people | Availability of local resources (m3 water/capita/a), (ha/capita) | Migration models | ethnic demographic data |
| | | | | | | | Increase in population | Local self supply rate | Economic pressures | land use maps, protected areas, local resources |
| | | | | | | | | | Land use changes | |
| | | | | | | Economy | Net benefits from tourism | # of visitors/a (soft tourism) | Socio-economic models | water quality data, infrastructural inventory, Socio-economic data, environmental quality data, |
| | | | | | | | | Investment costs ($) | Infrastructural development tools | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Environment | Sustainable use of resources | Biodiversity indicator | Environmental flow models | Hydro-chemical data. environmental quality data, water and land resources, hydro-meteorological data, biodiversity data, demographic and ethnic data |
| | | | | | | | Preservation of environmental flows | | Water quality models | |
| Sudan | Area of Concern:<br>Flood<br>Specific Concern:<br>Inadequate flood control | Improve flood forecasting and early warning<br>Expand flood mitigation measures<br>Harmonization of risk zonation and land use planning<br>Develop Flood protection structure | Decrease of inverse effects | Objective:<br>Improve flood management (risks and benefits).<br>Externalities:<br>-<br>Rank:<br>11 | 1. Installation of prediction models (not relevant for the DSS design)<br>2. Rehabilitation of monitoring station/establishment of new ones (not relevant for the design of the DSS)<br>3. Exchange of real data (not relevant for the design of the DSS)<br>4. Construction of dams<br>5. Construction of levees | Society | Improved flood safety (reduced human losses…) | Reduced flooding of settlements (%)(%) | Rainfall runoff model | Meteorological forecasts, Historical meteorological data records, hydro-meteorological data, digital terrain data, inundation areas, River characteristics (morphologic data), flood risk maps, demographic data. |
| | | | | | | | | Decrease in flooded area (ha) | Hydrodynamic models | |
| | | | | | | | | # of people affected by floods | Reservoir management model Flood routing (reservoir and canal) | |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | # of fatalities | | |
| | | | | | | Economy | Improved flood safety (reduced human losses…) | Reduced flooding of settlements (%)(%) | Rainfall runoff model | Meteorological forecasts, Historical meteorological data records, hydro-meteorological data, digital terrain data, inundation areas, River characteristics (morphologic data), flood risk maps, demographic data. |
| | | | | | | | | Decrease in flooded area (ha) | Hydrodynamic models | |
| | | | | | | | | # of people affected by floods | Reservoir management model Flood routing (reservoir and canal) | |
| | | | | | | | | # of fatalities | | |
| | | | | | | Environment | Environmental degradation due to flood protection measures | Length of modified water courses (dammed or impounded, km) | Hydrodynamic models | River morphological data, hydro-meteorological data, Satelite Imagery |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Available storage capacity (10x m3) | EIA models | |
| Sudan | Area of Concern: Navigation<br>Specific Concern: Obstacles and underdevelopment of navigation potentials | Maintain draft level for boats<br>Maintain water ways and develop structures for navigation | | Objective: Develop Navigation potentials<br>Externalities: -<br>Rank: 12 | 1. Dredging of the water ways to maintaining sink level for boats<br>2. Adaptation of boats to river conditions: Use of appropriate boats with engine and low sink level<br>3. Construction of ship locks at dams | Society | Access of rural people to major centres (% of riverine population) | People and goods transported by boat (# and tons/a) | River navigation model | river morphology data, cross sections and longitudinal sections, hydrological data, Max. and min. water depth, demographic data |
| | | | | | | | | | (hydrodynamic model) | |
| | | | | | | Economy | Benefits from improved navigation conditions ($/a) | People and goods transported by boat (# and tons/a) | River navigation model | River morphological data, hydrological data, , Specific costs for ship locks, dredging activities, Specification of vessels and boats |
| | | | | | | | | Construction and maintenance costs ($/a) | River morphological model (bank and water way stability) | |
| | | | | | | | | | Sediment transport model | |
| | | | | | | | | | Regional economic model | |
| | | | | | | Environment | Preservation of water quality (mg/l) of pollutant | Changes in water quality (mg/l) | EIA model | Hydrological data, Water quality data, |
| | | | | | | | Exceedance of water quality standards | Accidential spills (t/a) | Water quality models | |
| Tanzania | Area of Concern: -<br>Specific Concern: | Improved Water Mgt. technology and practice | Economic efficiency of water use | Objective: Increased water use | 1. Sprinkler Irrigation<br>2. Drip Irrigation<br>3. Surface Irrigation | Society | Engineering efficiency not be lower 50% | Lysimetric measurements | Equipment performance model | Manufacturer's specifications |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | Water Resources Availability | | | efficiency in agriculture<br>Externalities:<br>Climate Change, Political Will<br>Rank:<br>1 | 4. Floodplain Mgt<br>5. Water Reuse and Recycling | Economy | Minimum reuse percentage 50% | Drainage Flows | Water Balance | Catchment characteristics, rain fall, water rights, water allocation data |
| | | | | | | Environment | Minimum Downstream Flow Achieved | Flow Rate | Surface water flow | Catchment characteristic, |
| | | | | | | | | | Water allocation model | rainfall data, water rights, water allocation data |
| Tanzania | Area of Concern:<br>-<br>Specific Concern:<br>Declining water levels | Investment in IWRM and Development | Water levels | Objective:<br>30% of the declined water level restored within 5 years (lake)<br>Externalities:<br>Transboundary Treaties, Policies and Strategies<br>Rank:<br>2 | 1. Promotion of water Demand Mgt. in all other use sectors<br>2. Promote Water shed Mgt.<br>3. Promotion of alternative sources of energy<br>4. Strengthening of hydrological monitoring and analytical capacity<br>5. Capacity Building for Water Reuse and Recycling | Society | Reduced water conflicts | Number of water conflicts | Water allocation model | Water supply data: stream flow, reservoir levels, ground water safe yield of aquifiers |
| | | | | | | | | | | Water demand data: demographic water use and type of use |
| | | | | | | Economy | 70% of opportunity costs achieved | % of opportunity costs achieved | Economic model | Historic revenue data from water activities |
| | | | | | | | | | | Shadow pricing data |
| | | | | | | Environment | Environmental flow satisfied | Stream flows | Surface water flow model | Historic flow data |
| Tanzania | Area of Concern:<br>-<br>Specific Concern:<br>Water Quality - Pollution | Investment in Water Resource Governance | Health of the lake, river, and other water bodies | Objective:<br>Pollution level of the water sources | 1. Enforcement of laws relevant to Environmental pollution/protection | Society | Cases of Water borne diseases reduced by 25% in ten years | Number of cases | Epidemiological model | Demographic data, health statistics |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | reduced to below Tanzanian Environmental LIMITS<br>Externalities:<br>Regional Treaty (EAC), Climate Change<br>Rank:<br>3 | 2. Strengthen water quality monitoring system<br>3. Public education and awareness creation<br>4. EIA & Auditing undertaken to all development projects<br>5. Environmental Planning of cities, industries and mines | | 10% of increase of employment opportunities in the capture fisheries | Fish population | Fish population model | Historic stream flows, nutrient data, number and types of species, BOD |
| | | | | | | Economy | Fishery contribution to GDP increased by 5% | Fishery contribution to GDP | Macroeconomic model | Macroeconomic sector data |
| | | | | | | Environment | Increased Biodiversity | Population of indicator species; Biodiversity index | Ecological model | Ecological data |
| Tanzania | Area of Concern:<br>-<br>Specific Concern:<br>Optimal utilisation of available water resources | Invest in water supply systems | Accessibility to enough safe water | Objective:<br>Improve supply of available water resources by 75% in 10 years<br>Externalities:<br>Political Will, Natural calamities, Opportunity cost of development funding<br>Rank:<br>4 | 1. Village stand pipes<br>2. Household standpipes<br>3. Shallow wells<br>4. Tube wells<br>5. Rainwater harvesting | Society | x liters per capita per day | Liters per capita per day | Water allocation model | Demand and supply data |
| | | | | | | | Water diseases not to exceed x per 1,000 per year | Number of disease cases forecasted | Vulnerability analysis (Water diseases) | Demographic data, health statistics |
| | | | | | | Economy | CAPEX not to exceed x per capita | CAPEX per capita | Financial model | Unit costs and prices |
| | | | | | | | OPEX not to exceed x per capita | OPEX per capita | Financial sustainability model | Unit costs and prices |
| | | | | | | Environment | Environmental stream flow satisfied | Stream flow | Rainfall run off model (with groundwater component) | Catchment characteristics, rainfall |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| Uganda | Area of Concern:<br>-<br>Specific Concern:<br>Water pollution | Strengthen regulatory mechanisms | Reduce water pollution | Objective:<br>Reduce water pollution to 20% of current levels by 2020<br>Externalities:<br>Non harmonised water laws in the region<br>Rank:<br>1 | 1. Introduce incentives to encourage compliance<br>2. Improve monitoring performance<br>3. Involve community participation in monitoring and enforcement | Society | Reduce the number of water related diseases 15/1000/year | Number of cases of water borne diseases | Disease prevalence model | Demographic data, water use data, historic water quality data |
| | | | | | | | Number of cases of non compliance reduced by 85% | Number of cases of non compliance | Social behaviour model | Number of potential polluters, demographic data |
| | | | | | | Economy | Reduction water treatment costs to x/m³ | Unit costs of water treatment | Financial model | Unit costs of construction and operation, water quality |
| | | | | | | | Increased fish catch per work days x% | Fish catch rates | Fish yield model | Fish population, nutrient level water quality |
| | | | | | | Environment | Reduction N by x% | Levels of N | Surface water quality | Historic N run off, stream flows |
| | | | | | | | Reduction P by x% | Levels of P | Surface water quality | Historic P run off, stream flows |
| | | | | | | | Reduction in water hyacinth by 50% | Area of water hyacinth | Aquatic weed model | Levels of N and P, spatial rates of hyacinth development, total water surface area, surface stream flow |
| | | | | | | | | | Nutrient – water hyacinth growth model | growth rate of ater hyacinth |
| Uganda | Area of Concern:<br>-<br>Specific Concern:<br>Increased energy demand | To develop enough energy sources | Amount of energy generated | Objective:<br>Efficient & sustainable technologies of energy production<br>Externalities:<br>Climate variations, financial constraints, political climate, global energy market<br>Rank:<br>2 | 1. Solar<br>2. Wind<br>3. Geothermal<br>4. Biogas<br>5. Large scale Hydro power storage<br>6. Small scale hydro power storage<br>7. Thermal power plants<br>8. Nuclear power plants | Society | X kWh per capita per year | kWh per capita per year | Electricity supply model | Population data, historic consumption per capita |
| | | | | | | Economy | Availability of energy to industry increased by x% | Amount of available energy to industry | Electricity supply model | Number of industries, types of industries, demand per industry |
| | | | | | | | Weighted tarif not to exceed x/kWh | Weighted tarif per kWh | Tarif model | Cost of generation, cost of transmission, cost of distribution, amount of consumption |

| COUNTRY /SUB-REGION | AREA OF CONCERN /SPECIFIC CONCERN | INTERVENTIONS | OUTPUT | OBJECTIVE / EXTERNALITIES / RANKING | ALTERNATIVES | | CRITERIA | IINDICATORS | MODEL CATEGORY | DATA/ INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Environment | Carbon emission per kWh not exceed x unit per year | Carbon emission per kWh per unit | Carbon emission model | Tons of carbon emitted at power plants, amount of power generated at power generation plants |
| Uganda | Area of Concern: - Specific Concern: Wetlands degradation | Investment in sustainable wetlands exploitation | Value of ecological services | Objective: Sustainable ecological services Externalities: Climate change & variability, political interference, population pressure, high levels of poverty, high rainfall, prolonged drought, land tenure system Rank: 3 | 1. Restoration of the degraded critical wetlands 2. Appropriate development projects in wetland catchments 3. Investments in improved agricultural productivity of available land | Society | Returns to wetland based livelihoods increased by x% | Returns to wetland based livelihoods | Wetland productivity model | Demographic data, livelihood base data |
| | | | | | | | Conflicts reduced by 10% among wetland communities | Number of conflicts | Societal behaviour model | Baseline data on exploitable wetland, resources, demographic data, social economic data, historic incidents of conflicts |
| | | | | | | Economy | Number of tourists visiting gazetted increased by 5% | Number of tourists | Tourism sector model | Historic tourism data, |
| | | | | | | | Water treatment costs reduced by x% | Water treatment costs | Recurrent cost model | Unit recurrent cost |
| | | | | | | Environment | Spatial regeneration of wetlands increased by 5% | % of spatial regeneration of wetlands | Wetland hydrological model | Topographical data, stage storage curves, climate data, water demand data |
| | | | | | | | Quality of effluents from wetlands compliant national regulations | Water quality | Water quality model | Baseline data, historic E-coli, pH, salinity, acidity, colour, nutrients (N and P) |
| | | | | | | | Populations of indicator species restored to benchmark levels | Populations of indicator species | Indicator species population model | Specified indicator species, nutrient data, historic population data |

# Appendix A3

# Minutes of Stakeholder Consultations

# Minutes of Workshop
## International Consultant

| | |
|---|---|
| Subject: | NBI-DSS Eastern Nile sub-regional consultation Workshop |
| Sub-Region / Country | Eastern Nile Region – Addis Ababa |
| Date | 16 and 17 November 2007 |
| Time : | 09 :00 -17 :30 |
| Venue: | Conference room NBI-WRPMP in Addis Ababa |
| Participants: | Dr. Mekuria Beyene, Dr. Aard Hartveld (hydrophil), Dr. Khaled AbuZeid (CEDARE), In addition to the country participants |

## Table of Content:

# 1 Introductory Remarks and opening of the Workshop

Dr. Mekuria Beyene, the acting NBI-DSS Lead Specialist made the opening remarks of the meeting by explaining the objective and expected outputs of the country level consultation. The main objective is to select the key overall and specific type of decisions on which a basin wide DSS should focus from an Eastern Nile sub-basin perspective. During the Inception Phase a large number of regional and country level water resources management concerns have been collected, however these need to be specified in the planning nomenclature (e.g. issues-objective-interventions) and prioritised within the goals of the NBI regional collaboration. The international consultants have prepared a design for the workshop, which has been successfully tested for the Ethiopia country level workshop. However, the country level consultation focused on country level concerns and the planning of sectoral projects, and the sub-regional consultation is expected to focus on key decisions concerning the planning and management of water resources at regional and sub-regional level.

# 2 Clustering and pre-selection of concerns

Dr. Hartveld presented the results of the inventory of water resources management issues that have been made during the inception phase. The concerns raised do not have the same character. Some concerns are thematic categories like water using sectors. Others are goals or objectives and others concern preconditions or externalities. For a discussion of decisions that a DSS can support it is important that the participants use a common planning nomenclature and therefore operational definitions where proposed for issues, objectives, interventions, alternatives and decisions. The DSS supports the decision makers in selecting alternatives for interventions.

Discussions:
The consultants removed from the list of 41 issues/concerns the topics that are related to development goals, externalities and pre-conditions for a DSS. The participants in three groups clustered the remaining 31 issues/concerns and agreed on the following 11 issues/concerns: Water availability, Water Conflicts, Water use efficiency, Water quality, Energy, Water Supply and Sanitation, Floods and Droughts, Sedimentation, Watershed management, Agriculture and Irrigation and Navigation. The participants agreed on categorizing the issues/concerns among 8 water use sectors including, Agriculture & livestock, Industry & Mining, Water Supply & Sanitation, Energy & Hydropower, Navigation, Tourism, Environment & Ecology, and Fisheries.

# 3 Group Work and Discussions

Three groups have been formed. The Stakeholders have been asked to choose between the 31 Concerns a maximum of 10 or 12 that should be ranked during the following session. The Concerns would have to be clustered according to the thematic categories and issues defined in a matrix that have been handed over to the participants.

Discussions:
Specification of issues/concerns in planning nomenclature. The participants expressed the issues/concerns into issues-objectives and interventions to deal with those issues. In the plenum discussion the participants agreed to split floods and droughts, and agriculture and irrigation because of the different characters of their interventions.

The final 13 concerns are as follows:

1. Water scarcity
2. Conflicts among users
3. Inefficient use of water resources
4. Water quality deterioration
5. Low agriculture and livestock productivity
6. Watershed degradation
7. Droughts
8. Increased energy demands
9. Floods
10. Underdevelopment of irrigation potential
11. Low water supply and sanitation coverage
12. Sedimentation of hydraulic structure
13. Underdevelopment of navigation potential

In addition, the objective of investment planning was raised and the need for the DSS to support decisions related to comparing different investment projects on the Nile was discussed, where the DSS can compare the impacts of different alternatives for projects in the same sector or among different sectors. The participants agreed to have this as an umbrella objective of the DSS.

A matrix of the water use sectors and the issues, objectives, and interventions is presented in the country workshop report.

# 4 Working Groups – Ranking of Concerns

The participants were asked to make a ranking of the above-identified 13 objectives to prioritise the type of decisions that the DSS should address in its first development phase. The proposed method for ranking was to use the different goals of the NBI: 1. Social =social welfare; 2. Economic=economic growth; 3. Environmental=sustainable use of natural resources; and 4. Regional Cooperation=regional collaboration among Nile Basin countries. The participants preferred to make the ranking in country break-out groups. The participants were asked to give a score of 0-1-2-3 to each objective for each of the four impact areas. The groups were asked to give weights on as scale from 0 to 3 to the NBI goals to reflect their preference to the type of NBI goals that they would like the DSS to address.

The ranking scores are presented in the country consultation workshop report showing:

- the country scores that were given to the different DSS objectives to reflect their priorities for the type of decisions to be supported by the DSS, and the weighted scores calculated for each objective.
- the weighted scores averaged among the three groups, categorized by countries and by NBI goals. The corresponding ranks of the objectives/decisions to be supported by the DSS are also presented.

# 5 Objectives, Interventions, Alternatives

Definitions of the terminology used in the context of the DSS: *Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions* were presented and the information was gathered in a plenary and will be presented in the Workshop report.

# 6 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

There was not enough time to present the Models and tools nor the data / information requirements.

# 7 Indicators and criteria.

Dr. Khaled Abu-Zeid gave a briefing about the definition of alternatives which could be the different interventions or sub-set of these interventions to address the DSS decision objectives. The DSS is intended to support the decisions of selection of the best alternative intervention option for any of the DSS objectives. The participants were introduced to the concept of identifying criteria to for the DSS to use to evaluate the impacts of alternative interventions for comparison and selection of best alternative. They were also introduced to the definition of indicators that are required to measure the impact of the different alternative interventions on the selected criteria. It was also discussed that the DSS should be able to evaluate the identified criteria, on a country by country basis, to highlight which countries may benefit from the interventions and which may be affected in one way or another.

Due to the workshop time constraint, the groups from Sudan, Ethiopia and Egypt were asked to select one decision objective each, where the exercise of selecting criteria and indicators would be conducted. The three groups selected the following decision objectives respectively;

1. Reduce sedimentation of hydraulic structures
2. Cope with drought
3. Increase water availability

The results of the identified criteria and indicators for each of the three DSS Decision Objectives are presented in the Forms provided in the country workshop report.

The participants were asked to contact the Team Leader to get copies of the Forms to fill them out with the criteria and indicators for the rest of the DSS objectives, and to send them to the consultant.

# 8 Presentation of Institutional Options for transboundary River Basin Planning and DSS development.

Dr. Hartveld gave a presentation about institutional aspects that focused on the arrangement that the regional, sub-regional and national DSS-Centres need to have with the potential users, the development partners (providers of knowledge and skills), the interested parties and the data suppliers. DSS Centres would be needed at regional, sub-regional and national level in the Eastern Nile to integrate the national and transboundary collaboration in water resources planning and management.
The participants supported an upgrading of the transitional institutional and legal framework of the Nile Basin Initiatives for example into an International Commissions for the Nile River Basin and for the Eastern Nile Sub-River Basin. Preferably there should be a strong connection between the Water Planning Centres and the DSS centres so that the DSS can support the development of basin-wide water resources management strategies. The DSS centres at regional, sub-regional and national level need to collaborate intensively. The DSS centres need a task force of national experts that provides political and technical guidance to the executive bodies of the DSS centres.

# 9 Trainings Needs Assessment

There was no enough time to represent Training Needs Assessment forms

# 10 Closing Remarks

Dr. Hartveld presented a summary of the results of the two-day workshop. The sub-regional consultation workshop will be complemented by national consultation workshops in Ethiopia, Sudan and Egypt. He thanked the participants for their active contributions during the workshop, which has resulted in qualitatively good output. Dr. Mekuria Beyene closed the workshop by thanking the participants for their contributions, and expressing the hope that the country level consultations will complement the sub-regional consultation in analysis and priority setting.

Cairo, 23 of December 2007

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Khaled AbuZeid
Team leader, International Consultant

# 11 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 16 November 2009** | | | |
| 08:30 | 09:00 | Registration | NBI |
| **Opening Session** | | | |
| 09:00 | 09:15 | Official Opening | Dr. Mekuria |
| **Working Session 1: Presentation 1** | | | |
| 09:15 | 09:45 | **Presentation 1** - Thematic and Key Issues | International Consultant |
| 09:45 | 10:15 | **Plenum** - Question and Discussions | International Consultant |
| **Working Session 2: Break-out groups – Identification of Key Issues** | | | |
| 10:15 | 10:30 | **Briefing 1**. Identification of Key Issues | International Consultant |
| 10:30 | 10:45 | Formation of break-out groups | International Consultant |
| 10:45 | 11:45 | **Group Work** – Identification of Key Issues | |
| 11:45 | 13:00 | **Plenum** – Discussion & Selection of Common key Issues | International Consultant |
| **Lunch** | | | |
| **Working Session 3: Plenum – Identification of Objectives and Interventions for Key Issues** | | | |
| 14:00 | 17:00 | Identification of Objectives and Interventions | International Consultant |
| **Day 2: 17 November 2007** | | | |
| **Working Session 4: Plenum – Identification of Objectives and Interventions for Key Issues (continued)** | | | |

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| 09:00 | 10:30 | Identification of Objectives and Interventions | International Consultant |
| **Working Session 5: Break-out Groups – Ranking of Objectives / Issues** | | | |
| 10:30 | 11:30 | **Group Work** – Ranking of Objectives | International Consultant |
| **Working Session 6: Plenum - Institutional Options** | | | |
| 11:30 | 12:30 | **Presentation 2** – Institutional Concepts | International Consultant |
| 12:30 | 13:00 | **Plenum** – Discussion | International Consultant |
| **Lunch** | | | |
| **Working Session 7: Plenum – Presentation & Discussion of Ranking Results** | | | |
| 14:00 | 15:00 | Discussion of Ranking Results | International Consultant |
| **Working Session 8: Plenum – Criteria and Indicators** | | | |
| 15:00 | 15:30 | **Presentation 3** - on criteria and indicators | International Consultant |
| 15:30 | 16:00 | Questions | International Consultant |
| 16:00 | 17:00 | **Plenum** – Collection of Criteria and Indicators | International Consultant |
| **Working Session 9: Workshop Conclusions** | | | |
| 17:00 | 17:30 | Summary Report of the Workshop Findings | International Consultant |

# 12 List of participants

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# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | Sub-Regional Stakeholder Consultation Workshop |
| Sub-Region / Country | NEL – Kigali |
| Date / Time: | 22.11.2007; 13:00 – 18:00 and 23.11.2007 ; 08:30 – 17:00 |
| Venue: | Ecole Notre Dame des Citaux |
| Participants: | Dr. Mekuria Beyene - NBI<br>Dr. Antoine Niragire – National DSS Specialist Rwanda<br>Dr. Richard Schuen – hydrophil<br>Mr. Jorge Dreher – hydrophil<br>Sylvain Rusanganwa – Local Consultant hydrophil<br>Stakeholders (see attached list of participants) |

## Table of Content:

# 1 Introduction

The workshop was supposed to begin on November 22nd, 08:00, apparently there was a discrepancy between the time schedule proposed to the local Consultant and NDSS-Specialist and that of the International Consultants. Due to the International Consultants' delay at the airport, it was only possible to begin the workshop at 13:30.

# 2 Introductory Remarks

Dr. Mekuria made the introductory presentation emphasising the Sub-Regional context of this Workshop. He put forward the main goal of the workshop as being to discuss the findings of the Inception Phase, in which the main concerns and issues for the DSS have been discussed in detail. He asked the participants to consider the main concerns related to the use of the DSS, especially with respect to the Nile Equatorial Lakes and to prioritize them in the ranking of the most relevant concerns and decisions.

Dr. Mekuria showed the relationship between the NELSAP and the other components of the Nile Basin Initiative Program in order to allocate the DSS within the institutional setup.

# 3 Presentation of the Consultants and of the Stakeholders

Mr. Schuen opened the Stakeholder Consultation Workshop by presenting himself and by asking the participants to present themselves.
Then he presented the Agenda.

# 4 Themes, Issues, and Decisions

Mr. Dreher made the next presentation on Themes, Issues, and Decisions. He made clear to the participants that the main concerns agreed by the Working Group 5 of the 1st Regional Workshop should be reduced to a maximum of 10 to 12 concerns, and that these concerns should be ranked, such that the most important can be discussed in more detail in order to define the objectives, the interventions, externalities, and alternatives. The next step would be to define the criteria, the corresponding indicators, the models and corresponding data requirements.

# 5 Discussions

One of the most intensively discussed issues was the "real-time data sharing" between the Nile Basin Countries. Some of the Stakeholders would like to have this defined as a very important Concern.

This was the reason to anticipate the presentation on "What is the DSS", in order to show to the participants that data sharing is rather a pre-condition and not a concern. Dr. Mekuria explained the same once more to point out the difference between concern and pre-condition clearly.

The following concerns were finally selected:

1. Water quality – pollution
2. Water resources avail./ use / management
3. Coping with floods and droughts
4. Increased energy demand
5. Watershed degradation, wetland degradation
6. Water conservation – rainwater harvesting
7. Water use efficiency demand / management
8. Water supply and sanitation
9. Irrigation
10. Biodiversity conservation
11. Population structure/ settlement pattern
12. Sedimentation of hydraulic infrastructure
13. Improving / developing navigation potential

# 6 Working Groups – Ranking of Concerns

After the presentation four groups have been formed and the concerns were discussed and ranked. The ranking had to be consolidated on the day after.

On the 23rd of November, at 08:30, the same working groups have been asked to continue to make the synthesis of their ranking of Concerns en plenum.

Mr. Schuen calculated ranking scores and presented the results to the participants. This was discussed in the plenum and the concerns were ranked accordingly. One condition was then again discussed, particularly that of the real-time data sharing that is considered as a very important issue. The International Consultants have been asked to emphasize this point visa-à-vis of the Nile Basin Initiative.

The results are summarized in the report of the International Consultants.

Problems:
Discussions on the payment of per diems to the Stakeholders delayed the workshop program so that discussions on the Alternatives, Criteria, Indicators, and Models could not be carried out completely. Nevertheless, substantial results have been achieved.

# 7 Objectives, Interventions, Alternatives

Due to the discussions of per diem payment, Mr. Schuen and Mr. Dreher had to speed up the following procedure in order to finalize the choice of interventions and to define the objectives, as well as the criteria for evaluating the alternatives. The results are included in the report of the International Consultants.

# 8 Institutional Concept

In the remaining short time Mr. Schuen presented the Institutional Concept and formulated the following five questions.

*Who requests the DSS Services?*
*Who provides the knowledge to DSS?*
*Who provides data to DSS?*

*Who should manage the data?*
*Who will provide the modelling?*

Those questions have been answered interactively and are included in the report of the International Consultants.

## 9 Training Needs Assessment

Unfortunately, due to short time available and because of the problems above mentioned, the Stakeholders were not able to stay longer in order to discuss about the training needs. The Workshop was terminated with a group photo.

## 10 Post-Workshop Meeting with Dr. Mekuria

On Saturday morning, 11:30, details on the workshop have been discussed with Dr. Mekuria:

- The Agenda of the Workshop was shortly discussed and agreed upon.
- The problem of real-time data sharing was discussed and seriously taken into consideration.
- Dr. Mekuria was surprised about the choice of Water Quality as the most important Concern.
- He was also very much concerned about the choice of criteria, indicators and models. He gave the impression to agree very much on the achievements of the workshops, even if the results could not be completed.
- He agreed that Mr. Dreher will prepare a detailed program for the discussions to be carried out in Addis Ababa

Kigali, 26 of November 2007

_____
Sylvain Rusanganwa
Local Consultant Rwanda

# 11 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 22 November 2007** | | | |
| 08:30 | 08:35 | Registration | NBI |
| **Opening Session** | | | |
| 13:30 | 13:45 | Welcome/Introductory Remarks | NB-DSS Specialist |
| 13:45 | 14:00 | Official Opening | NBI-WRPMP: Dr. Mekuria |
| **Working Session 1: Identification and Clustering of Concerns** | | | |
| 14:00 | 14:30 | **Presentation 1** - Thematic and Key Issues | International Consultant |
| 14:30 | 14:50 | **Plenum** - Question and Discussions | |
| 14:50 | 16:00 | **Break-out groups pre-selection of 31 concerns** | International Consultant |
| 16.00 | 16.15 | **Coffee break** | |
| 16.15 | 17.00 | **Plenum** specification of concerns in issue-objective-interventions | International Consultant |
| **Day 2: 23 November 2007** | | | |
| **Working Session 2: Ranking of Concerns** | | | |
| 08.30 | 09.15 | **Briefing:** method and ranking criteria for main Decisions that have been specified as key concerns | International Consultant |
| 09.15 | 11.00 | Country group ranking of the key concerns | |

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| 11.00 | 11.15 | **Coffee Break** | |
| **Working Session 3: Institutional Options** | | | |
| 11.15 | 11.45 | **Presentation 3** – Institutional Concepts | International Consultant |
| 11.45 | 12.30 | **Plenum** Discussion of options for instructional arrangements for demand-knowledge-data-modelling | International Consultant |
| Lunch | | | |
| 13.30 | 14.00 | **Presentation Results Ranking Objectives** | International Consultant |
| 14.00 | 14.15 | **Plenum** Discussion of the results of the ranking | |
| **Coffee break** | | | |
| **Working Session 4: Option Criteria and criteria** | | | |
| 14:30 | 14:50 | **Briefing on options, criteria and indicators** | International Consultant |
| 15:50 | 17.00 | **Break-out groups** – Discussion of the options, criteria and indicators of three concerns | International Consultant |
| **Working Session 5: Workshop Conclusions** | | | |
| 17:00 | 17.15 | **Plenum** – Discussion of the options, criteria and indicators of three concerns | International Consultant |
| 17:15 | 17.30 | **Closing session** | Dr. R. Schuen<br>Dr. Mekuria NBI |

# 12 List of Participants

| Name of National participant on T/A | Country | Institution / Function | Telephone | e-mail |
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# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Burundi – Bujumbura |
| Date | 29.11.2007 – 01.12.2007 |
| Time : | 09 :00 -17 :30 (29.11. and 30.11.), 11:00 – 14:30 on 01.12. |
| Venue: | Orpahn's AID, Avenue du Large, Bujumbura |
| Participants: | Dr.-Ing. Gabriel NDIKUMANA – National DSS Specialist Burundi<br>Dr. Richard Schuen – hydrophil<br>Dr. Jorge Dreher - hydrophil<br>Stakeholders: see attached list of participants (ANNEX 1)<br>Workshop was carried out in French |

## Table of Content:

# 1 Introductory Remarks and opening of the Workshop

The Gen. Dir. of the IGEBU (Institut Géographique du Burundi), Prof. Gabriel Ndikumana made the introductory remarks on the purpose of Stakeholder Consultation Workshop and presented the preliminary agenda that had been adapted before. He emphasised the importance of that workshop for the future development of the water resources for the Republic of Burundi.

After this introduction, the Chief of Staff of the Ministry of Environment, Regional Development, and Public Works, opened officially the Consultation Workshop.

# 2 Presentations on "What is the DSS?", Themes, Issues, and Decisions.

Mr. Dreher presented the DSS, the *three phases of the Decision Making Process, the System Architecture, and the Model tools*. Included was also an example. It followed a short discussion about the next steps of the workshop.

After this, Mr. Schuen presented the *Themes, Issues, and Decisions*. He made clear to the participants that the main concerns agreed by the Working Group 5 of the 1st Regional Workshop should be reduced to a maximum of 10 to 12 concerns, and that these concerns should be ranked, such that the most important can be discussed in more detail in order to define the objectives, the interventions, externalities, and alternatives. The next step would be to define the criteria, the corresponding indicators, the models and corresponding data requirements.

Discussions:
The National DSS-Specialist of Burundi, Gen. Dir of the IGEBU, Dr-Ing. Gabriel Ndikumana, explained that people in Burundi are not used to models. Therefore, he asked the Consultants to present and explain in detail what is a model and what are the purposes of modelling. The Consultant should also show the functionalities of the models and how models can provide the expected results, and additionally, how the DSS will improve this situation and how can one know what adequate models are.

Mr. Dreher explained that most of the models are to be defined during the workshops and that the there are different manners to chose the models. On the one hand models that are already used can be proposed, if any, and on the other hand there are several criteria to help in guiding the choice of the models (licensing, source code, etc).

# 3 Group Work and Discussions

Four groups have been formed. The Stakeholders have been asked to choose between the 31 Concerns a maximum of 10 or 12 that should be ranked during the following session. The Concerns would have to be clustered according to the thematic categories and issues defined in a matrix that has been handed over to the participants.

Mr. Dreher supported the groups in order to explain in detail the objectives of that exercise and the meanings of concerns. One of the groups found very easily the main concerns, the other group has taken too many concerns as the main ones and had to be supported again in reducing the concerns to a manageable number.

Discussions:

Intensive discussions concerning the main problem of Burundi: the population growth (demographic expansion of more than 3% per year) and the mortality as well are considerably high.
The next problem discussed was the data acquisition and data sharing. There is a communication problem between the Institutions and data providers. Most of the people dealing with agriculture were very concerned about the need on reliable data about the main agricultural parameters (production factors, rainfall, water availability, etc).

There is no data measured, etc.

The next problem of Burundi is the water quality. Measurement of water quality parameters is very deficient, especially in the rural areas.

The concern “Floods and Droughts” was also discussed as being a concern that considers opposite issues. On the one hand, it considers droughts, that are very important for Rwanda and on the other hand it takes floods into consideration that are not very relevant for Rwanda. It was proposed to separate Floods from Droughts as Concerns. It was also proposed to consider inter-annual variability for droughts and to include it in the Concern Droughts

After the discussions, Mr. Schuen moderated the consolidation of the concerns with the result that following were selected:

1. Efficient water management in agric. & energy
2. Drought and flood forecasting
3. Optimal utilisation of available water resources
4. Soil management and conservation
5. Intra- and inter-annual climate fluctuations
6. Water supply and sanitation
7. Biodiversity conservation
8. Water quality
9. Equitable water distribution
10. Increased energy demand
11. Wetland management
12. Population structure/ settlement patterns
13. Development of navigation and tourism

# 4 Working Groups – Ranking of Concerns

After consolidation of the concerns, the two groups met again to rank the concerns. The lists of concerns have been prepared during the coffee break. Mr. Dreher moderated the ranking session.

Mr. Schuen made the presentation of the results that have been agreed after a short discussion on the relevance of “Water Supply and Sanitation” that was ranked on the fourth place. One of the participants would like to have Water Supply and Sanitation ranked higher than the third place that was ”Increased Energy Demand”. After a short discussion the participants agreed upon the scores of the Concerns. The workshop was closed at 17:10. The participants where informed about the program for the next days.

A number of 16 concerns have been chosen by the 4 groups. During the plenum it was agreed to take only the first 13 into consideration.

Of these 13 the participants have been asked to rank.

# 5 Objectives, Interventions, Alternatives

The following program was carried out during the second day. Mr. Schuen presented the definitions of the terminology used in the context of the DSS: Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions.

The Group Work begun after a detailed explanation of the steps of the exercise. Mr. Dreher explained all those steps of the whole process in very detail to give the participants all necessary support.

Very intensive discussions have been carried out within the groups. An agreement on the definitions of the Alternatives and Criteria was achieved at 14:00. The results have then been presented before lunch and will be presented in the report of the International Consultants.

# 6 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Mr. Dreher presented the Type of Models, Tools and Data needs for the DSS.

The four groups have been requested to define the Models and the Data needed to express the Indicators they have chosen for each criterion.

# 7 Presentation of Institutional Options for transboundary River Basin Planning and DSS development.

Richard presented the Institutional Concept and formulated the following five questions.

*Who requests the DSS Services?*
*Who provides the knowledge to DSS?*
*Who provides data to DSS?*
*Who should manage the data?*
*Who will provide the modelling?*

Those questions have been answered interactively and are included in the report of the International Consultants.

# 8 Trainings Needs Assessment

Mr. Schuen presented shortly the *Training Needs Assessment* forms and the work was done by the same groups.

The results are included in the report of the International Consultants.

# 9 Closing Remarks

Closing remarks have been then made by Mr. Schuen and Chef de Cabinet Du Ministère de l'Environnement, de l'Aménagement du Territoire et des Travaux publics .

The Workshop finished at 14:20.

Bujumbura, 1 of December 2007

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Victor GIRUKWISHAKA
Local Consultant Burundi

# 10 Closing Speech

**DISCOURS DE CLOTURE DE L' L'ATELIER SUR LE SYSTEME D'AIDE AUX DECISIONS (DSS) AU BURUNDI**

*Orphan's Aid, le 1er Décembre 2007*

Messieurs les Directeurs Généraux,
Mesdames, Messiers les Représentants des Institutions oeuvrant dans le secteur des ressources en Eau au Burundi,
Distingués Invités,
Mesdames, Messieurs,

Nous voici au terme de 3 jours d'intense activité relative à l'atelier de Consultation des parties prenantes sur le Système d'Aide aux Décisions qui s'est déroulé dans les enceintes de l'Orphan's Aid.

Permettez moi de vous rappeler les objectifs aue s'était fixé l'atelier qui vient de prendre fin . Il s'agissait de :

- Examiner les nouveaux processus de prise de décision à adopter en matière de régulation et d'exploitation des ressources en eau au niveau national ;
- Identifier toutes les décisions clé adaptées au Système d'Aide aux Décisions du Burundi ;
- Identifier toutes les décisions spécifiques qui seront appliquées par la Gestion Intégrée des Ressources en Eau au niveau du bassin du Nil, en mettant un accent particulier sur les secteurs de l'Agriculture, de la production de l'énergie électrique, du transport, de la gestion des eaux de surface, de la gestion des zones humides , de la gestion des sécheresses et des inondations ;
- Identifier un ensemble de critères et indicateurs qui seront utilisés comme mesure de performance dans l'évaluation des alternatives pour une meilleure prise de décisions. Ces indicateurs seront directement exploités pour une utilisation équitable en vue de la sauvegarde des intérêts communs en matière du développement socio-économique durable.

Mesdames, Messieurs les participants,

Vous vous êtes appliqués, pour toute la période de 3 jours, à atteindre ces objectifs et il y a lieu d'attester que les résultats obtenus sont satisfaisants.

Permettez- moi de les reprendre dans leur intégralité.

Les sujets de discussion soumis lors de l'Ateliersétaient au nombre de 41. Conformément aux réalités du Pays, vous les avez condensés en 13 sujets prioritaires
Dans une évaluation préliminaire, les sujets suivants ont été choisis par tous les groupes :

- La Qualité de l'eau
- La Gestion et conservation des sols
- L'Approvisionnement en eau et assainissement
- L'Eau en agriculture

Dans une évaluation plus approfondie, l'eau est et restera un impératif dans tous ces secteurs, dans le contexte national et régional, les Parties prenantes ont choisi les thèmes relativement aux objectifs de l'Initiative du Bassin du Nil à savoir *la société, l'économie, l'environnement et la collaboration régionale :*

1ère place : Gestion rationnelle de l'eau en Agriculture et en Energie – Irrigation
2ème place : Lutte contre les sécheresses et les inondations
3ème place : Utilisation optimale des ressources en eau disponible
4ème place : Gestion et conservation des sols

L'étape finale a été la définition des Actions / Interventions qui pourront être menés afin de résoudre les problèmes principaux dont soufre la population burundaise.

Ainsi, le Système d'Aide aux Décisions, l'une des quatre composantes du Projet Gestion et Planification des Ressources en Eau de l'Initiative du Bassin du Nil vient de former et sensibiliser les parties prenantes aux outils de Gestion et d'utilisation efficiente des ressources en eau.

J'aimerais, dans un premier temps interpeller les participants pour une mise en application de ce qu'ils viennent d'apprendre pour l'intérêt de notre pays.

Par la suite, je demanderais aux autres composantes du projet, de suivre le même modèle afin de répondre massivement aux objectifs du millénaire pour le développement.

Aux bailleurs de fonds , nous demandons de rester toujours à nos côtés et de répondre à temps aux sollicitations formulées par les partenaires ci-haut évoqués.

Messieurs les Directeurs Généraux,
Mesdames, Messiers les Représentants des Institutions oeuvrant dans le secteur des ressources en Eau au Burundi,

Distingués Invités,
Mesdames, Messieurs,

Je ne saurais terminer cette allocution sans remercier l'IBN à travers le Projet Gestion et planification des ressources en Eau qui a facilité la réalisation et la réussite de cet atelier.

Je voudrais également exprimer mes sentiments de gratitude à l'égard des consultants qui ont assuré avec dextérité la formations et facilitation de l'Atelier.

C'est par ces mots de remerciement que je déclare clos les travaux de l'atelier de Consultation des parties prenantes sur le Système d'Aide aux Décisions au BURUNDI .

Vive la Coopération Régionale,
Vive l'Initiative du Bassin du Nil,
Vive le Burundi.

Je Vous remercie !

# 11 Workshop agenda

| TIME From | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| Day 1: 29.11.2007 | | | |
| 09:30 | 09:35 | Registration | NBI |
| Opening Session | | | |
| 09:35 | 09:40 | Welcome/Introductory Remarks | NBI-DSS specialist |
| 09:40 | 09:45 | Welcome/Introductory Remarks | Directeur Général IGEBU |
| 09:45 | 10:00 | Official Opening | Chef de Cabinet Du Ministère de l'Environnement, de l'Aménagement du Territoire et des Travaux publics |
| Working Session 1: Presentations 1 and 2 | | | |
| 10:00 | 10:30 | Presentation 1 - What is a DSS and What Can it Do? | International Consultant |
| 10:30 | 10:45 | Plenum – Questions, translation, and Discussions | |
| Refreshments | | | |
| 10:45 | 11:00 | Presentation 2 - Thematic and Key Issues | International Consultant |
| 11:00 | 11:15 | Plenum - Question and Discussions | |
| Working Session 2: Clustering and selection of concerns | | | |
| 11:15 | 11:30 | Briefing on clustering and pre-selection of concern | International Consultant |
| 11:30 | 12:30 | Group Work – Clustering and pre-selections | |
| 12.30 | 13.30 | Plenum-Presentations by groups – Clustering/pre-selection | |
| Lunch break | | | |
| 14:30 | 14:40 | Plenum- Pre-selection and pre-ranking of Concerns | International Consultant |
| 14.40 | 15:00 | Plenum- Final ranking of Concerns | International Consultant |
| Working Session 3: Reformulation of concerns into Key-Issues-objectives and interventions – Formulation of Alternatives, Criteria, Indicators | | | |
| 15:00 | 15:30 | Briefing on Key-Issues, Objectives and Interventions, Alternatives, Criteria and Indicators | International Consultant |
| 15.30 | 16.30 | Break-out group- Formulation of Concerns into Key-Issues, objectives and interventions | International Consultant |
| Coffee break | | | |
| 16.45 | 17.30 | Break-out Groups – Defining the Alternatives, Criteria and Indicators | |
| Day 2: 30.11.2007 | | | |
| Working Session 4. Formulation of Alternatives, Criteria and Indicators | | | |
| 09:00 | 09:15 | Recapitulation of Alternatives, Crietria, Indicators | International Consultant |

| TIME | | | |
|---|---|---|---|
| 09.15 | 11.15 | Break-out Groups – Defining the Alternatives, Criteria and Indicators | |
| 11.15 | 12.15 | Plenum-Presentation of results by groups | International Consultant |
| Lunch | | | |
| Working Session 5 Presentation 3 and Break-out Groups- Models/Tools and Data/Information | | | |
| 14:00 | 14:45 | Presentation 3 – Possible Models/tools | International Consultant |
| 14.45 | 16:15 | Group Work – What are the tools and data/information requirements | |
| 16:15 | 16:40 | Plenum - Discussion | International Consultant |
| Working Session 6: Institutional concepts and Break-out Groups – Institutional Arrangements | | | |
| 16:45 | 17:00 | Presentation 4 – Institutional Concepts | International Consultant |
| 17.00 | 17:30 | Plenum- Stakeholders mapping/institutional arrangements for demand-data and modelling | International Consultant |
| Day 3: 01.12.2007 | | | |
| Working Session 7. Institutional & Human Capacity Building | | | |
| 11:00 | 11:15 | Briefing institutional and human capacity building for DSS | International Consultant |
| 11.15 | 12:00 | Group Work Capacity building for DSS development | International Consultant |
| Lunch break | | | |
| Working Session 8: Workshop Conclusions | | | |
| 1330 | 13.40 | Summary of the Workshop Findings | International Consultant |
| 13:40 | 13:50 | Conclusion | NBI Representative |
| 13.50 | 14.00 | Closing Remarks | Chef de Cabinet Du Ministère de l'Environnement, de l'Aménagement du Territoire et des Travaux publics |

# 12 List of Participants

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# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | DR Congo - Kinshasa |
| Date / Time: | 13.12.2007, 14:00 – 17:30, 14.12.2007, 09:30 – 15:00 |
| Venue: | CEPAS |
| Participants: | Dr. Bertin Bagula – National DSS Specialist DRC<br>Dr. Richard Schuen – hydrophil<br>Mr. Reinold Seidelmann – hydrophil<br>Stakeholders (see attached list of participants)<br>Workshop was held in French |

## Table of Content:

# 1 Presentation and Introductory Remarks

The Stakeholder Consultation Workshop was opened by a presentation of the consultants and the participants, followed by a presentation of the Agenda.

Dr. Bagula made the introductory presentation of the Nile Basin Initiative, the Sub-Regional context of the Workshop, and the purpose of the NBI-DSS.

# 2 Presentations on "What is a DSS?" , Themes, Issues, and Decisions.

The introductory presentation "What is a DSS?" was held in French, as all the other presentations. It explained the characteristics and phases of decision making processes, the structure of a DSS and a concrete example of a multi-criteria decision problem.

# 3 Presentation of Institutional Options.

Mr. Schuen presented institutional options for transboundary river basin planning and formulated the following five questions:

*Who requests DSS services?*
*Who provides the knowledge needed for the DSS?*
*Who provides data for the DSS?*
*Who should manage the database?*
*Who will provide modelling services?*

Those questions have been answered interactively and resulted in a list of stakeholders structured according to these questions.

# 4 Trainings Needs Assessment

Due to the restricted number of participants, only two groups were formed.

Mr. Schuen presented shortly the *Training Needs Assessment* forms and the work was done by the groups. The results are included in the Training Needs Assessment report.

End of Day 1.

# 5 Presentation on Themes, Issues, and Decisions.

After an introductory presentation on *Themes, Issues, and Decisions* the purpose of the following session was explained to the participants. It was explained that the main concerns agreed at the 1st Review Workshop should be reduced to a maximum of 10 to 12 concerns, and that these concerns should be ranked, such that the most important can be discussed in more detail in order to define interventions, externalities, and alternatives. The next step would be to define the criteria, the corresponding indicators, the models and corresponding data requirements.

# 6 Group Work and Discussions

The participants formed two groups to identify the 10 to 12 concerns that are most relevant from the point of view of the DR Congo. It was mad clear that the situation in the Nile basin portion of DRC should be assessed, not in the country as a whole.

The concerns were first allocated to thematic categories in a matrix that had been handed out to the participants. Both groups engaged in detailed and fruitful discussion on the character and the relative importance of the variousconcerns. At the end, both groups had elaborated a quite similar list of concerns (9 matches between the two groups). The remaining concerns were discussed in the plenary and a consolidated list of 12 concerns was established by consensus.

The participants insisted that certain issues that are more remotely related to water resources management, namely land use conflicts, settlement patterns and tourism are crucial for the DRC part of the Nile basin and that these should therefore be addressed by a DSS.

# 7 Working Groups – Ranking of Concerns

After consolidation of the concerns, the participants split again into two groups to rank the concerns. Both groups separately scored the concerns according to their importance for society, economy, the environment and regional collaboration.

Thereafter, the consultant prepared and presented a consolidated list of ranked concerns.

The resulted ranking was as follows:

1. Soil erosion and watershed degradation
2. Land use conflicts (parks, agriculture, cattle)
3. Tourism
4. Water supply and sanitation
5. Water resources availability and optimal use
6. Hydropower projects
7. Lake water quality (pollution, salinity)
8. Industrial development and settlement patterns
9. Fisheries: Transboundary conflicts
10. Biodiversity conversation (protected areas)
11. Complementary rainfed agriculture and irrigation
12. Declining water levels in lakes and rivers

After a lively discussion the participants agreed that this result was satisfactory.

The participants where informed about the program-for the last day.

End of Day 2.

# 8 Objectives, Interventions, Alternatives

The following program was carried out during the third day, December 15$^{th}$:

Mr. Seidelmann presented the definitions of the terminology used in the context of the DSS: *Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions*.

The consultant provided a detailed explanation of the steps of the exercise. It turned out that the participants had no experience with identifying and distinguishing these elements. The exercise needed considerable support and advice from the consultant. Thus, the exercise was characterised by intensive and fruitful discussions on concepts, terminology and on the issues themselves. However, this process needed considerable time and only two of the selected priority concerns, soil erosion / watershed degradation and water supply / sanitation, could be addressed in the time available.

## 9 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

After a short presentation on *Models, Tools and Data needs* for the DSS the participants returned to their groups. Due to time constraints and a lack of specific experience with models only few models could be identified. However, an in-depth discussion on data availability and on options to improve the situation followed.

## 10 Closing Remarks

Closing remarks were made by Dr. Bagula and Mr. Seidelmann.
The Workshop finished at 13:00.

_____
Reinold Seidelmann
International Consultant

# 11 List of Participants

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| 19 | SEDEKE | PSC | MIN ENV | |
| 20 | NSALA | IGC | | |
| 21 | YUMA | Juriste | MIN ENV | |
| 22 | Dr MALEMBI | medecin | Ecole de Santé | |

# Minutes of Workshop
## National Stakeholder Consultations Egypt

| | |
|---|---|
| Subject: | National Stakeholder Consultations Egypt Workshop |
| Sub-Region / Country | Cairo, Egypt |
| Date | 11-13 December 2007 |
| Time : | 09 :00 -17 :30 |
| Venue: | Nile Water Sector premises in Nasser City |
| Participants: | The complete list of participants as attached in ANNEX1 |

## Table of Content:

# 1 Introductory Remarks and Opening of the Workshop

Dr. Wael Khairy, the Director of NBI National Office, opened the Meeting giving brief remarks on the Nile basin Initiative, and goals of the NBI to achieve sustainable socio-economic development through the equitable utilization of and benefit from, the common Nile Basin Resources. He wished the participants a successful meetings and deliberations. Eng. Ahmed El Sonosy, the vice chairman of Nile Water Sector gave his opening speech, where he welcomed the participants and illustrated the history and objectives of the Nile Basin DSS. He elaborated on Meeting the objectives and expected outcomes. Finally, he officially opened the Meeting.

# 2 Working Session 1 ("What is the DSS?"; Themes, Issues, and Decisions)

Supported and chaired by Dr. Ahmad Wagdy representing the consultant, the session started by Dr. Mohamed Roushdy, the DSS-Network member presented the concept of the DSS, where Eng. Aref Ghareeb, presented the Themes, Issues, and Decisions.

The participants discussed the presented issues and raised the following comments:

- The importance of Data availability and sharing as a prerequisite of any DSS developments.
- The Level of DSS (Whom will address, and on which scale?)
- The importance of socioeconomic and Environmental impacts of the proposed projects.
- The importance of considering the Climate Change and prediction uncertainties.
- The importance of having accurate assessments of Data, Models, human capacities.
- Use of new technologies for data collection and analysis. (i.e. Remote sensing, GIS, .)
- The need to revisit the identified themes, issues, and decision to reflect the most important areas of Decision Making.

The DSS Specialist presented the stakeholders mapping and gave brief information of the history of DSS development up till this meeting. A copy of relevant documents has been distributed to participants.

# 3 Working Sessions 2 and 3: Identification and clustering and pre-selection of concerns

The participants were divided into three groups. These groups were heterogeneous consisting of different sectors and institutions. Print-outs of the original 31 concerns have been distributed for all participants. The groups were then asked to cluster the 31 concerns that were strongly connected and to select of concerns that are important in the context of developing a DSS.

The results of the group work were presented in plenary, where each group presented a final list of 10-13 agreed concerns. Each group present its finding and explained its opinion. The plenary group agreed on final list of 12 concerns to be further prioritized based upon the identified methodology. These 12 concerns were as follows:

1 Water resources availability
2 Water quality

3 Optimal utilisation of available water resources
4 Agriculture & livestock production
5 Coping with droughts
6 Coping with floods
7 Increased population density
8 Sedimentation and erosion
9 Water supply and sanitation
10 Navigation improvement & development
11 Investment planning
12 Increased energy demand

# 4 Working Session 4: Working Groups – Ranking of Concerns

The participants were asked to make a ranking of the above-identified 13 objectives to prioritize the type of decisions that the DSS should address in its first development phase. The proposed method for ranking was to use the different goals of the NBI: 1. Social =social welfare; 2. Economic=economic growth; 3. Environmental=sustainable use of natural resources; and 4. Regional Cooperation=regional collaboration among Nile Basin countries. The participants preferred to make the ranking in country break-out groups. The participants were asked to give a score of 0-1-2-3 to each objective for each of the four impact areas. The groups were asked to give weights on as scale from 0 to 3 to the NBI goals to reflect their preference to the type of NBI goals that they would like the DSS to address.

Presentation of Group results and consolidated results based on forms A1 and A2 will be presented in the Workshop report.

# 5 Objectives, Interventions, Alternatives

Definitions of the terminology used in the context of the DSS: *Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions* were presented and the information was gathered in a plenary and will be presented in the Workshop report.

# 6 Working Session 5: Outputs, Criteria and Indicators

Outputs, Criteria and Indicators will be presented in the workshop report.

# 7 Working Session 6: Models/Tools and Data/Information requirements

Presentation of results based on form B will be presented in the workshop report.

# 8 Indicators and Criteria.

Presentation of results based on form B will be presented in the workshop report.

# 9 Working Session 7: Institutional Arrangements

Institutional aspects

- DSS should have 2 roles on the Regional level and the National Level.
- Centralization is very important for the regional data base
- All countries should use the same models, database on the regional scale
- Same methodology should be applied in all countries
- Credibility of the data should be applied
- Data sharing protocols
- Panel of experts one from each country should be responsible on data base and model concepts
- Separate the Eastern Nile and the Southern Nile
- Each country can run simulations for study and published the desired runs for sharing between countries.
- Categorize the type of projects

    A. Projects do not need any acceptance
    B. Projects have limited impacts on other country but need to be published
    C. Projects have impacts on other country, need approval from all countries

- Establishment of panel of Experts to study proposed projects and their different alternatives

# 10 Training Needs Assessment

Training Needs Assessment will be presented in the Workshop report.

# 11 Closing Remarks

In conclusion the following were some identified general comments and guide lines for the DSS development process:

- The location of the regional/sub regional DSS should be identified.
- Data has to be verified and approved by countries
- Additional criteria/indicators/models/data may be provided later to guide the development process.
- All criteria should be evaluated for all countries to assess positive and negative impacts on each country.
- Methodology of compiling or selecting issues/objectives should be agreed by countries.
- Methodology for naming issues /objectives should be agreed by countries.
- Criteria and indicators should be standard for all issues/ objectives /interventions / alternatives (following same social/economic /environmental criteria)
- Panel of operators/experts representing all countries is important for DSS operation.
- Use of commercial software/models may provide unbiased tools.
- Categorization of projects as per the level of approval / notification needs may help in narrowing the scope of the DSS.

Cairo, 23 of December 2007

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Omar Elbadawy
Local Consultant, Egypt

# 12 Workshop Agenda

| TIME from | to | ACTIVITIES | RESPONSIBLITY |
|---|---|---|---|
| **11 December 2007** | | | |
| 08:00 | 08:30 | Registration | NBI (national office - NO) |
| **Opening Session** | | | |
| 08:30 | 08:45 | Welcome/Introductory Remarks | Dr. Wael Khairy |
| 08:45 | 09:00 | Official Opening | Eng. Ahmed ElSonosy |
| **Working Session 1** | | | |
| Chairman : Dr. Ahmed Wagdy | | | |
| 09:00 | 09:30 | What is a DSS and What Can it Do? | Dr. Mohamed Roshedy |
| 09:30 | 09:50 | Questions and Discussions | Dr. Mohamed Roshedy |
| **Coffee Break** | | | |
| 10:10 | 10:30 | Thematic and Key Issues | Eng: Aref Gharib |
| 10:30 | 10:50 | Question and Discussions | Eng: Aref Gharib |
| **Working Session 2: Break-out groups – Stakeholder Mapping** | | | |
| Chairman: Dr. Ahmed Wagdy | | | |
| 10:50 | 11:00 | Briefing on Stakeholder Mapping | Eng. Yasser Elwan |
| 11:00 | 11:15 | Formation of break-out groups | Eng. Yasser Elwan |
| 11:15 | 13:00 | Group Work – Stakeholder Mapping | |
| **Lunch** | | | |
| 14:00 | 15:00 | Discussion of Stakeholder Mapping | |
| **Working Session 3: Identification and Clustering of Decisions** | | | |
| Chairman: Dr. Karima Attia | | | |
| 15:00 | 17:30 | Identification and Clustering of Key Overall and Specific Decisions | Dr. Mohamed Roshedy |
| **Coffee Break** | | | |
| 12 December 2007 | | | |
| **Working Session 4: Break-out Groups – Ranking Decisions (refreshments on the side)** | | | |
| 08:30 | 08:45 | Recapitulation of Working Session 3 | Resource Person |

| TIME | | ACTIVITIES | RESPONSIBLITY |
|---|---|---|---|
| from | to | | |
| 08:45 | 10:45 | Group Work - Ranking/Decision Hierarchies | |
| 10:45 | 11:30 | Discussion | NDSS-N |
| **Coffee Break** | | | |
| **Working Session 5: Break-out Groups – Outputs, Criteria and Indicators** | | | |
| 11:45 | 12:00 | Briefing on criteria and indicators | Resource Person |
| 11:45 | 12:00 | Questions | Resource Person |
| 12:00 | 13:00 | Group Work - Outputs/Criteria and Indicators | NDSS-N |
| **Lunch** | | | |
| 14:00 | 16:00 | Group Work (cont'd) - Outputs/Criteria/Indicators and Alternatives | |
| **Coffee Break** | | | |
| 16:00 | 17:00 | Discussion | NDSS-N |
| **13 December 2007** | | | |
| **Working Session 6: Presentation 3 and Break-out Groups – Models/Tools and Data/Information** | | | |
| 08:30 | 09:00 | Possible Models/tools | Resource Person |
| 09:00 | 10:30 | Group Work – What are the data/information and Tool Requirements | |
| 10:30 | 11:00 | Discussion | NDSS-N |
| **Coffee Break** | | | |
| **Working Session 7: Break-out Groups - Institutional Arrangements** | | | |
| 11:00 | 11:30 | Presentation 4 – Institutional Concepts | Resource Person |
| 11:30 | 12:00 | Group Work – institutional capacity | |
| 12:00 | 12:30 | Summary of the Workshop Findings | NDSS-N |
| 12:30 | 13:00 | closing remarks | NDSS-N, NDSSS |
| **Lunch** | | | |
| 14:00 | 17:00 | Finalization of DSS workshop report (Organization Committee) | (NDSS Unit, NDSS-N, NBI-NO) |

## 13 List of Participants

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# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Ethiopia - Addis Abeba |
| Date / Time: | 14 to 16 November 2007; 09:00 – 17:00 |
| Venue: | NBI-WRPM Office, Addis Abeba, Ethiopia |
| Participants: | National DSS Specialist and Chairman: Mr. Deksyos Tarekegn<br>Deputy Team leader Consortium: Mr. Imeru Tamrat<br>Consultants: Mr. H.P. Nachtnebel and Mr. A. Hartveld,<br>Local Consultant: Mr. Dereje Hailu Asfaw<br>Representatives of the Water Administration at federal and state level, of the water related Ministries at federal level, of water knowledge centres and one national NGO. |

## Table of Content:

# 1 Introductory Remarks, Background

As preparation for the development of a conceptual design for a basin wide Decision Support System, the Consultants conducted country assessment in Ethiopia between 3rd and 7th of September 2007. During the country assessment, many resource institutes in the field of integrated water resources management were visited to explore the stakeholders and the main water resources management concerns in the countries. On the basis of the country assessments in all nine riparian counties of the Nile Basin a list of concerns was prepared for the Inception Report. The list of concerns should help to develop the key and specific decisions at regional, sub-regional and national level that the DSS should aim at for supporting.

The sub-regional and national consultations have as objective to analyse the stakeholders concerns and develop a list of key decisions to be supported and the identification of functionality and outputs of the DSS to support these decisions. This objective requires an analysis of the current and (projected) current decision-making processes on planning and management of water resources at regional (subsidiary vision program) and sub-regional level (subsidiary action program). It also requires that the most concerns raised during the country studies are specified in a uniform planning nomenclature and prioritised with the goals of the Nile Basin Initiative.

The consultation workshop focussed on the identification of the key concerns, their specification in planning nomenclature and the formulation of an institutional concept. Firstly the key issues had to be specified into interventions that the DSS can support. The participants had to develop these interventions into alternatives, output, indicators and criteria. a for the workshop have been prepared by the consultants. Another working session focuses on models and data requirements. The final session focused on institutional options for national DSS Centres and the various services that the centre needed to give and receive for developing its decision support capacities. Chapter 12 presents the agenda of the workshop that has been implemented and Chapter 11 the list of participants.

# 2 Presentation of the Consultants and of the Stakeholders

Mr. Deksoys opened the workshop by a welcoming speech. He told the meeting that the consultation workshop is instrumental in identifying and prioritising issues/concerns with regard to Nile Basin water resources planning and management at the national level. This in turn, he said, is an important step in defining the functionality of the NB-DSS and it is also an important input to the conceptual design and development process of the DSS.

After the opening speech, each participant was given a chance to introduce himself briefly. Mr. Imeru introduced the program for the consultation workshop. The workshop program (Chapter 12) is divided into seven working sessions, each session comprising different activities. The participants endorsed the program.

# 3 Presentations on “What is the DSS?”, Themes, Issues, and Decisions

Mr. Hartveld made a brief presentation on the topic “what is DSS?”. It was agreed that there is no need to go into details of DSS since the participants have already attended a two-day training/awareness raising workshop on the subject. Mr. Hartveld reiterated that the main purpose of the presentation is to refresh the memories of participants on some of the most important aspects of DSS. He highlighted the decision-making process, general system architecture of DSS

and multi-criteria analysis tools. After the presentation, the participants raised questions. Some of these are:

- Priorities at different stratified levels of the Basin (local, national, sub-regional, regional) are different and some times conflicting. How do we harmonize these disparities in priorities at different levels? Is it not a challenge for the DSS?
- How can DSS be used at all levels (local, national, sub-regional, regional)? How do we overcome the problem of scale?
- NB countries interest may vary from country to country and in some cases conflicting? How can DSS help in achieving the maximum interest of each country?
- Mr. Imeru and Mr. Hartveld responded to the questions raised by participants.

Mr. Hartveld presented a wide range of key issues/areas of concern identified at the 1st Regional Workshop during the inception phase. Not all of these key issues have relevance at the national level. He pointed out that the participants should identify and cluster key issues of high importance to their country. After identifying key issues, the participants should make suggestions about what they would like the DSS to do for them and hence what decisions they would like it to support. Mr. Hartveld reminded the participants of the NBI goals and the themes that it defines. He explained in detail the methodology, a two-dimensional cross-reference linkage matrix, which will help the participants in prioritising the key issues.

# 4 Group Work and Discussions

A short briefing on stakeholders mapping was given to the participants. The main objectives for stakeholders mapping is to identify institutions, groups and individuals that are active in a given sector and to illustrate the relative importance and levels of communication/collaboration in the sector. The procedure that should be followed in preparing stakeholder maps with respect to sectors was explained. Participants are then divided into four Break-out groups and each group is assigned to identify and map stakeholders in one or more sectors as given below.

- Group 1: Agriculture
- Group 2: Industry, mining & municipal services
- Group 3: Environment and Fisheries
- Group 4: Hydropower and Power trade and Navigation

The results of the group work are presented and discussed in a plenary. The participants gave comments for improvements of stakeholder maps produced by each group.

The thirty one concerns identified at the inception workshop were presented to the participants. Each of these areas of concern/key issue is discussed to identify whether that particular area of concern is a thematic category, key issue, decision, objective or externalities. The participants identified seven areas of concerns/key issue that are relevant to NB-WRPM at the national level. These key issues are:

- Wetland degradation
- Watershed degradation
- Under development of irrigation
- Low level of hydropower development
- Low level of coverage of water supply and sanitation
- Poor preparedness to cope with drought
- Poor preparedness to cope with flood

After articulating key issues of high relevance, the participants identified ways by which the DSS would support in decision-making. For each of the key issues objectives are formulated and for each objective, decisions/interventions are specified by the participants.

# 5 Working Groups – Ranking of Concerns

The participants decided to do the ranking in a plenary rather than in a break-out session. The procedure for the ranking of each key issue/objective was explained to the participants. Each objective was evaluated in terms of criteria, which refer to:

- Society
- Economy
- Environment and
- Regional cooperation

A very simple scoring system was used. If the objective is irrelevant to the criteria it is given zero score, if less relevant it is scored one; if moderately relevant it is scored two, and if highly relevant it is scored three. The plenum gives its scores for each issue/objective in terms of each criterion after discussions and if no consensus could be reached a vote was taken. The weights to be given for each criterion are agreed by the participants as follows: four to economy, three to society, two for environment and two for regional cooperation.

Each thematic category was firstly analysed within a lively discussion with respect to its relevancy for the four impact areas: society, economy, environment and regional collaboration. Afterwards, the participants ranked the importance of the thematic categories for their country by assigning a weighting factor. The detailed results can be found in the workshop report, but are summarised and analysed in Annex A of the Requirements Analysis and DSS Design Report.

Irrigation development was classified as the most relevant issue, followed by watershed management. Hydro-power development, drought preparedness and water supply and sanitation were considered as highly relevant issues. Flood preparedness and wetland management were ranked as moderate relevance for Ethiopia.

The participants agreed to consider the first five high-ranking objectives to specify alternatives, criteria and indicators in the following sessions.

# 6 Objectives, Interventions, Alternatives

Prof. Nachtnebel gave a briefing on criteria and indicators. In his presentation, he gave the definitions of terminologies like criterion, indicators and alternatives and also showed some examples. The briefing was helpful for the participants in identifying alternatives, criteria and indicators.

The four groups are tasked with defining alternatives, criteria and indicators for the objectives of the four key issues. Identifying the alternatives, criteria and indicators for the key issue of drought is done in plenary. The groups focused on the first five concerns that received the highest ranking.

Each group presented its findings and the participants discussed and forwarded suggestion to improve the results of the groups. The consolidated results of the group discussions and the

discussion during the plenum session are summarised and analysed in Annex 1 of the Draft DSS Design Report.

# 7 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Prof. Nachtnebel gave a presentation about models, tools and data requirements. The main objective of the presentation is to increase the awareness of participants on a range of analytical tools available for supporting decision-making process.

The meeting agreed to identify models and data requirement of these models in a plenary. The participants discussed and selected models required to process decisions and also identified data/information requirements of the models for the five priority areas of concerns/objectives, these results are also summarised and analysed in Annex A of the Draft DSS Report.

# 8 Presentation of Institutional Options for Transboundary River Basin Planning and DSS Development

Mr. Hartveld made a presentation on institutional concepts. The presentation focused on five generic types of stakeholders and their roles in the water sectors. Mr. Hartveld emphasized the stakeholders that will use the DSS and provides services needed for operating the DSS.

The meeting agreed to identify institutions and to assess the institutional capacities with particular reference to DSS service providers and users in a plenary.
A questionnaire approach is used for this purpose.

- Who can request demands for DSS providers?
- Who provides knowledge?
- Who provides data?
- Who enters/manage data base?
- Who will provide modelling services?

The participants expressed the opinion that the DSS design should minimally incorporate a regional and national DSS centre. The water resource management issues discussed showed that regional collaboration is required for the key overall decisions (developing regional planning, policy and strategies). The specific national concerns for which regional collaboration does not form a pre-condition, deal predominantly with the sectoral projects at country level. For these country level concerns a national DSS Centre is needed. A sub-regional DSS centre should be considered for enhancing transboundary collaboration between the riparian countries in respectively the sub-basins of the Nile,

The development of national, sub-regional and regional DSS Centres requires the development of an appropriate institutional and legal framework. The current Nile Basin Initiative institutional framework for transboundary collaboration at regional and sub-regional level is of transitional nature and requires upgrading. One option would be to form an International Commission for the Protection of the Nile Basin and an International Commission for the Protection of the Blue Nile Sub-basin. These international commissions would make it easier to develop collaboration protocols for data sharing and harmonization.

Public institutes at national and state level, and private and voluntary organizations that are involved in the water sector can formulate requests for operations services to the national DSS centre. The water related ministries are recommended to form national committee in which the senior policy makers coordinate the national policy concerning transboundary collaboration in the water sector. In addition it is recommended to form a tasks force of national DSS experts that should provide technical and managerial guidance to the national DSS Centre. The Ministry of Water Resources should have the coordinating role in the committee that is initially dominated by public sector organizations and in which a representation of the voluntary sector is foreseen in future.

# 9 Closing Remarks

Prof. Nachtnebel summarized the major findings of the workshop. He said the workshop has met the objectives which is reflected in the outputs obtained from this national consultations. Mr. Deksyos made a closing remark. He said the workshop was fruitful and thanked the Consultants and the participants for the contributions they made towards the success of the workshop.

# 10 Consultants' Review of Results

The discussion during the NBI-DSS country level consultation in Ethiopia was very lively and experts tried to find a compromise quickly. Flood preparedness was seen as an important issue but only a minority of the people lives in endangered areas and therefore this issue was ranked low. The ranking seems rational because major parts of the Nile catchment located in Ethiopia are considered as a headwater area and therefore watershed management is gaining higher importance. Further, irrigation systems are not yet well developed and thus this issue has the highest priority. Concerning hydropower development two alternative strategies were discussed, one referring to large-scale development and the second one considering small-scale hydropower schemes serving local supply needs by implementing local grids.

The top ranking thematic category "irrigation" is well described by the objective and the interventions. The listed indicators, criteria and models reflect the interests of the participants but it would be necessary to revise and complete them. It is proposed to include some indicators, which refer to the increase in agricultural production e.g. expressed by yield/crop and year. Further it is recommended to include an indicator, which characterises the uncertainty in the productivity due to natural variability of climate and stream flow. Although no explicit indicator for environmental impacts is mentioned it can be concluded that indicators "drawdown of groundwater table" and change in physical and chemical property of soils" cover some of the possible adverse impacts associated with irrigation development. It is also suggested to include a water distribution model describing the water flows and losses within the distribution system. In the economic models some attention should be given to sharing of the operation and maintenance costs.

Some comments are made with respect to the thematic category "increasing energy demand". Instead of the indicators "power generated per $m^3$" and "energy produced by $m^3$" it is proposed to use "hours of full capacity operation/year" which would describe the utilisation of available runoff appropriately. Secondly, a social indicator should be included expressing the number of people connected to the grid, and the percentage of energy utilised within the country. Obviously, hydropower has also some adverse impacts on environment, such as cutting the longitudinal connectivity and sometimes the lateral connectivity between the river and the flood plain. This implies that some environmental indicators are additionally included to cover these impacts. The data set could be accomplished by longitudinal hydrological profiles of the river network, by a

digital terrain model, and by a GIS including catchment boundaries, the river network, gauging stations etc.

The findings from the national consultation workshop in Ethiopia include all major issues and provide a useful basis for the conceptual design of a national DSS

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Dereje Hailu Asfaw, Hans Peter Nachtnebel and Aard Hartveld
Local and International Consultant Ethiopia

# 11 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 14/11/2007** | | | |
| 08:30 | 09:15 | Registration | NBI |
| **Opening Session** | | | |
| 10:00 | 10:10 | Opening of the workshop | Mr. Deksyos |
| 10:10 | 10:30 | Objectives and program of the workshop | International consultant |
| **Working Session 1: Presentations 1 and 2** | | | |
| 10:30 | 10:50 | **Presentation 1** - What is a DSS and What Can it Do? | International Consultant |
| 10:50 | 11:10 | **Plenum** – Questions and Discussions | Participants |
| 11:10 | 11:40 | **Presentation 2** - Thematic and Key Issues | International Consultant |
| 11:40 | 11:50 | **Plenum** - Question and Discussions | Participants |
| **Working Session 2: Clustering and selection of concerns** | | | |
| 11:50 | 12.00 | **Briefing** on stakeholders mapping | International Consultant |
| 11:45 | 13:15 | **Group Work** – Mapping of stakeholders for different water related sectors | Participants |
| **Lunch break** | | | |
| 14:00 | 14:20 | **Plenum** – Presentations by groups of stakeholders' maps | Group spokespersons |
| 14:20 | 15:00 | **Plenum**- Final-selection of Concerns | Participants |
| 15.20 | 17.00 | **Plenum- Discussion of issues, objectives and interventions of selected concerns** | International Consultant and participants |
| **Day 2: 15/11/2007** | | | |
| **Working Session 3: Ranking Issues** | | | |
| 9.30 | 10:00 | Review of issues, objectives and interventions | Participants |
| 10.00 | 10.15 | **Plenum – Discussion of Briefing**- Criteria for ranking the selected concerns | International Consultant |
| 10:15 | 12:15 | **Plenum – Ranking the concerns on social, economic, environment and regional collaboration** | International Consultant |

| TIME | | | |
|---|---|---|---|
| 13:15 | 14.00 | **Plenum**-Final approval of country level ranking | International Consultants |
| **Lunch break** | | | |
| **Working Session 4: Break-out Groups – Outputs, Criteria and Indicators** | | | |
| 14:00 | 14:50 | **Briefing** on Key Issues, Objectives, Alternatives, Criteria and Indicators | International Consultants |
| 14:50 | 16:00 | **Group Work** –Alternatives criteria and Indicators | Participants |
| 16.00 | 17.00 | **Plenum-** Alternatives criteria and Indicators | Group spokespersons |
| **Day 3: 16/11/2007** | | | |
| **Working Session 5: Presentation 3 and Break-out Groups- Models/Tools and Data/Information** | | | |
| 09:30 | 10:00 | **Presentation 3** – Possible Models/tools | International Consultants |
| 10:00 | 11:15 | **Group Work** – What are the models (tools) and data/information requirements (indicators) | Participants |
| 11:15 | 13:00 | **Plenum** - Discussion | Group spokespersons |
| **Lunch break** | | | |
| **Working Session 6: Institutional concepts and Break-out Groups - Institutional Arrangements** | | | |
| 14:00 | 14:20 | **Presentation 4** – Institutional Concepts | International Consultants |
| 14:20 | 15:00 | **Plenum- Stakeholders mapping/**institutional arrangements for demand-data and modelling | Participants |
| 15:00 | 15:10 | **Briefing** institutional and human capacity building for DSS | International Consultants |
| 15:10 | 15.30 | **Individual Work** Capacity building for DSS development | Participants |
| | | Capacity building for DSS development | International Consultants |
| **Working Session 7: Workshop Conclusions** | | | |
| 15.30 | 15.50 | Summary of the Workshop Findings | International Consultants |
| 15.50 | 16.00 | Closing Remarks | Chairman |

# 12 List of Participants

**Annex 1: National DSS Awareness/Training and Stakeholder Consultation Workshop**
**12-15, November 2007**
**WRPM Project Conference Hall**

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# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Kenya - Nairobi |
| Date / Time: | 03.12..2007; 09:30 – 17:00, 04.12..2007; 09:30 – 17:00, 5.12.2007 ; 09:30 – 13:00 |
| Venue: | Kenya Water Institute (KEWI) |
| Participants: | Mohammed Hassan (Dr) – National DSS Specialist, Kenya<br>Richard Schuen – hydrophil<br>Philip Riddell – ITAD<br>Munyikombo, L.S. – Local Consultant hydrophil<br>Stakeholders (see attached list of participants) |

## Table of Content:

# 1 Presentation of the Consultants and of the Stakeholders

Richard Schuen opened the Stakeholder Consultation Workshop by presenting himself and by asking the participants to present themselves.

After the session of self introduction the programme for the three days was adopted with minor alterations which were agreed upon.

Then he presented the Agenda and explained the various items on the programme adding that most of the work will be done in group work.

# 2 Introductory Remarks

Dr. Hassan Mohammed (NDSS-Specialist) made the introductory presentation of the Nile Basin Initiative, outlining the countries involved, the challenges and the opportunities in the basin. He showed the two major programmes, which are the SVP, based in Addis Ababa and SAP, based at Kigali, emphasising the Sub-Regional context of this Workshop.

He explained that the main purpose of the NBI is to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin Water Resources. This was to be achieved through two main programmes; Subsidiary Action Program (SAP): to promote action on the ground, and Shared Vision Program (SVP): to build trust, capacity and an enabling environment for investment in Nile Basin countries.

He explained the main purpose of the NBI-DSS as being; a common computer-based platform for communication, information management and analysis of water resources, and that it provides a framework for sharing knowledge, understanding river system behavior, evaluating alternative development and management strategies, and supporting informed decision making.

# 3 Presentations on “What is the DSS?” Themes, Issues, and Decisions

Mr. Schuen presented the DSS, the three phases of the Decision Making Process, the System Architecture, and the Model tools. He explained that in decision making it was important to

- Define the problem
- Prepare a model that defines the problem
- Then give possible solutions and possible alternatives
- And evaluate, and compare the different solutions and choose the best suitable

In considering alternatives one should be able to predict consequences of uncertainties and to make rapid decisions in a changing controversial environment.

He outlined the process of DSS emphasizing that it was a participatory, integrated planning process.

He explained that the challenges in decision making included competing institutions and stakeholders, different sectors with conflicting objectives, multiple criteria, different rationalities and lack of accurate and available data.

Included in his explanation was also an example. It was followed by a short discussion about the next steps of the workshop.
The discussion also covered analysis matrix, evaluation matrix and the sensitivity matrix and the handicaps that are usually encountered.

After this, Mr. Riddell presented the Themes, Issues, and Decisions. He explained that the goal in all the concerns was to address Kenyan concerns in the fields of society, economy, natural resources and regional collaboration. He made it clear to the participants that the main concerns agreed by the Working Group 5 of the 1st Regional Workshop were 31 and that these were to be reduced to a maximum of 10 to 12 Concerns that are important and relevant to Kenya. He added that these concerns were to be ranked, such that the most important will be discussed in more detail in order to define the objectives, the interventions, externalities, and alternatives. The next step was to define the criteria, the corresponding indicators, the models and corresponding data requirements.

# 4 Group Work and Discussions

Due to the restricted number of participants, only three groups were formed. The groups were formed in such a way as not to put participants from the same institution in one discussion group. The Stakeholders were then asked to consolidate from the list of 31 Concerns to a maximum of 10 or 12 that should be ranked during the following session. The Concerns would have to be clustered according to the thematic categories and issues defined in a matrix that was handed over to the participants.

Dr. Schuen, Mr. Riddell and Dr. Hassan were on hand to support the groups in order to explain in detail the objectives of that exercise and the meanings of Concerns. Two groups easily consolidated the main Concerns, while the other group ended up with 18 Concerns as the main ones and they had to be supported again in reducing the Concerns to a manageable number.

Discussions:
There were discussions on the definitions of Concerns and on the meaning of Concerns.
The Concern “Water Quality” was also discussed. One of the participants argued that water quality has a secondary relevance and is not as important as water availability. Mr. Riddell explained that water quality is a very important Concern because it is related to public health and with pollution and should be considered as well. This argumentation was accepted.

The Concern “Floods and Droughts” was also discussed as being a Concern that considers opposite issues. On the one hand, it considers droughts, that are very important for Kenya in the Lake Region and on the other hand it takes floods into consideration that are very relevant for the Nyando and Budalang’i areas.

After the Discussions, Mr. Schuen moderated the consolidation of the Concerns. The Concerns were reduced to a total of 12 during the plenum for each group as follows:

- Water quality (agricultural chemicals—Eutrophication) and water quality Urban industrial pollution)
- Coping with droughts and floods
- Increased energy demand
- Declining water levels in lakes and rivers
- Land use, cover change, and impacts on runoff
- Need to improve conservation to cope with climate variability through water harvesting

- Irrigation
- Water supply and sanitation
- Biodiversity conservation
- Watershed degradation
- Improving and developing navigation

# 5 Working Groups – Ranking of Concerns

After consolidation of the Concerns, the three groups met again to rank the 12 Concerns. The lists of Concerns have been prepared during the coffee break.

Dr. Schuen moderated the ranking session. The following scores were used during the ranking:

1 less important
2 important
3 very important
4 most important

# 6 Objectives, Interventions, Alternatives

Mr. Riddell then led the discussion in looking at the first three concerns in terms of objectives, output, criteria, economy and environment. The purpose of the presentation was to explain the differences between the terminologies - criteria and indicators. He explained that

- Indicators can address both impacts and activities, and can be both quantitative and qualitative. An activity indicator is a measure of progress of implementation e.g. hectares of irrigation
- Impact is a measure of the extent of the activity

He presented the definitions of the terminology used in the context of the DSS: Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions.
Group 1 discussed the concern ‘irrigation’; group 2 ‘environment and ecology—biodiversity’ while group 3 ‘declining water levels in lakes and rivers’

The Group Work begun after a detailed explanation of the steps of the exercise. Mr. Riddell explained all those steps of the whole process in very detail in order to support the participants in this complex task.

Very intensive discussions have been carried out within the groups. An agreement on the definitions of the Alternatives and Criteria was achieved.

# 7 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Mr. Riddell presented the Type of Models, Tools and Data needs for the DSS.
The two groups have been requested to define the Models and the Data needed to express the Indicators they have chosen for each Criterion.

## 8 Presentation of Institutional Options for Transboundary River Basin Planning and DSS development

Mr. Schuen presented the Institutional Concept and formulated the following five questions.

*Who requests the DSS Services?*
*Who provides the knowledge to DSS?*
*Who provides data to DSS?*
*Who should manage the data?*
*Who will provide the modelling?*

Those questions have been answered interactively and are included in the report of the International Consultants.

## 9 Trainings Needs Assessment

Mr. Schuen presented shortly the forms and the work was done by the same groups.
The results are included in the report of the International Consultants.

## 10 Closing Remarks

Closing remarks were then made by Mr. Schuen, Mr. Riddell and Dr. Hassan. The Workshop ended at 13:15 on the 5th December 2007

Nairobi, 5th December 2007

_____

Munyikombo, L.S.
Local Consultant, Kenya

# 11 Workshop Agenda

| TIME | | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| from | to | | |
| **Day 1: 03/12/2007** | | | |
| 09:30 | 09:35 | Registration | NBI |
| **Opening Session** | | | |
| 09:35 | 09:45 | Welcome/Introductory Remarks | NBI-DSS specialist |
| 09:45 | 10:00 | Official Opening<br>Presentation NB-DSS | NBI-WRPMP representative |
| **Working Session 1: Presentations 1 and 2** | | | |
| 10:00 | 10:30 | **Presentation 1** - What is a DSS and What Can it Do? | International Consultant |
| 10:30 | 10:45 | **Plenum** – Questions, translation, and Discussions | |
| **Refreshments** | | | |
| 10:45 | 11:00 | **Presentation 2** - Thematic and Key Issues | International Consultant |
| 11:00 | 11:15 | **Plenum** - Question and Discussions | |
| **Working Session 2: Clustering and selection of concerns** | | | |
| 11:15 | 11:30 | **Briefing** on clustering and pre-selection of concerns | International Consultant |
| 11:30 | 12:30 | **Group Work** – Clustering and pre-selections | |
| 12.30 | 12.45 | **Plenum** – Presentations by groups – Clustering/pre-selection | |
| **Lunch break** | | | |
| 13.50 | 14:40 | **Plenum**- Final-selection of Concerns | International Consultant |
| **Working Session 3: Reformulation of concerns into issues-objectives and interventions** | | | |
| **Working Session 4. Ranking Issues** | | | |
| 16:00 | 16:15 | **Briefing**- Criteria for ranking the Key Overall and Specific Issues | International Consultant |
| 16.15 | 17.15 | **Break-out Groups** – Ranking the Issues | |
| 17.15 | 17.30 | **Plenum**- Consolidation of Group rankings | International Consultant |
| **Day 2: 04/12/2007** | | | |
| **Working Session 4. Ranking Issues** | | | |
| 09:00 | 09:15 | Recapitulation of ranking results | International Consultant |
| 09:15 | 09:45 | **Plenum**-Final approval of country level ranking | International Consultant |
| **Working Session 5: Break-out Groups – Outputs, Criteria and Indicators** | | | |

| TIME | | | |
|---|---|---|---|
| 09:45 | 10:00 | **Briefing** on Key Issues, Objectives, Alternatives, Criteria and Indicators | International Consultant |
| 10:00 | 10:15 | Questions | |
| 10:15 | 12:30 | **Group Work** –Alternatives criteria and Indicators | International Consultant |
| 12:30 | 13:15 | **Plenum-** Alternatives criteria and Indicators | International Consultant |
| **Lunch** | | | |
| **Working Session 6 Presentation 3 and Break-out Groups- Models/Tools and Data/Information** | | | |
| 14:00 | 14:20 | **Presentation 3** – Possible Models/tools | International Consultant |
| 14:20 | 16:00 | **Group Work** – What are the tools (criteria) and data/information requirements (indicators) | International Consultant |
| 16:00 | 17:30 | **Plenum** - Discussion | International Consultant |
| **Day 3: 05/12/2007** | | | |
| **Working Session 7: Institutional concepts and Break-out Groups - Institutional Arrangements** | | | |
| 09:30 | 10:00 | **Presentation 4** – Institutional Concepts | International Consultant |
| 10:00 | 11:00 | **Plenum- Stakeholders mapping/**institutional arrangements for demand-data and modelling | International Consultant |
| 11:15 | 11:30 | **Briefing** institutional and human capacity building for DSS | International Consultant |
| 11:30 | 12:15 | **Group Work** Capacity building for DSS development | International Consultant |
| 12:15 | 12:45 | **Plenum** Capacity building for DSS development | International Consultant |
| **Working Session 8: Workshop Conclusions** | | | |
| 12:45 | 13:00 | Summary of the Workshop Findings | |
| 13:00 | 13.15 | Closing Remarks | NBI-Representative |

# 12 List of Participants

| No. | NAME | INSTITUTION |
|---|---|---|
| 1 | Phil Ridell | ITAD |
| 2 | Richard Schuen | Hydrophil |
| 3 | Dr. Hassan Mohammed | NBI-DSS Country Specialist |
| 4 | Munyikombo, L. S. | Local Hydrophil Consultant |
| 5 | Eratus Orwa | KNDF |
| 6 | A.M Kariuki | NEMA |
| 7 | Jacinta | Ministry of Water and Irrigation |
| 8 | Godfrey A. Ikunda | Ministry of Water and Irrigation |
| 9 | P.K. Supeyo | WRMA |
| 10 | Peter Odhiambo | East African Wildlife Society |
| 11 | Thomas M. Matias | Kenya Water Institute |
| 12 | Geoffrey O. Wekesa | Lake Basin Development Authority |
| 13 | David N. Chege | Kenya Forest Service |
| 14 | Simon K Kirui | Ministry of Energy |
| 15 | Samuel C. Ondieki | Ministry of Agriculture |
| 16 | Ndung'u A. G. | NDSS Country Counterpart |
| 17 | Mbayi H Malumbe | Ministry of Water and Irrigation |
| 18 | Hanshi Jama | Ministry of Health |
| 19 | Hosea K. Wendot | National Irrigation Board |
| 20 | William O. Ogola | Ministry of Regional Development |
| 21 | Johnson Maina | Meteorological Department |
| 22 | Charles Mwangi | Survey of Kenya |

# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Rwanda – Kigali |
| Date / Time: | 26.11.2007; 09:30 – 17:00 and 27.11.2007 ; 09:30 – 18:30 |
| Venue: | Ecole Notre Dame de Citeaux |
| Participants: | Antoine Niragire – National DSS Specialist Rwanda<br>Richard Schuen – hydrophil<br>Jorge Dreher – hydrophil<br>Sylvain Rusanganwa – Local Consultant hydrophil<br>Stakeholders (see attached list of participants)<br>Workshop was held in French |

## Table of Content:

# 1 Presentation of the Consultants and of the Stakeholders

Richard Schuen opened the Stakeholder Consultation Workshop by presenting himself and by asking the participants to present themselves.
Then he presented the Agenda.

# 2 Introductory Remarks by Antoine Niragire, NDSS-Specialist

Antoine Niragire made the introductory presentation of the Nile Basin Initiative, showing the two major programmes, which are the SVP, based in Ethiopia and SAP, based at Kigali, emphasising the Sub-Regional context of this Workshop. He explained the main purpose of the NBI-DSS.

# 3 Presentations on "What is the DSS?", Themes, Issues, and Decisions.

Mr. Dreher presented the *DSS, the three phases of the Decision Making Process, the System Architecture, and the Model tools*. Included was also an example. It followed a short discussion about the next steps of the workshop.

After this, Mr. Schuen presented the *Themes, Issues, and Decisions*. He made clear to the participants that the main concerns agreed by the Working Group 5 should be reduced to a maximum of 10 to 12 concerns, and that these concerns should be ranked, such that the most important can be discussed in more detail in order to define the objectives, the interventions, externalities, and alternatives. The next step would be to define the criteria, the corresponding indicators, the models and corresponding data requirements.

# 4 Group Work and Discussions

Due to the restricted number of participants, only two groups have been formed. The stakeholders have been asked to choose between the 31 Concerns a maximum of 10 or 12 that should be ranked during the following session. The concerns would have to be clustered according to the thematic categories and issues defined in a matrix that have been handed over to the participants.

Mr. Dreher supported the groups in order to explain in detail the objectives of htat exercise and the meanings of concerns. One of the groups found very easily the main concerns, the other group has taken too many concerns as the main ones and they have to be supported again in reducing the Concerns to a manageable number.

**Discussions:**

There were discussions on the definitions of concerns and on the meaning of concerns.
One of the participants argued that tourism should not be considered as a concern because this has nothing to do with water resources and it is considered by other specialised Institutions.

The concern "Water Quality" was also discussed. One of the participants argued that water quality has a secondary relevance and is not as important as water availability. Mr. Dreher had to

explain that water quality is a very important concern because it is related to public health and with pollution and should be considered as well. This argumentation was accepted.

The concern “Floods and Droughts” was also discussed as being a concern that considers opposite issues. On the one hand, it considers droughts, that are very important for Rwanda and on the other it takes floods into consideration that are not very relevant for Rwanda. It was proposed to remove “Floods” from this Concern and maintain Droughts as Concern.

After the Discussions, Mr. Schuen moderated the consolidation of the concerns. The concerns were reduced to a total of 10, these were as follows:

1. Soil erosion
2. Climatic change
3. Increased energy demand
4. Water supply and sanitation
5. Optimal utilisation of available water resources
6. Tourism
7. Wetland degradation
8. Flood and drought control
9. Water quality – pollution
10. Irrigation, drainage of wetlands for agriculture

# 5 Working Groups – Ranking of Concerns

After consolidation of the Concerns, the two groups met again to rank the concerns. The lists of concerns have been prepared during the coffee break.

Mr. Dreher moderated the ranking session.

Mr. Schuen made the presentation of the results that have been agreed after a short discussion on the relevance of “Water Supply and Sanitation” that was ranked on the fourth place. One of the participants would like to have Water Supply and Sanitation ranked higher than the third place that was ”Increased Energy Demand”. After a short discussion the participants agreed upon the scores of the concerns. The workshop was closed at 17:10. The participants where informed about the program for the next days.

# 6 Objectives, Interventions, Alternatives

The following program was carried out during the second day, November 27:
Mr. Schuen presented the definitions of the terminology used in the context of the DSS: *Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities and Decisions*.

The Group Work begun after a detailed explanation of the steps of the exercise. Mr. Dreher explained all those steps of the whole process in very detail because the participants gave the impression to need more support.

Very intensive discussions have been carried out within the groups. An agreement on the definitions of the *Alternatives and Criteria* was achieved at 14:00. The results have then been presented before lunch and will be presented in the report of the International Consultants.
During the discussions, one of the participants was surprised that for the “increased energy demand” the group dealing with this thematic area has not considered the alternative energies.

## 7 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Mr. Dreher presented the *Type of Models, Tools and Data needs* for the DSS.
The two groups have been requested to define the models and the data needed to express the Indicators they have chosen for each criterion.

## 8 Presentation of Institutional Options for transboundary River Basin Planning and DSS development

Mr. Schuen presented the Institutional Concept and formulated the following five questions.

*Who requests the DSS Services?*
*Who provides the knowledge to DSS?*
*Who provides data to DSS?*
*Who should manage the data?*
*Who will provide the modelling?*

Those questions have been answered interactively and are included in the report of the International Consultants.

## 9 Trainings Needs Assessment

Mr. Schuen presented shortly the *Training Needs Assessment* forms and the work was done by the same groups. The results are included in the report of the International Consultants.

## 10 Closing Remarks

Closing remarks have been then made by Messrs. Schuen and Niragire.
The Workshop finished at 18:20.

Kigali, 27 of November 2007

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Sylvain Rusanganwa
Local Consultant Rwanda

# 11 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 26.11.2007** | | | |
| 09:30 | 09:35 | Registration | NBI |
| **Opening Session** | | | |
| 09:35 | 09:45 | Welcome/Introductory Remarks | NBI-DSS specialist |
| 09:45 | 10:00 | Official Opening<br>Presentation NB-DSS | NBI-WRPMP representative |
| **Working Session 1: Presentations 1 and 2** | | | |
| 10:00 | 10:30 | **Presentation 1** - What is a DSS and What Can it Do? | International Consultant |
| 10:30 | 10:45 | **Plenum** – Questions, translation, and Discussions | |
| **Refreshments** | | | |
| 10:45 | 11:00 | **Presentation 2** - Thematic and Key Issues | International Consultant |
| 11:00 | 11:15 | **Plenum** - Question and Discussions | |
| **Working Session 2: Clustering and selection of concerns** | | | |
| 11:15 | 11:30 | **Briefing** on clustering and pre-selection of concern | International Consultant |
| 11:30 | 12:30 | **Group Work** – Clustering and pre-selections | |
| 12.30 | 12.45 | **Plenum-**Presentations by groups – Clustering/pre-selection | |
| **Lunch break** | | | |
| 13.50 | 14:40 | **Plenum**- Pre-selection and pre-ranking of Concerns | International Consultant |
| **Working Session 3: Reformulation of concerns into issues-objectives and interventions** | | | |
| 14.40 | 15.15 | **Plenum**- Formulation of concerns into issues, objectives and interventions | International Consultant |
| **Working Session 4. Ranking Issues** | | | |
| 16:00 | 16:15 | **Briefing**- Criteria for ranking the Key Overall and Specific Issues | International Consultant |
| 16.15 | 17.15 | **Break-out Groups** – Ranking the Issues | |
| 17.15 | 17.30 | **Plenum**- Consolidation of Group rankings | International Consultant |
| **Day 2: 27.11.2007** | | | |
| **Working Session 4. Ranking Issues** | | | |

| TIME | | | |
|---|---|---|---|
| 09:00 | 09:15 | Recapitulation of ranking results | International Consultant |
| 09:15 | 09:45 | **Plenum**-Final approval of country level ranking | International Consultant |
| **Working Session 5: Break-out Groups – Outputs, Criteria and Indicators** | | | |
| 09:45 | 10:00 | **Briefing** on intervention alternative-criteria and indicators | International Consultant |
| 10:00 | 10:15 | Questions | |
| 10:15 | 13:30 | **Group Work** – Intervention alternatives criteria and Indicators | International Consultant |
| 13.30 | 14.00 | **Plenum-** | |
| **Lunch** | | | |
| **Working Session 6 Presentation 3 and Break-out Groups- Models/Tools and Data/Information** | | | |
| 15:00 | 15:15 | **Presentation 3** – Possible Models/tools | International Consultant |
| 15.15 | 15:45 | **Group Work** – What are the tools and data/information requirements | |
| 15:45 | 16:00 | **Plenum** - Discussion | International Consultant |
| **Working Session 7: Institutional concepts and Break-out Groups - Institutional Arrangements** | | | |
| 16:00 | 16:20 | **Presentation 4** – Institutional Concepts | International Consultant |
| 16.20 | 17:00 | **Plenum- Stakeholders mapping/**institutional arrangements for demand-data and modelling | International Consultant |
| 17:00 | 17:10 | **Briefing** institutional and human capacity building for DSS | International Consultant |
| 17.10 | 17:45 | **Group Work** Capacity building for DSS development | International Consultant |
| 17.45 | 18.00 | **Plenum** Capacity building for DSS development | International Consultant |
| **Working Session 8: Workshop Conclusions** | | | |
| 18.00 | 18.10 | Summary of the Workshop Findings | International Consultant |
| 18.10 | 18.15 | Closing Remarks | NBI-Representative |

# 12 List of Participants

| 26.Nov.07 | Name of National participant on T/A | Qualification | Institution | Telephone | e-mail |
|---|---|---|---|---|---|
| 1 | Twahirwa Anthony | METEO | MININFRA | 08484636 | twakig@yahoo.com |
| 2 | Uwamariya Pascasie | Engineer | ELECTRAGAZ | 08771590 | puwamariya@ electrogaz.co.rw |
| 3 | Lobga Monia | Engineer | PEAMR | 05148504 | mssmonia@yahoo.fr |
| 4 | Nzeyimana Bonaventure | Engineer | MININFRA | 08833694 | bnzeyimana@ yahoo.fr |
| 5 | Tabaro Rene | Nutritionnist | Ministry of Health | 08416683 | renekari2006@yahoo.fr |
| 6 | Nshuti Pascal | Chef de Projet Informatique | BNR | 08618629 | pnshuti@bnr.rw |
| 7 | Kamikazi Mwajabu | Engineer | RBS | O8842524 | kamikazimwajabu@yahoo.com |
| 8 | Ndekezi Fr.Xavier | Engineer | RSSP-MINAGRI | 08610295 | ndexavier@ yahoo.com |
| 9 | Musango K. Jacques | Environnementaliste | MINITERE | 08692216 | moussangho@yahoo.fr |
| 10 | Dr. Kamanzi wa Sangano J.M.V. | Medical Doctor | Muhima Hospital | 08403599 | sangakamanzi@yahoo.fr |

| 27.Nov.07 | Name of National participant on T/A | Qualification | Institution | Telephone | e-mail |
|---|---|---|---|---|---|
| 1 | Mukiza Odillo | Engineer | MINITERRE | 08418945 | odillonrw@ yahoo.com |
| 2 | Twahirwa Anthony | METEO | MININFRA | 08484636 | twakig@yahoo.com |
| 3 | Uwamariya Pascasie | Engineer | ELECTRAGAZ | 08771590 | puwamariya@ electrogaz.co.r |
| 4 | Nzeyimana Bonaventure | Engineer | MININFRA | 08833694 | bnzeyimana@ yahoo.fr |
| 5 | Tabaro Rene | Nutritionniist | Ministry of Health | 08416683 | renekari2006@yahoo.fr |
| 6 | Nshuti Pascal | Chef de Projet Informatique | BNR | 08618629 | pnshuti@bnr.rw |
| 7 | Kamikazi Mwajabu | Engineer | RBS | 8842524 | kamikazimwajabu@yahoo.com |
| 8 | Ndekezi Fr.Xavier | Engineer | RSSP-MINAGRI | 08610295 | ndexavier@ yahoo.com |
| 9 | Musango K. Jacques | Environnementaliste | MINITERE | 08692216 | moussangho@yahoo.fr |
| 10 | Dr. Kamanzi wa Sangano J.M.V. | Medical Doctor | Muhima Hospital | 08403599 | sangakamanzi@yahoo.fr |

# Minutes of Workshop
## International Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Sudan - Khartoum |
| Date / Time: | 19 to 21 November 2007; 09:00 – 17:00 |
| Venue: | Conference Hall Ministry of Irrigation and Water Resources, Khartoum, Sudan<br>NWRPMP Steering Committee member: Dr. Idris Mohammed<br>National DSS Specialist and Chairman: Dr. Salih Hamed Hamid |
| Participants: | Consultants: Mr. H.P. Nachtnebel and Mr. A. Hartveld<br>Representatives of the water administration and water related Ministries at national level, and national water knowledge centres. |

## Table of Content:

# 1 Introductory Remarks, Background

As preparation for the development of a conceptual design for a basin wide Decision Support System, the Consultants conducted a country assessment in Sudan from 26 until 30 August 2007. During the country assessment, many resource institutes in the field of integrated water resources management were visited to explore the stakeholders and the main water resources management concerns in the Sudanese water sector. On the basis of the country assessments in all nine riparian counties of the Nile Basin a list of concerns was prepared for the Inception Report. The list of concerns should help to develop the key and specific decisions at regional, sub-regional and national level that the DSS should aim at for supporting.

The sub-regional and national consultations have as objective to analyse the stakeholders' concerns and develop a list of key decisions to be supported and the identification of functionality and outputs of the DSS to support these decisions. This objective requires an analysis of the current and (projected) current decision-making processes on planning and management of water resources at regional (subsidiary vision program) and sub-regional level (subsidiary action program). It also requires that most concerns raised during the National Consultations are specified in a uniform planning nomenclature and prioritised with the goals of the Nile Basin Initiative.

The National Consultation workshop focussed on the identification of the key concerns, their specification in planning nomenclature and the formulation of an institutional concept. For this purpose the consultants have prepared a detailed programme. The key concerns had to be specified into interventions for which the DSS can be used for selecting alternative options. For these interventions the participants had to develop alternative options, outputs, indicators and criteria. Another working session focused on models and data requirements. The final session focused on institutional options for national DSS Centres and the various services that the centre needed to give and receive for developing its decision support capacities. Chapter 13 presents the agenda of the workshop that has been implemented and Chapter 14 the list of participants.

# 2 Opening of the Workshop

Dr. Saleh, the NBI-national DDS specialist made the opening remarks of the workshop by explaining the objective and expected outputs of the country level consultation. The main objective is to select the key overall and specific decisions on which a basin wide DSS should focus from a Sudanese perspective. Stakeholders from a wide range of institutions dealing with water management issues, of whom many attended the country level DSS training and awareness workshop, are present so that this consultation meeting can benefit from the previous activity.

Dr. Indris Mohammed opened the workshop on behalf of the Under Secretary of the Ministry of Irrigation and Water Resources. Dr. Indris represents the Sudanese Ministry of Irrigation and Water Resources in the NBI Steering Committee for the Water Resources Planning and Management Project. Transboundary collaboration in planning and management of water resources is becoming increasing important for the Nile Basin. The DSS is a potential tool for enhancing regional collaboration, however the riparian countries need to set their priorities for water management issues on which the DSS should focus. During the country level consultation there will be many opportunities to discuss the main concerns of Sudan in water resources management.

# 3 Objectives, Architecture and Functions of DSS

Prof. Nachtnebel presented a Power Point presentation named “What is a DSS and what can it do?” The presentation dealt with the issues and the nature of the decision making process in water resources management and the potential role that a DSS could play in supporting the decision making process that is becoming increasingly complex in the context of IWR management where many stakeholders with conflicting objectives are involved. The discussion after the presentation focussed on the connection between a DSS system at national, sub-regional and regional level in terms of harmonising institutional concept, objectives and modelling tools. Participants stressed the importance that the DSS should focus on the major concerns of the riparian states. Some key concerns require regional collaboration between the riparian countries and the regional DSS system should focus on these issues. Other concerns are specific to the country level and therefore the national DSS system should focus on these specific issues. The participants were interested to know how long it would take to develop an operational DSS. Prof. Nachtnebel explained that the development of a DSS is a time consuming activity that might require 15 years or more. However, he considered it realistic that after a period of five years a prototype would be operative.

# 4 Presentations on Themes, Issues, and Decisions.

Mr. Hartveld presented a wide range of key issues/areas of concern identified at the 1st Regional Workshop during the Inception Phase. Not all concerns have the same character: some deal with economic sectors and others with specific water resources management issues. Some deal with externalities on which the managers’ decisions have little influence and others deal with preconditions for the operation of a Decision Support System. Some issues like water quality deal with the same concern but use different wordings. The consultants eliminated already the issues dealing with development goals, externalities and DSS preconditions from the list of issues. The participants were expected to cluster issues and make a first ranking of issues/concerns that have a high importance to their country. After identifying key issues, the participants should make suggestions about management decision for which the DSS should provide them with tools to support them in the decision making process. Mr. Hartveld reminded the participants of the NBI goals and the themes that it defines. He explained in detail the methodology, a two-dimensional cross-reference linkage matrix, with on one axis the water using sectors and on the other axis the water resources management issues, which will help the participants in prioritising the key issues.

# 5 Group Work and Discussions

The participants divided themselves into three groups that would make a clustering of the issues and make a first ranking of the issues on their relevance at country level. The groups later reported the results of their discussion in small groups in the plenum.

As a result of the groups work and subsequent plenum session, the workshop selected the following concerns:

1. Water availability
2. Drought
3. Access to water
4. Sediment management
5. Water quality
6. Water supply and sanitation
7. Hydropower development
8. Water use in agriculture

9. Watershed management
10. Wetland management
11. Floods
12. Navigation
13. Aquatic weeds
14. Tourism
15. compound issue

# 6 Working Groups – Ranking of Concerns

The participants decided to do the ranking in a plenary rather than in a break-out session. The procedure for the ranking of each key issue/objective was explained to the participants. Each objective was evaluated in terms of criteria, which are relevant to four themes of the NBI goals. These criteria are:

- Society
- Economy
- Environment and
- Regional cooperation

A very simple scoring system was used. If the objective is irrelevant to the criteria it is given zero score, if less relevant it is scored one; if moderately relevant it is scored two, and if highly relevant it is scored three. The plenum gives its scores for each issue/objective in terms of each criterion after discussions and if no consensus could be reached a vote was taken. The weights to be given for each criterion are agreed by the participants as follows: four to economy, three to society, two for environment and two for regional cooperation.

The participants ranked the 14 concerns using for impact areas that are derived form the NBI goals: 1. Society (human welfare), 2. Economy (economic growth), 3. Environment (sustainability), 4. River basin (regional collaborate). Table 2 represents the results of the ranking. The participants decided to give different weights to the different impact areas and row two shows the weight factors.

# 7 Objectives, Interventions, Alternatives

Prof. Nachtnebel gave a briefing about alternatives for interventions for which the DSS supports the selection of attractive alternatives satisfying to a large extent multiple objectives that the decision makers wants to realize. Four groups were formed that formulated for three concerns the intervention alternatives, the indicators and the criteria that had to be fulfilled. Thereby the first twelve concerns were covered and the break-out groups presented the results of the discussions in plenum.

# 8 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Prof. Nachtnebel gave a presentation about models, tools and data requirements. The main objective of the presentation is to increase the awareness of participants on a range of analytical tools available for supporting decision-making process.

The meeting agreed to continue working in the four working groups to identify models and data requirement of these models on the same concerns as during the previous group work. The participants discussed and proposed models supporting the decision making process and also identified data/information requirements of the models.

# 9 Presentation of Institutional Options for transboundary River Basin Planning and DSS development

Mr. Hartveld gave a presentation about institutional aspects that focused on the arrangement that a national DSS-Centre needs with the potential users, the development partners (providers knowledge and skills), the interested parties and the data suppliers. Four working groups were formed to discuss the potential arrangements between a National DSS Centre and different stakeholders categories. For the purpose the participants received the table of stakeholders categories in Sudan that is presented in the NBI-DSS Inception Report.

The participants expressed the opinion that the DSS design should minimally incorporate regional and national DSS centres. A sub-regional DSS centre should be considered for enhancing transboundary collaboration between the riparian countries in respectively the sub-basins of the White and Blue Nile. The participants recommended the formation of a National Task Force or Steering Committee for Water and Environment that provides scientific and technical guidance to the development of the national DSS system, and represents Sudan in the NBI Steering Committee that guides the development of the regional DSS system. The Steering Committee, which is chaired by key DSS expert in the Ministry of Irrigation and Water Resources, has planning experts of the water and environment sectors as its member. The Steering Committee advises the policy-making council of ministers involved in the water sector, and provides scientific guidance to the management of the national DSS centre.

The participants hoped that besides public sector organizations also interested parties from private and voluntary sectors would participate in the development of a basin wide DSS system. The public sector organizations involved in the water sector are expected to become the main users of a national DSS given their planning responsibilities. However, the stakeholders considered it important that in the near future also universities and NGOs should participate in the formulation of DSS operations and in reviewing the results. Therefore procedures need to be developed to submit study proposals to the Steering Committee of the national DDS, and to regulate accessibility to the study reports for different stakeholder categories. Three code levels are proposed: 1. General public; 2. Interested parties (Universities and NGOs) and 3.Ministeries involved in water sector.

# 10 Trainings Needs Assessment

Prof. Nachtnebel explained the questionnaire in which different training modules for managers, operators, experts, interested parties and data suppliers are presented. The participants made an individual ranking of the proposed modules concerning the relevance of the training modules. Annex 6 presents the average scores that the participants gave to the different potential training modules.

# 11 Closing Remarks

Prof. Nachtnebel presented a summary of the results of the three-days workshop. He thanked the participants for the active contributions during the workshop, which has resulted in qualitatively good output of the workshop. Dr. Ali M. Adeeb closed the workshop and thanked the international consultants for their facilitation.

# 12 Comments of the International Consultants

The participants in the consultation workshop acted actively in the various working groups and in the plenum discussions. Several MoIWR senior managers made efforts to participate in all major discussions. The participants demonstrated the capacity to develop compromises through discussion on the basis of arguments.

It was interesting to learn that the highest weight was given to social impacts (outputs), followed by economic and environment with both having the same rank. International cooperation was considered as important but of less relevance than the other impact areas.

The number of identified thematic categories (14) was surprisingly large. Analysing these thematic categories the linkages between some are strong that the consultants suggested to reduce them by combining several thematic categories. The consultants propose to merge water resources availability, and access to water into management of scarce water resources. In addition, it is proposed to merge drought and floods into ‘ Drought and flood preparedness’. Finally, it is proposed to merge the thematic categories ‘aquatic weeds’ with ‘navigation’.

The territory of Sudan is situated in many sub-river basins of the Nile Basin and in two NBI sub-regions: the Eastern Nile Sub-basin and the Nile Equatorial Lakes Sub-basin. The nature of the water resources management issues differ per sub-basin and consequently for the sub-regions. For the development of a national DSS in Sudan the institutional set-up will be very important since the main Nile river flows through Sudan, some of the sub river basins are locate only in Sudan, other sub-river basins Sudan shares with respectively Ethiopia and Egypt. The territory of Sudan forms a very strategic position in the Nile River Basin. However, the political and administrative structures are issues that are debated in the national and international political platforms. Therefore also in the NBI the design of the DSS and institutional structures for DSS require special attention and flexibility in case of Sudan.

Hans Peter Nachtnebel and Aard Hartveld
International Consultants Sudan

# 13 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 19/11/2007** | | | |
| 08:30 | 09:15 | Registration | NBI |
| **Opening Session** | | | |
| 10:00 | 10:10 | Introduction workshop | Dr. Salih Hamid Hamed (National DSS specialist) |
| 10:10 | 10:30 | Opening of the workshop | Dr. Idris Mohammed NBI-WRPMP Steering Committee member |
| **Working Session 1: Presentations 1 and 2** | | | |
| 10:30 | 10:50 | **Presentation 1** - What is a DSS and What Can it Do? | International Consultant |
| 10:50 | 11:30 | **Plenum** – Questions and Discussions | Participants |
| 11:30 | 12:00 | **Presentation 2** - Thematic and Key Issues | International Consultant |
| 12:00 | 12:10 | **Plenum** - Question and Discussions | Participants |
| **Working Session 2: Clustering and selection of concerns** | | | |
| 12:10 | 13.00 | **C**lustering and ranking of issues for Sudanese context | Participants |
| **Lunch break** | | | |
| 14:00 | 14:40 | **Plenum** – Presentations of group results of clustering and pre-selection | Group spokespersons |
| 14:40 | 17:00 | **Plenum**- Discussion of concerns- issues- objectives and interventions of pre-selected concerns | Participants and international consultants |
| **Day 2: 20/11/2007** | | | |
| **Working Session 3: Ranking Issues** | | | |
| 9.00 | 09:30 | Summary of findings Day-1 workshop | |
| 09:30 | 11:00 | **Plenum**- Discussion of concerns- issues- objectives and interventions of pre-selected concerns | Participants and international consultants |
| 11.00 | 11.15 | **Plenum – Discussion of Briefing**- Criteria for ranking the selected concerns | International Consultant |
| 11:15 | 12:15 | **Plenum –** Ranking the concerns on social, economic, environment and regional collaboration | Participants and International Consultant |

| TIME | | | |
|---|---|---|---|
| 12:15 | 13.00 | **Plenum**-Final approval of country level ranking | Participants and International Consultants |
| **Lunch break** | | | |
| **Working Session 4: Break-out Groups – Outputs, Criteria and Indicators** | | | |
| 14:00 | 14:50 | **Briefing** on Key Issues, Objectives, Alternatives, Criteria and Indicators | International Consultants |
| 14:50 | 16:00 | **Group Work** –Alternatives criteria and Indicators | Participants |
| 16.00 | 17.00 | **Plenum-** Alternatives criteria and Indicators | Group spokespersons |
| **Day 3: 21/11/2007** | | | |
| **Working Session 5: Presentation 3 and Break-out Groups- Models/Tools and Data/Information** | | | |
| 09:30 | 10:00 | **Presentation 3** – Possible Models/tools | International Consultants |
| 10:00 | 11:15 | **Group Work** – What are the models (tools) and data/information requirements (indicators) | Participants |
| 11:15 | 13:00 | **Plenum** - Discussion | Group spokespersons |
| **Lunch break** | | | |
| **Working Session 6: Institutional concepts and Break-out Groups - Institutional Arrangements** | | | |
| 14:00 | 14:20 | **Presentation 4** – Institutional Concepts | International Consultants |
| 14:20 | 15:00 | **Group Work** institutional arrangements for formulating demands- data supply-modelling expertise- accessibility reports | Participants |
| 15:00 | 15:10 | **Briefing** institutional and human capacity building for DSS | International Consultants |
| 15:10 | 15.30 | **Individual Work** Capacity building for DSS development | Participants |
| | | Capacity building for DSS development | International Consultants |
| **Working Session 7: Workshop Conclusions** | | | |
| 15.30 | 15.50 | Summary of the Workshop Findings | International Consultants |
| 15.50 | 16.00 | Closing Remarks | Chairman |

# 14 List of Participants

| No. | NAME | ORAGANIZATION | LOCATION |
|---|---|---|---|
| 1 | Eng. Mohamed Bahr Eldein Abdalla | U/S MOIWR - TAC member | Khartoum |
| 2 | Dr. Salah Yousif | WR Organ chairman –TAC member | Khartoum |
| 3 | Dr Idris Mohmed Idris | D.G for dams, WRPMP SCM | Khartoum |
| 4 | Isaac Liabwel | MWRI-Gov. of Southern Sudan | **Juba** |
| 5 | Dr. Seif Hamed | Technical D. of the Minister's office | Khartoum |
| 6 | Ibrahim Salih Adam | NBI focal person | Khartoum |
| 7 | Dr. Kamal Bashar | UNESCO Chair for water resources- SUDAN | Khartoum |
| 8 | Amin Sabri | D. NEC | Khartoum |
| 9 | Badr El Din Taha | NC for EWAP | Khartoum |
| 10 | Hasab El Nabi Musa | W.N D Projects | Khartoum |
| 11 | Hydar Yousif Bakheit | D. Nile waters | Khartoum |
| 12 | Karorri Elhag Hamed | D. of Planning – DSS R network member | Khartoum |
| 13 | Ahmed Abdalla A/Shemela | Coordinator DST FAO project | Khartoum |
| 14 | Dr. Salih Hamad Hamid | N DSS S-Sudan | Khartoum |
| 15 | Osman Yousif Ibrahim | N coordinator of CB& SI project | Khartoum |
| 16 | Omer Mohamed Zein | Info. Center MOIWR | Khartoum |
| 17 | A/Gadir Mukhtar El Imam | WR Organ | Khartoum |
| 18 | Hassan Abu El Bashar | Hydrological Research Station | **Wad Medani** |
| 19 | Ibrahim Adam Balila | Watershed project coordinator | Khartoum |
| 20 | Prof. Abdalla AbdelSalam | G.D UNESCO Chair for water resources- SUDAN | Khartoum |
| 21 | Widad Mutwakil Saadalla | DSS Counterpart | Khartoum |
| 22 | Musa M. Mustafa | Directory Dams | Khartoum |
| 23 | Mirghani Sidahmed | U/S Office MOIWR | Khartoum |

| | | | |
|---|---|---|---|
| 24 | Hassan Ahmed Widaaa | GIRP/PIU | **Wad Medani** |
| 25 | Dr. Ali Adeeb | Dean of Water Management & Irrigation Institute | **Wad Medani** |
| 26 | Adam Abbakar Basheer | G.D of Projects Direcorate | **Wad Medani** |
| 27 | El Sidig Hamid | U/S Office MOIWR | Khartoum |
| 28 | Faysal El Kurdi | U/S Office | Khartoum |
| 29 | Alawia Abd El Hameed | Nile Waters Directorate | Khartoum |
| 30 | Dr. Ahmed Ibrahim Kabo | I&D R N member | **Wad Medani** |
| 31 | Dr. Babiker Abdlla | ENTRO | Khartoum |
| 32 | Tahani Ibrahim Adam | WR Organ | Khartoum |

# Minutes of Workshop
## International Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Tanzania - Dar Es Salaam |
| Date / Time: | 06.12.2007; 09:30 – 17:00 and 07.12..2007 ; 09:30 – 18:30 |
| Venue: | Blue Pearl Hotel & Apartments |
| Participants: | Dr. George Lugomela – National DSS Specialist Tanzania<br>Mr. Richard Schuen – hydrophil<br>Mr. Phillipp Riddell – ITAD<br>Stakeholders (see annexed List of participants) |

## Table of Content:

# 1 Presentation of the Consultants and of the Stakeholders

Mr. Ipyana Mwakalinge opened the Stakeholder Consultation Workshop. Opening speech is attached in para 11. Then, Mr. Riddell presented the Agenda.

# 2 Introductory Remarks

Mr. Saidi Faraji, Chairman of the Workshop, made the introductory presentation of the Nile Basin Initiative, showing the framework of the NBI and emphasising the national context of this Workshop. He explained also the main purpose of the NBI-DSS.

# 3 Presentations on "What is the DSS?", Themes, Issues, and Decisions.

Mr. Schuen presented the *DSS, the three phases of the Decision Making Process, the System Architecture, and the Model tools*. Included was also an example. A short discussion about the next steps of the workshop followed.

After this, Mr. Riddell presented the *Themes, Issues, and Decisions*. He made clear to the participants that the main concerns agreed by the Working Group 5 of the 1st Regional Workshop should be reduced to a maximum of 10 to 12 concerns, and that these concerns should be ranked, such that the most important ones can be discussed in more detail in order to define the objectives, the interventions, externalities, and alternatives. The next step would then be to define the criteria, the corresponding indicators, the models and corresponding data requirements.

# 4 Group Work and Discussions

Four working groups have been formed. The Stakeholders have been asked to choose a maximum of 10 or 12 concerns out of the 31 that should be ranked in the following session. The concerns would have to be clustered according to the thematic categories and issues defined in a matrix that was handed over to the participants.

Mr. Riddell and Mr. Schuen supported the groups in order to explain in detail the objectives of that exercise and the meanings of Concerns.

Mr. Riddell moderated the plenum discussion for the consolidation of the concerns. The concerns were reduced to a total of 12 as follows:

1. Water resources availability
2. Declining water levels in lakes and rivers
3. Water quality - pollution
4. Optimal utilisation of avail. water resources
5. Water use efficiency, demand management
6. Biodiversity conservation
7. Irrigation
8. Water quality - eutrophication
9. Water supply and sanitation
10. Watershed degradation (destruction of forests)
11. Increased energy demand
12. Wetlands degradation

# 5 Working Groups – Ranking of Concerns

After consolidation of the Concerns, the four groups met again to rank the concerns. The lists of concerns have been prepared during the coffee break.

Mr. Schuen moderated the ranking session.
Mr. Schuen made the presentation of the results that have been agreed after a short discussion.

# 6 Objectives, Interventions, Alternatives

The following program was carried out during the afternoon of the first day.
Mr. Riddell briefed the work shop on the concepts of Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions.

The group work begun after a detailed briefing of the steps of the exercise. Mr. Riddell explained those steps of the whole process.

Very intensive discussions have been carried out within the groups.

End of Day 1.

# 7 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Mr. Riddell presented the Type of Models, Tools and Data needs for the DSS.
The groups have been requested to define the models and the data needed to calculate the indicators they had previously chosen for each criterion. A brief discussion about the level of model specification followed. It was then agreed that there are only generic types of models to be indicated. The groups then worked out the models and tools. The results have then been presented before lunch and will be presented in the report of the International Consultants.

# 8 Presentation of Institutional Options for transboundary River Basin Planning and DSS development

Mr. Schuen presented the *Institutional Concept* and formulated the following five questions.

*Who requests the DSS Services?*
*Who provides the knowledge to DSS?*
*Who provides data to DSS?*
*Who should manage the data?*
*Who will provide the modelling?*

Those questions have been answered interactively in the plenum, thus the main stakeholders have been identified. The results are included in the report of the International Consultants.

# 9 Trainings Needs Assessment and Closing Remarks

Mr. Schuen briefed the plenum about the forms to be used for the *Training Needs Assessment* and the work was done by the same groups.

The results are included in the report of the International Consultants.
Closing remarks have been then made by the Chairman.

Dar Es Salaam, 07.12.2007

# 10 Opening Speech

SPEECH BY THE GUEST OF HONOUR THE DIRECTOR OF WATER RESOURCES AT THE OPENING CEREMONY OF THE SECOND ROUND OF STAKEHOLDER CONSULTATIONS ON THE NILE BASIN DSS NEEDS ASSESSMENT AND CONCEPTUAL DESIGN

Dear,
Chairman of the workshop, Mr. Saidi Faraji
International Consultants, Mr. Mr. Schuen and Mr. Riddell
National DSS Specialist, Dr. George Lugomela
Ladies and Gentlemen:

It gives me great pleasure and honour to be invited to open this workshop, the second round of stakeholder consultations on the Nile Basin Decision Support System needs assessment and conceptual design. The Nile Basin Initiative through its Water Resources Planning and Management Project is involved in a unique process in the development of the Nile Basin Decision Support System (DSS). I call it unique because the development adopts a participatory approach. Normally, systems of this nature are developed by few individuals and then brought to the end users without their involvement in the development. As the name of the workshop suggest, it is the second round and I understand that the first round was conducted in September 2007, which involved visits to selected institution. The results of the first round have necessitated the need for more detailed consultation with stakeholders who have been categorized as potential users of the DSS, potential development partners, interested parties and data supplying institutions, and am told that they are all represented in this workshop today.

The approach of involving stakeholders is aimed at ensuring the ownership of the DSS by the Nile riparian countries through;-

- Participation of the Decision makers in the overall development of the DSS throughout the process.
- User participation in the DSS design and technical development
- Employment of flexible and modular architecture of the DSS that can be upgraded and adjusted according to user needs and their development over time.
- Clear response to perceived needs based on a comprehensive DSS needs assessment conducted at regional, sub-regional and national level

Thus

- Ensuring transparency and confidence in such a way that all riparian countries have full trust in the ability of the system to provide rational and objective support based on best available data, information and estimates.

- Enhancing sustainability of the DSS to continue to function and be used within the framework of Nile Basin collaboration as well as at the national level

Therefore, this workshop today is the testimony of the participatory approach that the NBI has adopted in order to come up with a tool acceptable and owned by stakeholders and the people of the Nile Basin in general. I wish to you all successful consultations which will contribute to the better DSS, and I therefore declare this workshop open.

# 11 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 06/12/2007** | | | |
| 08:30 | 09:15 | Registration | NBI |
| **Opening Session** | | | |
| 09:15 | 09:35 | Welcome Speech | Mr Mwakalinga |
| 09:35 | 10:00 | Official Opening Presentation NB-DSS | Country PMC Member |
| **Working Session 1: Presentations 1 and 2** | | | |
| 10:00 | 10:25 | **Presentation 1** - What is a DSS and What Can it Do? | International Consultant |
| 10:25 | 10:30 | **Plenum** – Questions and Discussions | Participants |
| 10:45 | 11:00 | **Presentation 2** - Thematic and Key Issues | International Consultant |
| 11:00 | 11:05 | **Plenum** - Question and Discussions | Participants |
| **Working Session 2: Clustering and selection of concerns** | | | |
| 11:05 | 11:10 | **Briefing** on clustering and pre-selection of concerns | International Consultant |
| 11:10 | 12:45 | **Group Work** – Clustering and pre-selections | Participants |
| 12:45 | 13:15 | **Plenum** – Presentations by groups – Clustering/pre-selection | Group spokespersons |
| **Lunch break** | | | |
| 14:10 | 14:30 | **Plenum**- Final-selection of Concerns | Participants |
| **Working Session 3 Ranking Issues** | | | |
| 14:30 | 14:40 | **Briefing**- Criteria for ranking the Key Overall and Specific Issues | International Consultant |
| 14:40 | 15:10 | **Break-out Groups** – Ranking the Issues | Participants |
| 15:10 | 15:20 | **Plenum**- Consolidation of Group rankings | International Consultants |
| 15:20 | 15:30 | **Plenum**-Final approval of country level ranking | Participants |
| **Working Session 4: Break-out Groups – Outputs, Criteria and Indicators** | | | |
| 15:30 | 15:45 | **Briefing** on Key Issues, Objectives, Alternatives, Criteria and Indicators | International Consultants |

| TIME | | | |
|---|---|---|---|
| 15:45 | 17:30 | **Group Work** –Alternatives criteria and Indicators | Participants |
| **Day 2: 07/12/2007** | | | |
| 09:00 | 09:30 | **Plenum-** Alternatives criteria and Indicators | Group spokespersons |
| **Working Session 5: Presentation 3 and Break-out Groups- Models/Tools and Data/Information** | | | |
| 09:30 | 10:30 | **Presentation 3** – Possible Models/tools | International Consultants |
| 10:30 | 11:30 | **Group Work** – What are the tools (criteria) and data/information requirements (indicators) | Participants |
| 11:30 | 12:00 | **Plenum** - Discussion | Group spokespersons |
| **Working Session 6: Institutional concepts and Break-out Groups - Institutional Arrangements** | | | |
| 12:00 | 12:30 | **Presentation 4** – Institutional Concepts | International Consultants |
| 12:30 | 13:00 | **Plenum- Stakeholders mapping/**institutional arrangements for demand-data and modelling | Participants |
| **Lunch break** | | | |
| 14:00 | 14:30 | **Briefing** institutional and human capacity building for DSS | International Consultants |
| 14:30 | 15:30 | **Group Work** Capacity building for DSS development | Participants |
| 15:30 | 16:00 | Capacity building for DSS development | International Consultants |
| **Working Session 7: Workshop Conclusions** | | | |
| 16:00 | 16:15 | Summary of the Workshop Findings | International Consultants |
| 16:15 | 16:30 | Closing Remarks | Chairman |

# 12 List of Participants

| No. | NAME | INSTITUITION | EMAIL | TELEPHONE |
|---|---|---|---|---|
| 1 | Joseph Sondi | Div. of Forestry & Beekeeping | puguforests@yahoo.com | 0784439372 |
| 2 | Hassani Mhitu | Tanzania Fisheries Research Institute (TAFIRI) | mhitu@yahoo.co.uk | 0754230956 |
| 3 | Saidi A. Faraji | Ministry of Water (Division of Water Resources) | saidifaraji@yahoo.co.uk | 0754685691 |
| 4 | Dr. Justus Rwetabula | Mwanza Urban Water and Sewerage Authority | jrwetabu2@yahoo.com | 0753277247 |
| 5 | Stanislaus Kizzy | Tanzania Electric Supply Company (TANESCO) | kizsta@tanesco.co.tz | 0784310340 |
| 6 | Omari Myanza | Lake Victoria Environmental Management. Project | chaluvara@hotmail.com | 0787071189 |
| 7 | Hosea Sanga | Ministry of Water (Division of Water Resources) | hoseasanga@yahoo.com | 0713456779 |
| 8 | Simon Mwanjali | Ministry of Livestock Development | smwanjali@gmail.com | 0784332037 |
| 9 | Dr. George Lugomela | NBI - WRPM | gvlugomela@nilebasin.org | 0784574122 |
| 10 | Arthur Lyatuu | Ministry of Energy and Minerals | Arthurlya2@yahoo.com | 0733170977 |
| 11 | Issa Kajega | Ministry of Energy and Minerals | | 0754746483 |
| 12 | Shigalla Mahongo | Tanzania Fisheries Research Institute (TAFIRI) | shigalla@yahoo.co.uk | 0713245449 |
| 13 | Styden Rwebangira | Ministry of Energy and Minerals | stydenr@yahoo.com | 0713518063 |
| 14 | Dr. Sellasie D. Mayunga | Ministry of Land and Human Settlements | magese22@yahoo.ca | 0784856775 |
| 15 | Jonathan Mgaiwa | Rwegarulila Water Resources Institute | mgaiwa2000@yahoo.com | 0754277940 |
| 16 | Felix Peter | Ministry of Water (Division of Water Resources) | kimataregis@yahoo.com | 0754287751 |
| 17 | Yohana Mtoni | National Environment Management Council | ymtoni@hotmail.com | 0713455862 |
| 18 | Damas W. Mapunda | Division of Environment (Vice President's Office) | dmapunda71@yahoo.com | 0754640992 |
| 19 | Lusekelo A. Mwambuli | Lake Victoria Basin Water Office (LVBWO) | lvbwo@yahoo.com | 0755318616 |
| 20 | Adeline E. Lyaruu | Commission for Science and Technology | alyaruu@yahoo.com | 0784299847 |
| 21 | Eng. January Kayumbe | Irrigation and Technical Services Division | rayjkayumbe@yahoo.co.uk | 0222865630 |
| 22 | Zafarani Madayi | National Environmental Management Council | zamadayi@yahoo.com | 0754287457 |
| 23 | Joel Nobert | Dept. of Water Resources Engineering (UDSM) | njoelk@yahoo.com | 0752546259 |
| 24 | Onespholy Kamukuru | Division of Environment (Vice President's Office) | okamukuru@yahoo.com | 0717572389 |
| 25 | J. E. Sendoro | Ministry of Health and Social Welfare | soljerr@yahoo.com | 0753009900 |
| 26 | Ipyana Mwakalinga | Ministry of Water (Division of Water Resources) | iemwakalinga@yahoo.co.uk | 0784635918 |

# Minutes of Workshop
## Local Consultant

| | |
|---|---|
| Subject: | National Stakeholder Consultation Workshop |
| Sub-Region / Country | Uganda – Entebbe |
| Date / Time: | 10 12.2007; 09:00 – 17:00 and 11.12.2007 ; 09:00 – 17:30 |
| Venue: | Nile Basin Initiative Offices Entebbe |
| | Vincent Ssebuggwawo – National DSS Specialist Uganda |
| | Richard Schuen – hydrophil |
| Participants: | Philip Riddell – ITAD |
| | Santa Vusia I. Kayonga – Local Consultant hydrophil |
| | Stakeholders (see attached list of participants) |

## Table of Content:

# 1 Introductory Remarks

The opening remarks at the start of the workshop were made by Engineer Callist Tindimugaya, in his capacity as Assistant Commissioner with Department of Water Development (DWD) in the Ministry of Water and Environment.

Mr. Tindimugaya welcomed participants and asked them to readily provide input on DSS. He provided a background overview to the DSS, pointing out that the joint projects in the Nile basin needed a sound and analytical base for decision making, to benefit all countries in the basin. He outlined the different phases of the process, emphasising that it was designed to be as participatory and consultative as possible at the country level; providing an opportunity for countries to be well informed. He pointed out that each country has its own needs in relation to the DSS and urged stakeholders to ensure that the needs of each sector are included in the overall process.

# 2 Presentation of the Consultants and of the Stakeholders

Mr. Richard Schuen led the self introduction session by presenting himself by asking the participants to present themselves. The participants came from a cross section of Ministries / organisations/functions including Meteorology, Energy and Minerals, Agriculture, Animal Industry and fisheries, Agriculture research institutions, Fisheries, National Environment Management authority, an environment and natural resources consultancy firm in addition to the NDSS specialist, the international and local consultants.

Mr. Schuen also gave an overview of the workshop programme and what was expected of participants (details in the workshop timetable). The workshop was organised around presentations, group work and plenary sessions. He clarified that national level perspectives will be focused at this workshop.

# 3 Presentations on “What is the DSS?”, Themes, Issues, and Decisions.

Mr. Schuen gave the presentation What is a DSS and what it can do?
Participants were informed that the project was about the Conceptual design of a DSS, which supports stakeholders in decision making. The consultant went through the process of the DSS using a power point presentation. He observed that the DSS enhanced decision making through presenting alternatives to identified issues and problems using data provided. He pointed out some challenges in developing the system including differences/multiplicity of objectives and criteria as well as incomplete and unreliable data. Stakeholders were introduced to the models.

During the discussions, a concern on ‘single access’ and whether it was feasible was raised. It was clarified that the system could only be accessed at one point. The users do not have to go to different places. A participant was concerned that the DSS was being designed with a regional perspective and wondered if the design would try to be country specific. An assurance was provided that NBI was very definite that the DSS has a geographic focus in the basin and the country level was focussed on. Although data may be a problem it was pointed out that the DSS must work with some kind of data and there is a data sharing protocol. Data consistency is to be addressed through a parallel project.

Mr. Riddell took participants through the presentation THEMES ISSUES AND CONCERNS and through the process to identify the most relevant concerns and issues:

He informed the stakeholders that in a sub-regional consultation workshop in Addis Ababa numerous raised issues and themes which were thinned down to 11 issues and 45 concerns at the end of the workshop and further reduced to 31 by the consultants having identified that some of those provided at the workshop were sectors, externalities themes or irrelevant concerns to the DSS.

A number of questions and concerns were raised by the participants. This included the concern that the process of developing the DSS seemed to be academic in addition to the observation that most of the concerns raised were included as projects / programmes of the NBI. The participant who raised this question wondered indeed whether the issues would be part of the process for policy development from the perspectives of the different sectors and if the outputs using DSS would be of benefit. The workshop was informed that the purpose of this particular process was the conceptual design and not the running of the DSS. Ag. Commissioner Tindimugaya observed that the steering committee was interested in something that will work for the country and stressed the importance of making sure that the final product is what Uganda wants / that it works for Uganda. He pointed out that a regional process was proposed at the beginning but this was shelved in preference of a national process, providing an opportunity for Uganda to internalise the proposals and ensure that it is okay with it.

Mr. Riddell promised to revisit the process during the wrap up session. He also informed the stakeholders that the concern of the NBI was to capture all the concerns at national and regional level and manage expectations. Ag. Commissioner Tindimugaya observed that it was important to differentiate between the DSS and DST and hoped this difference would be highlighted at the workshop, which the consultant immediately proceeded to do in a few words. He pointed out again that the particular process was for specifying rather than designing the DSS.

# 4 Group Work and Discussions

Mr. Riddell explained the group work assignment and asked participants to form multi sectoral groups, each of which was given a form to fill and a list of issues from which to choose the concerns. Three groups were formed and the group task explained to stakeholders. The group tasks were to choose between the 31 Concerns a maximum of 10 or 12 and cluster them according to the thematic categories and issues defined in a matrix handed over to them. The groups were free to collapse / cluster the issues into fewer concerns. The exercise went on smoothly. One group was of the opinion that some categories were missing such as physical planning / human settlements. None of the groups went beyond 12 issues. One group had 10 instead of twelve, after merging some options.

Discussions:
Participants wanted to include the water hyacinth as an issue important for the country. The consultants wondered why it had not featured in the consolidation of the concerns at the regional workshop and in the country consultations if it is such a big issue for the country. In the discussion, it was observed that the issue could be included as part of water pollution and that it was implied under water quality issues. A participant involved in the prior processes clarified that water hyacinth was taken as an invasive weed and later it was reduced even further. Compromise position reached was that if during ranking water pollution was in the top three, then the issue would be included. Participants also wondered why drought prediction was not put together with coping with drought and received the explanation that one is institutional capacity building while the other was investment. Another stakeholder wanted to include irrigation on the overall list, since it was linked to agriculture as the mainstay of Uganda's economy yet the country

depended on increasingly unpredictable / unreliable rainfall for rain fed agriculture and therefore has to contend with threats to food security. The following list comprises the final selection:

1. Increased energy demand
2. Watershed degradation (destruction of forests)
3. Water quality - pollution
4. Water resources availability
5. Rainfed agriculture
6. Biodiversity conservation
7. Water supply and sanitation
8. Wetlands degradation
9. Coping with droughts and floods
10. Irrigation
11. Population structure/ settlement patterns
12. Conflicts in water use (pastoralists etc)

# 5 Working Groups – Ranking of Concerns

After consolidation of the Concerns, the three groups met again to rank the Concerns which they handed over to the consultants for processing.

A presentation was then made of the weighted results of the group work ranking in priority order by the consultants, who observed that there was a general consensus. 10 items were taken as priority on the basis of what the groups had chosen, weighted, 3 of these were first priority for all the three groups. The plenary discussed some of the other items to identify what could be included to make twelve in the final list, if so desired. Two were collectively chosen from the overall list to address some of the concerns raised in the discussion. Finally 12 concerns were selected at plenary session. (see report for details)

# 6 Objectives, Interventions, Alternatives

The presentation Objectives, Interventions, Alternatives was made by Mr. Riddell on the above, with a number of examples. VIPP cards were displayed on the wall with the definitions of the important terminology used in the context of the DSS i.e. Issues, Objectives, Alternatives, Scenarios, Output, Criteria, Indicators, Externalities, and Decisions. Participants were asked to develop ranking and criteria. The groups were then asked to fill out forms identifying the objectives interventions, alternatives, criteria and indicators for the first three issues. They were however cautioned to use the forms rationally i.e. institutional based and capacity building criteria should be separated. An example was provided. The day's sessions ended at this point with a call to participants to come in time to complete the group work (fill in the first part of the forms)

# 7 Presentation and Group Work to define Models and Tools as well as Data/Information requirements

Day 2 began with group work, after which the forms, with the first part filled in were handed over to the consultants for processing. The plenary session discussed and improved the different matrices handed over by the three groups and developed a consensus on what they should include i.e. the logic of the criteria and indicators.

A presentation was made on Models and Data by Mr. Riddell, during which he defined a model and its elements. A list of models was shown and provided to participants who were told that it was not exhaustive and they were free to add to or change it during the following group work. They were given back the forms from the previous group work and requested to fill in the last two columns on models and data requirements for each of the models responding to the particular criteria and indicators. Participants then handed in their forms for processing

The Plenary Discussion was facilitated by Mr. Riddell who read out the results for the groups and took them through a process of rationalising the group inputs. The plenary discussed the type of data needed to feed the models and rationalised the information. Some of the models chosen were too generic and had to be specified much further. A number of things needed social behaviour models to address them. One of the forms was agreed with hardly any changes. The completed forms have a list of all the models. This session was considered to be very satisfactory in terms of fulfilling the expectations.

# 8 Presentation of Institutional Options for transboundary River Basin Planning and DSS development.

This presentation Institutional Options was made by Richard Schuen, who took participants through the aspects of transboundary river basins. He indicated that the institutional aspects would be the beginning point, and then stakeholders identification, capacity and needs assessment.

The Danube river basin was used as an example for the institutional concept of the river i.e. the elements and a description of the river (its physical features). Stakeholders in their groups were finally required to identify stakeholders in the following categories in the Ugandan context.

*Demands for services*
*Who provides knowledge*
*Who provides data*
*Who enters/ manages the data base*
*Who will provide modelling services*

At the plenary session, the different stakeholders were identified through brainstorming on the five items. An exhaustive list was made. During the discussions, participants wanted to know how the modelling services would be solicited / procured i.e. whether it would be through consultants or universities. It was observed that universities are subject to different procurement procedures, although consultants may be from universities.

# 9 Trainings Needs Assessment

Mr Schuen provided an explanation of the tables to be filled in during the training needs assessment. Half an hour was provided for the participants to carry out the exercise. The group work was to fill out the needs for various skills and its availability at different levels of stakeholders. The filled out forms were handed over to the consultants for processing.

# 10 Closing Remarks

The workshop wrap up session was done by Mr. Schuen who pointed out that the objective of the workshop had been to consult at the country level to see what Ugandan stakeholders 'wanted the DSS to do for them'. He recapitulated the processes in the workshop in which issues expected to be handled in the DSS and alternatives ways of addressing them were identified, outputs for the DSS decision making were defined as were various criteria for them and indicators crafted to test the extent to which these criteria were satisfactory and the data needs for the models defined. He informed participants that the next regional workshop would be in Entebbe, at which selected stakeholders would be able to comment on the appropriateness of the conceptual design document. He noted that a serious issue of data scarcity had been noted in the course of the workshop. He thanked participants for their participation and hard work.

A vote of thanks / closing remarks were made by one of the stakeholders; Mr. Wambedde, who observed that for two days the participants in the workshop had been like a family and had come to know one another, mainly because the consultants used a highly interactive system. He also observed that a number of stakeholders may have come to the workshop without knowledge of DSS but each participant had at the end of the workshop acquired a basic understanding of what the DSS is. Mr. Wambedde thanked the consultants for all materials provided to the participants and promised on behalf of all the stakeholders that the materials would not just be kept away in the CDs but studied further in order to improve understanding of DSS and continue participating in the process. He thanked the hosts of the workshop, the NBI and the NDSS expert for Uganda for making the arrangements and concluded by wishing the consultants a safe journey back and a successful completion of the consultancy work.

Participants were then asked to go out for a group photograph.

12 December 2007

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Santa Vusia I. Kayonga
Local Consultant Uganda

# 11 Opening speech


**The Republic of Uganda**

Ministry of Water and Environment

SPEECH BY WRP&M PROJECT PSC MEMBER AT THE CONSULTATIVE WORKSHOP ON THE NILE DSS, ENTEBBE NBI BOARDROOM,
DECEMBER 10th, 2007

Ladies and Gentlemen

I am pleased to have this opportunity to say a few words on behalf of Ministry of Water & Environment, which is the Focal Institution for the Water Resources Planning & Management Project of the Nile Basin Initiative in Uganda.
As you are aware, implementation of joint projects within the Nile Basin is taking place in different sectors at different levels. However these projects require decisions to be made based on a sound and scientific information base coupled with analytic tools that are agreed upon by all riparians.

The Water Resources Planning and Management (WRPM) project was tasked by the Nile basin countries through the Nile basin Initiative to design and implement these analytical tools/Decision Support tools for the benefit of all the other projects. This set of tools is what we refer to as the Nile Decision Support System. The development of the Nile Decision Support System has been divided into two major phases, namely the development of the conceptual design and the implementation phase. Currently, the project is developing the conceptual design, which is the basis on which actual design of the software, hardware and human resources development will be based. The project intends to make the development of these tools as participatory and consultative as possible to ensure that all important elements of decision making can be supported as appropriate.
This consultative meeting is one of a series of consultations and trainings that have been prepared to achieve this objective. Last week some of you participated in the training/awareness workshop in this same boardroom. You may, also, recall that in the past months, consultants hired by the project visited a number of institutions, NGOs, Authorities and collected baseline information on the Decision support system requirements. This was followed by a national workshop to consolidate the findings of the baseline findings.
This consultative workshop is a follow up of the DSS needs that you identified in the previous meeting held on the 10th October 2007. The workshop is aimed at:

- Defining process towards formulation of decision variables
- Defining critical themes for the conceptual framework
- For the above themes, develop some areas of concern and some key questions

It is important that this exercise is given maximum priority since any issues that will be missed at this stage may not be easily handled by the DSS at a later stage. Maximum participation at this

level of formulation will ensure that our national issues are properly catered for in the DSS design and that all opportunities that the Nile cooperation offers to Uganda are considered.

Tindimugaya Callist
Ministry of Water & Environment
Uganda

# 12 Workshop Agenda

| TIME from | to | DESCRIPTION | RESPONSIBILITY |
|---|---|---|---|
| **Day 1: 06/12/2007** | | | |
| 08:30 | 09:15 | Registration | NBI |
| **Opening Session** | | | |
| 10:00 | 10:10 | Welcome Speech | Mr Mwakalinga |
| 10:10 | 10:30 | Official Opening Presentation NB-DSS | Country PMC Member |
| **Working Session 1: Presentations 1 and 2** | | | |
| 10:30 | 10:50 | **Presentation 1** - What is a DSS and What Can it Do? | International Consultant |
| 10:50 | 11:00 | **Plenum** – Questions and Discussions | Participants |
| 11:00 | 11:20 | **Presentation 2** - Thematic and Key Issues | International Consultant |
| 11:20 | 11:30 | **Plenum** - Question and Discussions | Participants |
| **Working Session 2: Clustering and selection of concerns** | | | |
| 11:30 | 11:45 | **Briefing** on clustering and pre-selection of concerns | International Consultant |
| 11:45 | 13:15 | **Group Work** – Clustering and pre-selections | Participants |
| **Lunch break** | | | |
| 14:40 | 15:15 | **Plenum** – Presentations by groups – Clustering/pre-selection | Group spokespersons |
| 15:15 | 15:30 | **Plenum**- Final-selection of Concerns | Participants |
| **Working Session 3: Ranking Issues** | | | |
| 15:30 | 15:45 | **Briefing**- Criteria for ranking the Key Overall and Specific Issues | International Consultant |
| 15:45 | 16:15 | **Break-out Groups** – Ranking the Issues | Participants |
| 16:15 | 16:20 | **Plenum**- Consolidation of Group rankings | International Consultants |
| 16:20 | 16:30 | **Plenum**-Final approval of country level ranking | Participants |
| **Working Session 4: Break-out Groups – Outputs, Criteria and Indicators** | | | |
| 16:30 | 16:50 | **Briefing** on Key Issues, Objectives, Alternatives, Criteria and Indicators | International Consultants |
| 16:50 | 17:30 | **Group Work** –Alternatives criteria and Indicators | Participants |

| TIME | | | |
|---|---|---|---|
| **Day 2: 07/12/2007** | | | |
| 09:00 | 10:30 | **Group Work** –Alternatives criteria and Indicators (Cont'd) | Participants |
| 10:30 | 11:30 | **Plenum-** Alternatives criteria and Indicators | Group spokespersons |
| **Working Session 5: Presentation 3 and Break-out Groups- Models/Tools and Data/Information** | | | |
| 11:30 | 12:00 | **Presentation 3** – Possible Models/tools | International Consultants |
| 12:00 | 13:15 | **Group Work** – What are the tools (criteria) and data/information requirements (indicators) | Participants |
| **Lunch break** | | | |
| 14:30 | 15:00 | **Plenum** - Discussion | Group spokespersons |
| **Working Session 6: Institutional concepts and Break-out Groups - Institutional Arrangements** | | | |
| 15:00 | 15:20 | **Presentation 4** – Institutional Concepts | International Consultants |
| 15:20 | 15:45 | **Plenum- Stakeholders mapping/**institutional arrangements for demand-data and modelling | Participants |
| 16:00 | 16:05 | **Briefing** institutional and human capacity building for DSS | International Consultants |
| 16:05 | | **Group Work** Capacity building for DSS development | Participants |
| | | Capacity building for DSS development | International Consultants |
| **Working Session 7: Workshop Conclusions** | | | |
| | | Summary of the Workshop Findings | International Consultants |
| | | Closing Remarks | Chairman |

# 13 List of Participants

**LIST OF PARTICIPANTS FOR THE NILE DSS CONSULTATIVE WORKSHOP 10TH-12TH DECEMBER 2007 UGANDA**

| 1 | Name | Functional Title | Institution | Phone | Mobile | email |
|---|---|---|---|---|---|---|
| 2 | Michael S.Z. Nkalubo | Ag. Assistant Commissioner Meteorology | Ministry of Water & Environment | 0414-251798 | 0772-453617 | nkalubo_m@yahoo.com |
| 3 | Andrew Alio | Farm Development | Mininstry of Agriculture, Animal Industry & Fisheries | 0414-322334 | 0772-567189 | lolendo2002@yahoo.co.uk |
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| 5 | Fredrick Muyodi | Senior Lecturerer | Makerere University | 0141-531902 | 0772-474242 | fmuyodi@zoology.mak.ac.ug |
| 6 | Mwebembezi Leo | Principal Water Officer | Directorate of Water Resources Management | 0414-321342 | 0772-427656 | mwebembezi.wrmd@dwd.co.ug |
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| 8 | Charles K Twesigye | Senior Lecturerer | Kyambogo University | 0414-285001 | 0782-353775 | twesigyeck@yahoo.com |
| 9 | Stephen B K Sekiranda | Research Scientist | National Fisheries Resources Research Institute | 0434-121369 | 0752-480212 | skintu2000@yahoo.com |
| 10 | Nicholas Azza | Ag Assistant Commissioner (WQM) | Directorate of Water Resources Management | 0414-323536 | 0782-241006 | azza.wrmd@dwd.co.ug |
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| 13 | Matovu Abdallah Karimu | Ag. Principal Analyst | Directorate of Water Resources Management | 0414-321342 | 0772-730038 | matovu.wrmd@dwd.co.ug |
| 14 | Callist Tindimugaya | Ag. Commissioner | Ministry of Water & Environment | 0414-320914 | 0772-521413 | ctindi.wrmd@dwd.co.ug |
| 15 | Julius Ayo-Odongo | Executive Secretary | Lake Victoria Region Local Authorities Cooperation | 0414-321784 | 0772-703146 | secretarygeneral@lvrlac.net |
| 16 | Herbert Oule | EIA Officer | National Environment Management Authority | 0414-251064/5/8 | 0772-620044 | houle@nemaug.org |
| 17 | Charles Mutumba | Director | AEATREC/National Agricultural Research Organisation | 0414-566161 | 0712-864987 | mutumbac@hotmail.com; aeartri@starcom.co.ug |
| 18 | Bakunda Aventino | Senior Fisheries Officer | MAAIF-Dept. of Fisheries Resources | 0414-323653 | 0772-592547 | aventino_b@yahoo.com |
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| 20 | Matua Richard | Senior Engineer | Ministry of Water & Environment | 0392-749632 | 0782-397860 | matua@dwd.co.iuug |
| 21 | Nsubuga Senfuma | Consultant | National Environment Consult ltd | 0414-271095 | 0772-720852 | nsubuga@utlonline.co.ug |
| 22 | Stephen Kigoolo | National Project Coordinator | NTEAP - NBI | 0414-342717 | 0772-624274 | skigoolo@nilebasin.org; skigoolo@yahoo.com |
| 23 | Ssebuggwawo Vincent | NDSS Specialist NBI | WRP&M Project | 0414-321441 | 0772-435249 | ssebuggwawo.wrmd@dwd.co.ug; vssebuggwawo@nilebasin.org |
| 24 | Kyobwenge F | Support Staff -WRMD | Ministry of Water & Environment | | | kyobwenge.wrmd@dwd.co.ug |
| 25 | Sikayana Charles | Support Staff -NDSS Office | WRP&M Project | | | sikayana@yahoo.com |

# Appendix A4:

# List of Participants at the Sub-Regional and National Training and Awareness Workshops

| | |
|---|---|
| Subject: | **Sub- Regional Training & Awareness Workshop** |
| Sub-region | **Eastern Nile Region** |
| Date / Time: | 14.11.2007 TO 17.11.2007 |
| Venue: | NBI/WRPM Office-Addis Ababa |
| Present: | Dr. Kurt Fedra – ESS<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Tesfaye Kidane | Water Works Design and Supervision Enterprise, Ethiopia |
| Mohamed Ibrahim Roushdy | Hydraulics Research Inc., Egypt |
| Eng. Aref Abdel Mobedy Ghareeb | Nile Water Sector, Egypt |
| Mekuria Beyene | WRPM-NBI |
| Claude Kakule | WRPM-NBI |
| Ephrem Getahum | WRPM-NBI |
| Ephrem Tesfaye | Ethiopian Electric Power Corporation, Ethiopia |
| Mengistu Teferra | Private Sector, Ethiopia |
| Hayder Yousif Bakhiet | Ministry of Irrigation and Water Resources, Sudan |
| Gamal Ismail Shaker | Ministry of Water Resources and Irrigation, Nile Water Sector, Egypt |
| Karori Elhaco Hamad | Ministry of Irrigation and Water Resources, Sudan |
| Hassab E. Inabi Musa Mohammed | Ministry of Irrigation and Water Resources, Sudan |
| Abdil Atty El Saman Ahmed | Ministry of Water Resources and Irrigation, Egypt |
| Mufadal Eltayeb Mohammed Ahmed | Ministry of Irrigation and Water Resources, Sudan |
| Younis A. Gismalla | Ministry of Irrigation and Water Resources, Sudan |
| Teferra Beyene | Ministry of Water Resources, Ethiopia |
| Yohannes Daniel | ENTRO |
| Solomon Seyoum | WRPM-NBI |

| | |
|---|---|
| Subject: | **Sub- Regional Training & Awareness Workshop** |
| Sub-region | **Nile Equatorial Lakes Region** |
| Date / Time: | 20.11.2007 TO 21.11.2007 |
| Venue: | Kigali Institute of Science and Technology |
| Present: | Antoine Niragire-NDSS Specialist, Rwanda<br>Dr. Kurt Fedra – ESS<br>Sylvain Rusanganwa- Local Consultant (Hydrophil)<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Alexis Nimubona | IGEBU, Burundi |
| Dr Ing. Ndikumana Gabriel | IGEBU, Burundi |
| Faustin Ngediko | Regional DSS Network, DRC |
| Augustin Mawalala | Directeur Ressource En Eau, DRC |
| Kabeya Nkozona | Fishery Department-Coordinator, DRC |
| Samir A.S Ibrahim | Associate Prof. Hydraulic Research Inst, Egypt |
| Samy Saad | National Water Research Centre, Egypt |
| Tahani Sileet | NBI National Office, Nile Water Sector, Egypt |
| Mekuria Beyene (Dr) | NBI-WRPM PMU |
| Agnes Mbuga | Ministry of Water and Irrigation, Kenya |
| George A. Koyier | Ministry of Water and Irrigation, Kenya |
| Robert M. Wanjara | Ministry of Water and Irrigation, Kenya |
| Sylvester Kiai | WRMA, Kenya |
| John Ntanganda Semafara | UNITE METEO, Rwanda |
| Karayenzi Tharcisse | Rwanda National Bank, Rwanda |
| Ndutiye Simon | MINITERE, Rwanda |
| Mohamed Ali Omer | Ministry of Irrigation and Water Resources, Sudan |
| Haliel Nour Mahmoud | National Electricity Corporation, Sudan |
| Hosea Sivonike Sanga | Ministry of Water Resources, Tanzania |
| January Kayumbe | Division of Irrigation and Technical Services, Tanzania |
| Stanislaus Kizzy | Tanzania Electric Supply Co., Tanzania |
| John Wambede | Ministry of Water/Environment/ Metereology, Uganda |
| Kitamirike Jackson | Directeur Ressource En Eau, Uganda |
| Twinomujuni | Directeur Ressource En Eau, Uganda |

| | |
|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Burundi** |
| Date / Time | 27.11.2007-28.11.2007 |
| Venue: | Orpahn's AID, Avenue du Large, Bujumbura |
| Present: | Gabriel Ndikumana – National DSS Specialist, Burundi<br>Dr. Kurt Fedra – ESS<br>Victor Girukwishaka, Local Consultant (Hydrophil<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Barancira Thadee | Université du Burundi : Faculté des sciences |
| Nusura Hassan | Université du Burundi : FACAGRO |
| Bunyungu Philippe | Cabinet du Ministère de l'Agriculture et de l'Elevage |
| Nkurikiye Anicet | Cabinet du Ministère de l'Aménagement du Territoire et de l'Environnement des Travaux Publics |
| Wakana Ferdinand | Direction des Ressources Hydrauliques |
| Ruranyije Aloys | IGEBU |
| Nimubona Alexis | IGEBU |
| Macumi Antoinette | Direction Générale du Ministère de l'Aménagement du Territoire et de l'Environnement des Travaux Publics |
| Nyandwi Venant | FCBN |
| Simbashizumburanye Cyriaque | ISABU/ Programme Gestion Conservation des Eaux et des sols |
| Sinarinzi Evariste | IGEBU/ PSC |
| Ntungumburanye Gérard | IGEBU-Hydrologie |
| Nzobandaba Bernard | REGIDESO |
| Barandemaje Denis | CBJI/NPC/NBI |
| Barandemaje Denis | IGEBU |
| Ntiranyibagira Aaron | IGEBU |
| Barakiza Ruben | IGEBU |
| Gahurura Jeanne | FAO |

| | |
|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **DR Congo** |
| Date / Time | 11.12.2007- 11.12.2007 |
| Venue: | Agence Universitaire de la Francophone, Kinshasa |
| Present: | Dr. Ir. Bagula Bertin Chibanvunya, NDSS Specialist, DRC<br>Dr. Kurt Fedra-ESS<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Ngediko Faustin | Regional DSS Network, NBI |
| Prof. Dr. Kanda Nkulu | CRGM |
| Nsaka Kalumbu | INERA |
| Ir. Mossala Makambo | INERA |
| Dr. Veterinaire Kipoy | INERA |
| Victor Vundu | DJISE/M.E.C.N.EF |
| Prof Kiyombo | Ecole de Sante Publique |
| Ing. Agro Kuburhanwa Pamani | OSFAC |
| Arly Batumbo | Mettelsat |
| Maloba | Mettlesat |
| Ir. Lombeya | Regie Voies fluviales |
| Ir. Cedric Tshumbu | Regie Voies fluviales |
| Ir. Koshi | Service Hydraulique rurale |
| Muntu Tchimol | REGIDESO |
| Luhembwe Vumba | Institut des Statistiques |
| Mawalala Augustin Nzola | Direction des Ressources en Eau |
| Musoyi Bayipoke W.E. | Programme Hydrologique International P.H.I |
| SEDEKE | MIN ENV |

| | |
|---|---|
| Subject: | **National Training & Awareness Workshop 1** |
| Country | **Egypt** |
| Date / Time | 13.1.2008-14.1.2008 |
| Venue: | Nile Water Sector premises in Nasser City |
| Present: | Kurt Fedra, Omar Elbadawy |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Prof . Nahla Abou El-Fotoh | NWRC-Elkanater |
| Prof. Alaa Abdien | NWRC- Kanater |
| Eng. Yasser Abd El-Monem Gomaa | Nasrcity |
| Dr. Yasser Raslan | Elkanater |
| Dr. Wael Khairy | Nasrcity |
| Eng. Waleed El-Dash | Nasrcity |
| Eng. Khaled Abdelwahab | NWS |
| Eng. Aref Gharib | NWS |
| Dr. Mohammed Ibrahim Roushdy | Delta- Barrage |
| Eng. Emad Ali | Nasrcity |
| Dr. Ayman Nassar | |
| Eng. Tarek El-Sayed Ahmed | MWRI- Imbaba |
| Eng. Mohammed Nabil Abd El- Monem | MWRI- Imbaba |
| Ass. Prof. Akram Mohammed El- Ganzori | Delta- Barrage |
| Dr. Mohammed Abd El-Monem Shehata Wahba | MWRI- Imbaba |
| Eng. Ahmed Medhat Ismail | MWRI- Imbaba |
| Dr. Reda Mohammed Abd El-Hady Rady | Delta- Barrage |
| Dr. Ahmed Talaat Abdel Aal | Delta- Barrage |
| Prof. Attiea El-Gayar | |
| Prof. Mahmoud Mohammed Fahim | Cairo Unvirsity |
| Eng.Nahla Mostafa Mohamed | MWRI- Imbaba |
| Eng. Fouad Yahia Mohammed El-Adawi | Uganda |
| Dr. Abdullatif Esawy | MWRI- Imbaba |
| Ass. Prof. Sohair Saad Zaghlol | Alkanater |
| Eng. Magdy El- Sayed Ahmed | Khartoum- Sudan |
| Dr. Omar Elbadawy | Heliopolice |
| Eng. Yasser Elwan | Nasrcity |
| Eng. Sherien Zahran | Nasrcity |

[1] The National Training and Awareness Workshop for Egypt is scheduled to take place from 13-14 January, 2008.

| | |
|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Ethiopia** |
| Date / Time: | 12.11.2007; 13:30 – 17:30 TO 13.11.2007 ; 09:00 – 17:30 |
| Venue: | NBI/WRPM Office-Addis Ababa |
| Present: | Deksyos Tarekegn (Mr) – National DSS Specialist, Ethiopia<br>Dr. Kurt Fedra – ESS<br>Dereje Hailu (Dr) – Local Consultant, Hydrophil<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Leulseged Tadesse | Ministry of Water Resources |
| Teodros Teferra | Ministry of Water Resources |
| Assefa Kebede | Ministry of Water Resources |
| Tamiru Gode | Ministry of Water Resources |
| Abera Mekonen | Ministry of Water Resources |
| Solomon Tassew | Ministry of Water Resources |
| Messele Fisseha | Ministry of Water Resources |
| Melaku Yirga | Water, Mines and Energy Bureau, Gambella |
| Nigussie Tekle | Arba Minch University |
| Deksyos Tarekegn | NDSS Specialist, NBI-WRPM |
| Gulte Metaferia | Ministry of Finance and Economic Development |
| Yonas Michael | Civil Engineering Department, Faculty of Technology, Addis Ababa University |
| Wondwosen Michago | Ethiopian Nile Discourse Forum |
| Endalkachew Bekele | National Meteorological Agency |
| Tsegaye Debebe | International Water Management Institute |
| Dejene Abesha | Ministry of Agriculture and Rural Development |

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|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Kenya** |
| Date / Time: | 29.11.2007; 09:30 – 17:00 TO 30.11.2007 ; 08:30 – 4:15 |
| Venue: | Kenya Water Institute (KEWI), Nairobi |
| Present: | Mohammed Hassan (Dr) – National DSS Specialist, Kenya<br>Dr. Kurt Fedra – ESS<br>Munyikombo, L.S. – Local Consultant Hydrophil<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUITON |
|---|---|
| Dr. Hassan Mohammed | Country NBI-DSS Specialist |
| Dr. Kurt Fedra | ESS |
| Munyikombo, L. S. | hydrophil Local Consultant |
| Erastus Orwa | KNDF |
| A.M. Kariuki | NEMA |
| Jacinta, M | Ministry of Water and Irrigation |
| Godfrey A Ikunda | Ministry of Water and Irrigation |
| P. K. Supeyo | WRMA |
| Peter Odhiambo | East Africa Wildlife Society |
| Thomas M. Matiasi | Kenya Water Institute |
| Geoffrey O Wekesa | Lake Basin Development Authority |
| David Chege | Kenya Forest Service |
| Simon K. Kirui | Ministry of Energy |
| Samuel C. Ondieki | Ministry of Agriculture |
| Ndung'u A. G. | NDSS Country Counterpart |
| Mbayi H. Malimbe | Water |
| Hanshi Jama | Ministry of Health |
| Hosea K. Wendot | National Irrigation Board |
| William O. Ogola | Ministry of Regional Development |

| | |
|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Rwanda** |
| Date / Time | 17.11.2007-19.11.2007 |
| Venue: | Kigali Institute of Science and Technology (KIST) |
| Present: | Antoine Niragire – National DSS Specialist, Burundi<br>Dr. Kurt Fedra – ESS<br>Sylvain Rusanganwa, Local Consultant (Hydrophil)<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Mukiza Odillo | MINITERE |
| Twahirwa Anthony | MININFRA |
| Uwamariya Pascasie | ELECTRAGAZ |
| Nzeyimana Bonaventure | MININFRA |
| Tabaro Rene | Ministry of Health |
| Nshuti Pascal | BNR |
| Duhuze Remy Norbert | REMA |
| Ndekezi Fr. Xavier | RSSP-MINAGRI |
| Muganga Robert | MINITERE |
| Ndutiye Simon | MINITERE |
| Blaise Uhagaze | MINISANTE |
| Musango K. Jacques | MINITERE |
| Rudasingwa Louis | MINAGRI |
| Kamikazi Mwajabu | RBS |
| Lobga Monia | PEAMR |

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|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Sudan** |
| Date / Time | 10.11.2007- 13.11.2007 |
| Venue: | Ministry of Irrigation and Water Resources, Khartoum |
| Present: | Salih H. Hamid (Dr)-NDSS Specialist, Sudan<br>Dr. Kurt Fedra – ESS<br>Prof. Dr. Abdallah A. Ahmed- Local Consultant (CEDARE)<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Eng.Mohammed Abdallah | U/S MOIWR-TAC Member |
| Dr.Salah Yousif | WR Organ Chairman-TAC Member |
| El Rayah M. Hamad | WR Directorate |
| Prof. Ahmed Salih | D.G HRS |
| Dr. Saif Hamed | Technical D. of the Minister's Office |
| Ibrahim Salih Adam | NBI focal person |
| Dr. Kamal Bashar | UNESCO Chair of Water Resources-Sudan |
| Amin Sabri | D. NEC |
| Dr. Idris Mohmed Idris | D.G for dams |
| Elmagzoob Ali Taha | D.G water resources |
| Hydar Yousif Bakhiet | D. Nile Waters |
| Karorri Elhag Hamed | D. of Planning-DSS R network member |
| Ahmed Abdalla A/Shemela | Coordinator DST FAO project |
| Younis A/Alla Gismalla | ENPM National Coordinator |
| Osman Yousif Ibrahim | National Coordinator-CBSI project |
| Intisar A. Salih | E&M LS-NTEAP |
| Mohamed Ali Omer | Projects Directorate-Design Office |
| Hassan A/El Bashar | HRS |
| Ibrahim Adam Ahmed | Watershed project coordinator |
| Dr. Yousif M. Ibrahim | UNESCO Chair for Water Resources-Sudan |
| Widad Mutwakil Saadalla | DSS Counterpart |
| Dr. A/Al Latif El Egaimy | D.G Ministry of Agriculture |
| Mr.Hafiz Atta El Mannan | MoF&NE-D.development directorate |
| Dr.Abd El Hadi A/Wahab | Dean of Land and water research ARC |
| Dr. Ali Adeeb | Dean of Water Management & Irrigation Institute |
| Adam Abbaker Basheer | G.D Projects Directorate |
| Prof. Ahmed Ali Salih | Forest Research Centre |
| Abu Obeida Babiker Ahmed | National Coordinator ATP-Sudan |
| Taghreed M.A | Nile waters directorate |
| Dr. Ahmed Ibrahim Kabo | I &D RN member |

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|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Tanzania** |
| Date / Time: | 3.12.2007-4.12.2007 |
| Venue: | Centre for Information and Communication Techno<br>logy, Dar es Salaam |
| Present: | George Lugomela (Dr) – National DSS Specialist, Tanzania<br>Dr. Kurt Fedra – ESS<br>Dr Faustin Maganga – Local Consultant (Hydrophi)<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Omary Myanza | Lake Victoria Environmental Management Project |
| Felix Peter | Ministry of Water |
| Lusekelo Mwanbuli | Lake Victoria Basin Water Office |
| Stanislaus Kizzy | Tanzania Electric Supply Company Limited |
| Yohana Mtoni | National Environmental Management Council |
| Hosea Sanga | Ministry of Water |
| Joseph Sondi | Division of Forestry and Beekeeping-MNRT |
| Nadhifa Kemikimba | Ministry of Water |
| Florence Mahay | Wami Ruvu Basin Water Office |
| Dr Joel Nobert | University of Dar Es Salaam |
| January Kayumbe | Division of Irrigation and Technical Services-MAFC |
| Addallah Shah | NBI-Transboundary Environmental Action Project |
| Jullen Mwanyilu | Tanzania Meteorological Agency |
| Dr. George Lugomela | NDSS Specialist, Tanzania |
| Hassani Mhitu | Tanzania Fisheries Research Institute |

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|---|---|
| Subject: | **National Training & Awareness Workshop** |
| Country | **Uganda** |
| Date / Time: | 6.12.2007-7.12.2007 |
| Venue: | NBI Office, Entebbe |
| Present: | Ssebuggwawo Vincent – National DSS Specialist, Tanzania<br>Dr. Kurt Fedra – ESS<br>Stakeholders (see attached list of participants) |

## List of Participants:

| NAME | INSTITUTION |
|---|---|
| Mwebembezi Leodinous | Directorate of Water Resources Management |
| Nabunnya Jane | Nile Basin Initiative CBSI Project |
| Twesigye Charles K | Kyambogo University |
| Nantongo Annette Kezia | Makere University Faculty of Technology |
| Sekiranda Stephen B K | National Fisheries Resources Research Institute |
| Nikalubo Michael Sevume | Meteorological Department |
| Bakunda Aventino | Department of Fisheries Resources, MAAIF |
| Mutumba Charles | National Agricultural Research Organisation |
| Ogwell Linda Adhiambo | Lake Victoria Region Local Authorities Cooporation |
| Odota Deo Wilbert | Directorate of Water Resources Management |
| Nakalyango Caroline | Directorate of Water Resources Management |
| Byanugisha Benon | Ministry of Agriculture, Animal Industry and Fisheries |
| Oule Herbert | National Environment Management Authority |
| Duli David | World Wide Fund for Nature-Uganda |
| Akena Frank | Ministry of Agriculture, Animal Industry and Fisheries |
| Echoku Samuel Okoron | Uganda Bureau of Statistics |
| Kasimbazi Emmanuel | Makerere University, Faculty of Law |
| Zaake Benon Tamukedda | Directorate of Water Resources Management |
| Matua Richard | Ministry of Water and Environment |
| Kyamugambi Kasingye | Ministry of Water and Environment |
| Mulindwa Joseph | Uganda Environmental Education Foundation |
| Abdon Atwine | Ministry of Energy and Mineral Development |
| Naigaga Sarah | Uganda Nile Discourse Forum |
| Ssebuggwawo Vincent | NDSS Specialist Uganda |
| Matoyu Abdalah | Directorate of Water Resources Management |
| Nakeyeyune Annet | Uganda Wildlife Society |
| Sikayana Charles | WRPM-NBI Staff |
| Kaobwennje | Directorate of Water Resources Management |

# Appendix A5:

## Schedule and Mission Teams Sub-Regional Consultations

| SUB REGION | MISSION TEAMS | DATES |
|---|---|---|
| Nile Equatorial | R Schuen, J. Dreher | 22 – 23 November 2007 |
| Eastern Nile | K Abu Zeid, A Hartveld | 16 – 17 November 2007 |

# Appendix A6:

## Schedule and Mission Teams National Consultations

| COUNTRY | MISSION TEAMS | DATES |
|---|---|---|
| Ethiopia | A Hartveld, HP Nachtnebel | 14 – 16 November 2007 |
| Sudan | A Hartveld, HP Nachtnebel | 18 – 21 November 2007 |
| Rwanda | R Schuen, J Dreher | 26 – 28 November 2007 |
| Burundi | R Schuen, J Dreher | 29 November – 01 December |
| Kenya | P Riddell, R Schuen | 03 – 05 December 2007 |
| Tanzania | P Riddell, R Schuen | 06 – 08 December 2007 |
| Uganda | P Riddell, R Schuen | 10 – 12 December 2007 |
| DR Congo | R Schuen, R Seidelmann | 13 – 15 December 2007 |
| Egypt | K AbuZeid | 11 – 13 December 2007 |