

# Development of a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System

## Background Information Document - 1

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### PURPOSE OF THIS DOCUMENT

This background information document (BID) provides information about the study, initiated by the Department of Water Affairs (DWA), to develop a Reconciliation Strategy for the Luvuvhu and Letaba Water Supply System.

**A Reconciliation Strategy identifies, prioritises and confirms the interventions required to reconcile the water requirements with the available water resources in a catchment or water system for a specific number of years.**

Stakeholders are invited to participate in the process by attending meetings or by corresponding with the public participation office or the technical team at the addresses provided below.

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### STUDY AREA

The Luvuvhu and Letaba Water Supply System is located in north-east Limpopo with Zimbabwe to the north and Mozambique to its east. Towns in the study area include Thohoyandou, Giyani and Tzaneen. The Kruger National Park comprises about one third of the study area.

Most of the development in the study area is agriculture based, with strong contributions by irrigated agriculture and afforestation. Approximately 80 to 90% of the population can be considered as rural.

The area can be described as fully developed. The demand for water from the Letaba River already exceeds its yield capability. Regulation in the Letaba system is mainly provided by Middle Letaba, Ebenezer and Tzaneen Dams. The Luvuvhu River has the Nandoni, Albasini, Vondo and Damani dams which will soon be fully utilised. The major rivers in the area are the Luvuvhu, Letaba, and Shingwedzi rivers which all flow in an easterly direction through the Kruger National Park and into Mozambique.

Requirements within the Kruger National Park, as well as international obligations are important aspects to be taken into account in the overall management, water balance and water quality of the river systems within the study area.

The Department, together with local authorities and water users are currently implementing a series of actions ranging from water restrictions to groundwater development to address the short term crisis.

### OBJECTIVES OF THE STUDY

The area under investigation is the entire Luvuvhu and Letaba Water Management Area (WMA) and parts of the adjacent WMAs. The main objectives of the study is to develop water availability assessment tools (mathematical models) and to formulate water resource reconciliation strategies that will ensure sufficient water up to the year 2040 during the 36 months study period, and include the following main components:

- Review of all available information and options for reconciliations.
- Develop a Water Availability Assessment Model for the quantification of allocable water including updating of the hydrological data and accounting for groundwater surface water interaction.
- Configure and apply the Water Resource Planning Model for the water resource system of the study area.
- Assess the historical water requirements and return flows, and compile projection scenarios.
- Evaluate both demand management and water resource infrastructure options to formulate scenarios to achieve a positive water balance until the year 2040.
- Develop a preliminary Reconciliation Strategy within 12 months followed by a final strategy.

### STUDY TASKS

The Reconciliation Strategy Study for the Luvuvhu and Letaba Water Supply System has been broken down into different tasks which will be discussed below.

## SUMMARY OF PREVIOUS AND CURRENT STUDIES

This task will involve compiling a summary report of information from previous studies, to assist in the refinement of the scope in the inception report.

The Luvuvhu Letaba System has been the subject of many studies from different perspectives, and it will be essential to collate and understand the approaches as well as the assumptions used in the previous studies. This is necessary to be in a position to undertake a synthesis of all available information and adding perspectives on whether the previously identified interventions are suitable for further consideration and assessment in this study.

The summary report will also list all relevant recommendations from previous reports and current water resource management processes in order to ensure that the developed strategy is not in contradiction with previous recommendations and the formulation is coherent with activities currently happening in the area.

## PRELIMINARY SCREENING WORKSHOP

Stakeholders have to evaluate the scenarios or options presented by the DWA and its study team. This will take place in March/April 2012. The various options will be explained in a document that will be distributed to all stakeholders who will attend this workshop. Stakeholders will be given the opportunity to identify issues and concerns related to water resource management that may influence the reconciliation strategy.

After the workshop, a summary of the main topics of discussion will be distributed to all. This summary will also feed into a document that will define the schemes to be investigated and the shortfalls in information to be provided. This document in turn will feed into the Preliminary Strategy Report.

## SYSTEM ANALYSES

### *Hydrological*

The approach of the hydrological analysis will be to build on the existing hydrological model (WRSM2000) configured during the Water Resources of South Africa – 2005 (WR2005) Study (WRC, 2008) for the Luvuvhu and Letaba WMA. The catchment area has a total of 46 quaternary catchments, but the WRSM2000 networks produced during this study made provision for several quinary sub-divisions, totalling to 59 sub-divisions.

Groundwater, streamflow records and rainfall statistics will be incorporated into the study. Rainfall records and natural

streamflow records will be produced for each of the sub-catchments to cover the entire record period 1920 to 2009 hydrological years.

### *Yield Analysis*

The Water Resource Yield Model (WRYM) was applied in previous studies for both the Letaba and Luvuvhu catchments to carry out various historic and stochastic yield analyses. The latest studies in this regard are the “Luvuvhu River System Annual Operating Analysis” completed in 2005 and the Letaba River System Annual Operating Analysis” completed in 2006. No WRYM system however exists for the Shingwedzi River System.

Yield analysis will be carried out for all major dams in these sub-systems using the updated hydrology and demand data. Coordination with the study team undertaking the development of operating rules for large river systems and stand-alone dams and schemes (study by the Directorate: Water Resource Planning Systems) will be necessary to ensure alignment and prevent duplication. Provision has been made in the financial proposal for yield analysis of 15 dams or systems.

The simulation results of Middle Letaba and Albasini dams in previous analysis did not agree with that observed in practice. This problem was overcome for Albasini Dam when the updated hydrology from the DWA was included in the WRYM setup as part of the “Luvuvhu River System Annual Operating Analysis”. It is anticipated that improved results will be obtained with this study since the groundwater surface water interaction will be included in the modelling process for the first time.

### *Planning Analysis*

The relevant information from the other tasks will be used to compile the Water Resource Planning Model (WRPM) for the study area. Details from the existing WRPM setups for the Luvuvhu and Letaba systems will be re-used where relevant.

The WRPM will be configured to cover the entire study area. One combined model setup will be created so that transfers from one system to another can be modelled and evaluated in a realistic manner. The allocation module of the WRPM uses a multi-risk user priority definition for each water use sector. These priorities will be confirmed with the client and key stakeholders during the course of the study. Different scenarios as identified and discussed in the screening workshops will be analysed with the WRPM.

Results from the WRPM analyses will be used to determine when interventions are required based on a defined risk criteria and to prepare water balances at key points in the system. These results will be used as input in the formulation of the Reconciliation Strategy for the entire water supply system.

## **Water Quality**

In order to develop a water quality profile of the Letaba and Luvuvhu System, water quality information will be collected and collated. The objective of the task is to identify the water quality variables of concern, the pollution sources and the water users in the catchment.

A set of interim reserve water quality objectives (RWQOs) will be proposed for use in managing the catchment. This will allow for the development of qualitative input to the Reconciliation Strategy.

The calibration of the Water Quality Modelling has been excluded from the scope of work. However allowance has been made in this task to assess the following:

- The type of water quality modelling system required to develop water quality management plans and to manage the water quality in the river system;
- The inputs needed for the model; and
- A gap analysis on the available database needed to support the modelling system and to propose a monitoring system to fill in the information gaps.

## **WATER USE AND NEEDS**

### ***Water use requirements and return flows***

This task will focus on collecting and processing the water requirements and related data for the different water use categories such as domestic (urban and rural), industrial, mining, power generation, irrigation, afforestation, etc.

The project team will liaise closely with the local authorities and DWA officials to utilise existing information and water requirement projection methods that are being applied.

The water requirements scenarios will be developed by first defining the baseline year to be used which will default to the year of the last comprehensive national census and then through:

- consultation with key stakeholders to ensure that reference is made to the most recent data sets (population, demographics, historic water demands, land-use, urbanisation, economic, socio-economic indicators, etc.);
- analysis of current data to firm up on identified drivers which impact on water usage (population – direct water use, socio-economic profile of residential water use categories and other economic indicators – indirect water use) and their correlation with actual water usage data;
- development of water requirement scenarios, which will include the views of key sectors and reflect realistic possibilities for the region, in terms of historic water demands and demographic, economic, geographic and climatological factors; and
- in addition to the volumetric water requirements it will be necessary to define the water supply reliability requirements for the different water user groups in the system. The priority classification tables based on the profile of users will be compiled.

### ***Invasive alien plants***

Significant areas of invasive alien plants do occur within the study area which affects the runoff generated from these

catchments. The areas covered by the invasive alien plants were not fully captured and modelled in the latest studies on the Luvuvhu and Letaba river catchments. The data from the existing studies will first be obtained and evaluated, in particular the sources of information used for the invasive alien plants. More up-to-date information will be sourced from the Directorate: Working for Water where available.

The effect of the invasive alien plants on the runoff from the infected catchments as well as on the sub-system yield will be determined.

### ***Reserve***

This task will only require the collation of existing Ecological Water Requirement (EWR) data for use in the study. The available EWR will be sourced from the Directorate: Resource Directive Measures and after evaluation will be included in the water resource models.

### ***International obligations***

The Luvuvhu and Letaba River System flows through the Kruger National Park, join the Olifants River just upstream of the Mozambique border and then flows into the Massingir Dam in Mozambique. The current inter-basin transfer information affecting the study area will be sourced, which will include source, quantity and operating rules.

The existing operating rules and transfer capacities of these systems will be ascertained for use in the update and configuration of the Water Resource Yield Model and Water Resource Planning Model.

The Luvuvhu and Letaba River System can therefore be classified as directly supporting international obligations. A detailed appraisal of the international water-related aspects of the WMA will be provided.

## **INTERVENTION OPTIONS**

### ***Water Conservation / Water Demand Management***

Water conservation and water demand management (WC/WDM) will be addressed in the urban-rural and irrigation sectors. For the irrigation sector the following components will be addressed:

- Past and present water use efficiency;
- Existing initiatives on WC/WDM;
- Benchmarks and best management practise; and
- Modus operandi for implementation of WC.WDM measures.

The objective for the urban/rural sectors will be to review the contents WC/WDM strategies developed by key Water Services Authorities (WSA). Based on the review, a realistic estimate will be made of the potential savings, cost implications and programme of implementation.

The following key WSA and Water Services Providers (WSP) have been identified in the area:

- Greater Giyani Local Municipality;
- Greater Letaba Local Municipality;
- Greater Tzaneen Local Municipality;
- Mutale Local Municipality;

- Thulamela Local Municipal;
- Makhado Local Municipality; and
- Lepelle Water Board.

### **Water Re-use**

The role that the re-use of treated effluent from the wastewater treatment plants (WWTP) can play in achieving reconciliation, will also be assessed. Opportunities will be identified across the study area.

### **Schemes**

The configurations for the bulk infrastructure for water supply, irrigation and other major users of the schemes identified by the Preliminary Screening Workshop will be reviewed and adjustments will be made if necessary to ensure that current and future water requirements can be supplied and the cost estimates of the schemes will also be updated accordingly. The state and operational status of the existing bulk infrastructure for water supply, irrigation and other major users will be assessed to determine maintenance and/or refurbishment requirements.

Groundwater utilisation will be determined to supplement or serve as the primary source of water supply. Various scenarios related to groundwater utilisation will be assessed. The feasibility of utilising groundwater will be assessed through costing of groundwater options.

### **Social and Environmental Assessment**

The objective of this socio-economic analysis is to review and analyse the population and their characteristics, settlement patterns, socio-economics, and change in circumstances in terms of impacts of schemes previously identified and assessed by earlier studies.

All available information will be evaluated to determine the environmental sensitivity of options and whether any of the circumstances have changed since previous assessments. The sensitivity will be rated from low to high. No specialist investigations will be conducted during the process.

## **FORMULATION OF SCENARIOS TO INFORM STRATEGY**

The approach for this task will be to use the information from the other study activities to formulate scenarios of how sufficient water at acceptable water quality can be made available to supply the water requirements in all supply areas until the year 2040. The identification and formulation of the scenarios will be based on a synthesis of information on the water resource availability, water quality, distribution infrastructure, potential schemes and interventions (such as WC/WDM) as well as future water requirement and return flow growth centres in the study area.

Annual projected water balance (yield versus water requirement) graphs will be compiled for each subsystem and for each scenario. The balances will account for any

interdependencies (transfers, etc.) between the sub-systems where both the yield and the conveyance infrastructure capacity limitations are taken into consideration.

### **Preliminary Reconciliation Strategy**

The Preliminary Reconciliation Strategy will be completed by April 2013. Due to the time required for the completion of the Hydrology task and the subsequent Yield and Planning Analysis tasks, which will only produce results after twelve months, the water availability (yields) for the Preliminary Strategy will be based on existing available data and model results.

The existing WRYM configurations will be applied in cases where sub-system yields are not available from existing reports. Although the focus period of the Preliminary Reconciliation Strategy will be on the initial ten years the annual water balances and sequencing of interventions will be carried out until the year 2040.

### **Final Reconciliation Strategy**

The Final Reconciliation Strategy will define the proposed actions and interventions (demand management and infrastructure) that will be required to make sufficient water available to supply the water needs in the study area up to the year 2040.

### **Final Screening Workshop**

Stakeholders have to share their views and also provide their agreement on the most favourable future reconciliation options and sequence of implementation and planning priorities in the medium and long term. This will be done at a Final Screening Workshop to be held at a venue in the study area.

## **STAKEHOLDER ENGAGEMENT**

### **Stakeholders**

The identification of stakeholders in the study area will be an on-going process. Some of the stakeholders included in the database currently are the relevant government departments on national and provincial level such as the Department of Environmental Affairs and the Department of Agriculture, Forestry and Fisheries; municipalities; agriculture; conservation organisations; community representatives and civil society.

Stakeholders will continue to be informed of progress with the study through a newsletter and will be asked for their inputs on an on-going basis. The DWA website will also be used for the publishing of information regarding this study.

### **Study Steering Committee**

Stakeholders representing specific sectors of society (e.g. agriculture, conservation, civil society as well as departmental officials) will be identified and asked to serve on a Study Steering Committee (SSC) for the duration (36 months) of this project. The SSC members will oversee the study and provide strategic advice and guidance.