Development of Reconciliation Strategies for Large Bulk Water Supply Systems: Orange River

Background Information Document

June 2012



water affairs Department: Water Affairs REPUBLIC OF SOUTH AFRICA

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 Orange River Water Supply System.

Α 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 at current and future development levels.

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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OBJECTIVES OF THE STUDY

The objective of the study is to develop a reconciliation strategy for the bulk water resources of the Orange River System to ensure sufficient water can be made available to supply the current and future water needs of all the users up to the year 2040. This Strategy must be flexible to accommodate future changes in the actual water requirements and transfers with the result that the Strategy will evolve over time as part of an on-going planning process.

Appropriate integration with other planning and management processes as well as cooperation among stakeholder will be key success factors in formulating coherent recommendations and action plans.

The outcomes of the Strategy will be specific interventions with particular actions needed to balance the water needs with the availability through the implementation of regulations, demand management measures as well as infrastructure development options.

STUDY AREA

As depicted on the inserted map of the study area, the study will focus on the water resources of the Upper and Lower Orange River Water Management Areas (WMAs), while also considering all the tributary rivers and transfers affecting the water balance of the system. This core area forms part of the Orange-Senqu River Basin, which straddles four International Basin States with the Senqu River originating in the highlands of Lesotho, Botswana in the north eastern part of the Basin, the Fish River in Namibia and the largest area situated in South Africa.

Major water resource infrastructure in the study area are the Gariep and Vanderkloof dams with associated conveyance conduits supporting large irrigation farming in the provinces of the Free State, Northern Cape and the Eastern Cape - through the Orange-Fish Tunnel.

The Caledon-Modder System supplies water to the Mangaung-Bloemfontein urban cluster (largest urban centre in the study area) and the 2 200 km long Orange-Senqu River is the lifeline for various industries, mines, towns and communities located along the way until the river discharges into the Atlantic Ocean at Alexander Bay.

Since 1994, a significant driver of change in the water balance of the Orange River System was brought about by the storing of water in Katse Dam as the first component of the multi-phase Lesotho Highlands Water Project (LHWP). Currently Phase 1 of the LHWP (consisting of Katse, and Mohale dams, Mosoku Weir and associated conveyance tunnels) transfers 780 million cubic metres per annum via the Liebenbergsvlei River into the Vaal Dam to augment the continuously growing water needs of the Gauteng Province.

The above description illustrates the complex assortment of interdependent water resources and water uses which spans across various international and institutional boundaries that will be considered in the development of the Orange River Reconciliation Strategy.

RECONCILIATION STRATEGY COMPONENTS

Lessons learned from strategies being implemented in other parts of the country identified the components shown in Figure 1 as the main variables involved in developing a Reconciliation Strategy. At the centre of the diagram the questions regarding how must water is **needed**, what water resources are **available** or could be made available, and which **interventions** can be consider to achieve a balance between demand and supply should be answered.

The coloured boxes indicate how each question is answered by undertaking various investigations and synthesising the results of several processes to formulate the most suitable strategy and plan to reconcile the water resources with the requirements.



Figure 1: Reconciliation Strategy Components

The particular tasks and activities relevant to the Orange River System were identified from the generic complements

STUDY TASKS

The Development of Reconciliation Strategies for Large Bulk Water Supply Systems: Orange River has been broken down into different tasks which will be discussed below.

INCEPTION PHASE

The project inception phase will involve compiling a Study Plan for the execution of the study which will be documented in the Inception Report. This Study Plan will form the baseline for monitoring and evaluating progress during the Study Implementation Phase.

A Summary Report will be complied of information from previous studies, to assist in the refinement of the scope in the Inception Report. The Orange River 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.

This report will be used as basis to prepare for the preliminary first screening workshop.

SYSTEM ANALYSIS

Hydrological

As part of the recently completed Phase II of the ORASECOM (Orange-Senqu River Commission) Basin Wide Integrated Water Resources Management Plan the hydrology for most catchments were extended and improved in some places, now covering the total record period from 1920 to 2004.

The hydrological database from the ORASECOM Study and any other investigations will be reviewed with the focus on the sub-

catchments of higher importance for existing and the location of possible future schemes and related Ecological Water Requirements (EWR).

Following the selection of the appropriate hydrological data for analysis, the standard DWA runoff-risk models will be configured and tested before it is applied in the water resources system models to quantify the assurance of supply of the water resources.

System Analysis

The Water Resource Planning Model (WRPM) and the Water Resource Yield Model (WRYM) were both updated during the ORASECOM Study and appropriate modifications will be made to analyse the scenarios that will be identified in this study.

These scenarios will typically include different future water requirement projections, saving scenarios through demand management measures, revised operating rules as well as infrastructure developments options such as the proposed Polihali Dam in Lesotho, Bosberg Dam in the Upper Orange WMA and/or Vioolsdrift Dam in the Lower Orange The water availability yield results from this task will be applied in the engineering and economic evaluation tasks for comparison purposes.

Water Quality

The water quality assessment task will consists of the following activities:

- Collate available Resource Water Quality Objectives (RWQO) and water quality guidelines set in the study area with the aim to propose a set of interim guidelines/RWQO for use in the study.
- Analyse the available water quality data and compare the water quality status to the RWQO to identify water quality variables of concern and possible water quality issues.
- Identify potential sources of pollution related to the measured water quality in the river system.
- Provide inputs to the reconciliation interventions regarding water quality impacts that can be expected.

Groundwater

The groundwater investigations will be undertaken at desktop level where the primary objective is to determine the role that groundwater can play in the reconciliation of water availability and the bulk water requirements. The approach will be to use existing information from previous studies, local knowledge, the DWA database (quantity and quality) to identify groundwater aquifers that can contribute significantly to the Reconciliation Strategy.

The costs to develop the infrastructure to exploit the aquifers will be determined in the engineering tasks with input from the groundwater task team.

WATER USE AND NEEDS

Current and future water requirements

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 and irrigation.

The urban/industrial use projections currently used for planning purposes originated from the *All Town Reconciliation Study* and the *Bloemfontein Reconciliation Study*. The data for the mine water use was not recently updated and will be verified. The intention is to extract all usable data from the reports and existing data sources and compile comparisons for scenario preparation. The comparison will be used to identify discrepancies that will guide the study team to compile the most appropriate water requirements database to be used for the study.

The water demand information will be assessed in terms of:

- The historical growth patterns of the domestic water requirements together with the abstraction pattern as well as the sources and locations of any return flows.
- The locations of all major groundwater abstractions and their effective contribution to the overall domestic water requirements will also be assessed.
- Both present and future water uses will be assessed and integrated with the water requirements scenarios.
- Water requirement and return flow scenarios including the effects of Water Conservation and Water Demand Management (WCWDM) measures will be compiled.

Since irrigation is by far the largest water use sector in the study area a detail evaluations and assessment will be carried out based on:

- Reports from previous studies with particular attention to the ORASECOM study where locale irrigation areas were determined using satellite imagery.
- WARMS database.
- Database developed during the validation and verification process, and;
- Local knowledge of DWA officials and Water User Associations/Irrigation Boards.
- Particular attention will be given to the required transfer volumes for irrigation to the Eastern Cape and the associated losses.

A summary database of all water requirements in the study area showing present and projected future water needs will be prepared for different scenarios.

Ecological Water Requirements

This task will involve collating Ecological Water Requirement information (In-stream and Estuary Flow Requirements) from previous studies as well as other parallel processes with the aim to formulate alternative scenario for analysis in this study.

In this regard information will be sources from the Directorate: Resource Directive Measures of the DWA, the recently completed *Basin-wide Integrated Water Resources* Management Plan and the UNDP-GEF Orange-Senqu Strategic Action Programme: Determining the environmental flows requirements of the lower Orange River with special focus on the Orange Estuary and coastal marine environment (both commissioned by ORASECOM).

International obligations

The study team will engage with relevant DWA officials to obtain the most recent documentation on Treaties and Protocols defining pertinent obligations and rights pertaining to the watercourse states of the Orange River. The deliverable of the task will be a short report on each treaty and protocol as well as a referenced schedule of international obligations and international rights (water allocations).

INTERVENTION OPTIONS

Irrigation water conservation / water demand management

The potential for water conservation and water demand management (WC/WDM) in the irrigation sector will be assessed by evaluating existing initiatives, strategies or studies against standard Benchmarks and Best Management Practice. Any implementation of recommendations of previous WC/WDM studies will be checked and the on-going monitoring /assessment of benefits of various interventions will be evaluated. This information will form the foundation for new or additional recommended approaches to WC/WDM for the irrigation sector in the study area.

A preliminary evaluation of the extent of unlawful irrigation water use will be carried out based on data from the Upper Orange River WMA Validation and Verification Project and related processes to prepare appropriate recommendations for inclusion in the Strategy.

Water Re-use

The major wastewater treatment works (WWTW) are located in the Bloemfontein area where the greatest potential is for water re-use. Both indirect and direct re-use have been identified in the Reconciliation Strategy for the Greater Bloemfontein Area as future sources of water to be used to achieve reconciliation. The use of treated wastewater effluent requires further treatment as well as an understanding of the nature of the contributing drainage area. Only drainage areas where about 90% of the effluent volume is generated by domestic users can be considered for re-use. Industrial effluent has health implications and can impact on the membrane treatment processes needed for direct re-use.

The objectives of this task are:

- To identify WWTW effluents that have potential for re-use and include in the reconciliation strategy.
- To provide high level costs of additional treatment required for re-use.

Urban water conservation /water demand management

The objective of this task will be to review the status quo and progress made with WC/WDM in the study area.

The following will be done:

- Collect and collate previous studies.
- Assess potential savings.

• Review information and scenarios.

It is imperative that the targets set in the Strategy are realistic and the goals are met as it has a direct implication on future augmentation schemes. The WC/WDM strategies will be reviewed after 18 months to assess whether the targets have been met.

Review Schemes and Update Cost Estimates

The objectives of this task are to review and revise the scheme configurations that will be identified at the Preliminary Screening Workshop, to prepare updated cost estimates for them and to determine Unit Reference Values (URVs) as an economic comparison metric.

Social and Environmental Assessment

The development of infrastructure to supply the water needs could have a profound impact on the environment and the social structures in the affected areas. This task will review existing information from previous investigations relating to the selected schemes that will be identified in the Preliminary Screening Workshop for evaluation. Appropriate recommendations on further detail work and any key environmental and social issues will be identified and incorporated in the Strategy recommendations.

Value of irrigation water

In view of the option to apply water use entitlement trading as an intervention measure, this task will provide an evaluation of the value of irrigation practiced in the Orange River System. The approach will involve the following:

- Determine the gross margins (gross revenue and direct production costs) for all the main enterprises in the study area and calculate the financial return per cubic metre as a first order indication of economic efficiency.
- Configure typical farm models for various bioclimatic/economic sub areas and aggregate those together as an estimate of the financial value of irrigation in the study area.
- The final component will be to determine the regional economic benefits of irrigation by applying a Social Accounting Matrix (SAM) model which takes into account the relevant economic multipliers across economic sectors.

The enterprise financial value and regional economic benefits will together provide an estimate of the overall value of irrigation water use in the study area.

FORMULATION OF SCENARIOS

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 levels can be made available to supply the water requirements in the study area 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, infrastructure, potential schemes and interventions (such as WC/WDM) as well as future water requirement and return flow growth centres.

Preliminary Screening Workshop (February 2013)

The objectives of this workshop will be to discuss the main issues and concerns with the key stakeholders in the study area, to identify possible options to solve the concerns and also to eliminate those options which should not be given further consideration in this study.

After the workshop, a summary of the main topics of discussion will be distributed to all Strategy Steering Committee (SSC) members. This summary will also be compiled into a document defining the schemes to be investigated and the shortfalls in additional information to be provided. This document in turn will feed into the Preliminary Strategy Report.

Preliminary Reconciliation Strategy (June 2013)

The Preliminary Reconciliation Strategy will be documented for comments as the first draft Strategy by June 2013. The information presented will include preliminary water balance projections for a number of water requirement scenarios and schedule of intervention options. This document will be distributed to the Study Steering Committee (SSC) for comments.

Final Screening Workshop (November 2013)

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

Final Reconciliation Strategy (April 2014)

The Final Reconciliation Strategy will incorporate additional information and the comments from the SSC, define the proposed interventions as well as specific actions with responsibilities that will be required to make sufficient water available to supply the water needs in the study are up to the year 2040.

STAKEHOLDER ENGAGEMENT

Stakeholders

The DWA recognises the importance of stakeholder contributions as a key requirement to develop a Reconciliation Strategy that is founded on sound information, relevant to the prevailing conditions in the study area and practical implementable. This will be achieved through the Study Steering Committee, public meetings as well as newsletters.

The study team will maintain a stakeholder database for the duration of the study. Some of the stakeholders currently included 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.

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 the 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. The inaugural SSC meeting is scheduled for August 2012 in Kimberley and will be held every six months thereafter.