

INVESTIGATION OF GROUNDWATER AND SURFACE WATER INTERACTION FOR THE PROTECTION OF WATER RESOURCES IN THE LOWER VAAL CATCHMENT

Background Information Document No. 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 and Sanitation (DWS), to investigate Groundwater and Surface Water Interaction for the Protection of Water Resources in the Lower Vaal Catchment.

The investigation comprises the quantitative modelling of surface and groundwater in an integrated manner to derive an integrated water balance of surface runoff and losses, groundwater recharge and baseflow. This is combined with an evaluation of groundwater quality. The study will define protection zones, identifying where these interactions are significant.

Stakeholders are invited to participate in the process by commenting on information that is sent to them, attending meetings or by corresponding with the stakeholder engagement office or the technical team at the addresses provided below.

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Project document accessible at this webpage: <https://www.dws.gov.za/rdm/currentstudies/default.aspx>

1. INTRODUCTION AND STUDY OBJECTIVES

The Chief Directorate: Water Ecosystems Management (CD: WEM) is tasked with the responsibility to coordinate all Reserve determination studies which have priority over other uses in terms of the National Water Act (Act No. 36 of 1998) (NWA). The CD: WEM initiated a study to determine and quantify groundwater and surface water interactions and delineate protection zoning to prevent the disturbance of the ecological integrity of ecosystems where such interactions occur. A feasibility study undertaken by the Department of Water and Sanitation (DWS) in 2007 and the National Water Resource Strategy II identified the need for surface-subsurface interaction studies in the Lower Vaal.

The purpose of such studies is to further the understanding of subsurface processes when determining the Reserve, whose quantification is required for various water use license applications, the conservation status of various resources and the associated impacts of proposed developments on the availability of water.

The specific objectives of the study are to:

- Review existing water resource information
- Conduct a hydrocensus of water abstraction, demands, water quality and monitoring at an institution and organizational level
- Conduct a groundwater resource assessment of recharge, baseflow, abstraction, groundwater balance, present status category
- Quantify aquifer parameters and describe aquifer types
- Determine groundwater-surface water interactions both in terms of quality and quantity to determine protection zones
- Capacity building and skills transfer to DWS officials

The NWA is founded on the principle that National Government has the overall responsibility for and authority over water resource management for the benefit of the public without seriously affecting the functioning of the natural environment. In order to achieve this objective, Chapter 3 of the NWA provides for the protection of all water resources, through the determination and implementation of the Reserve for these resources. The Reserve is one of a range of resource directed measures (RDM) aimed at the ecological protection of water resources and the provision of Basic Human Needs (BHN). The Reserve is defined in terms of the Ecological Water Requirements (EWR) of the resource and an assurance of supply provided at a defined spatial and temporal distribution together with the protection of the BHN requirements so as to ensure ecologically sustainable development and utilization of a water resource. Quantification of the groundwater component of the Reserve and allocable groundwater requires the quantification of surface-groundwater interactions in terms of baseflows.

2. OVERVIEW OF THE STUDY AREA

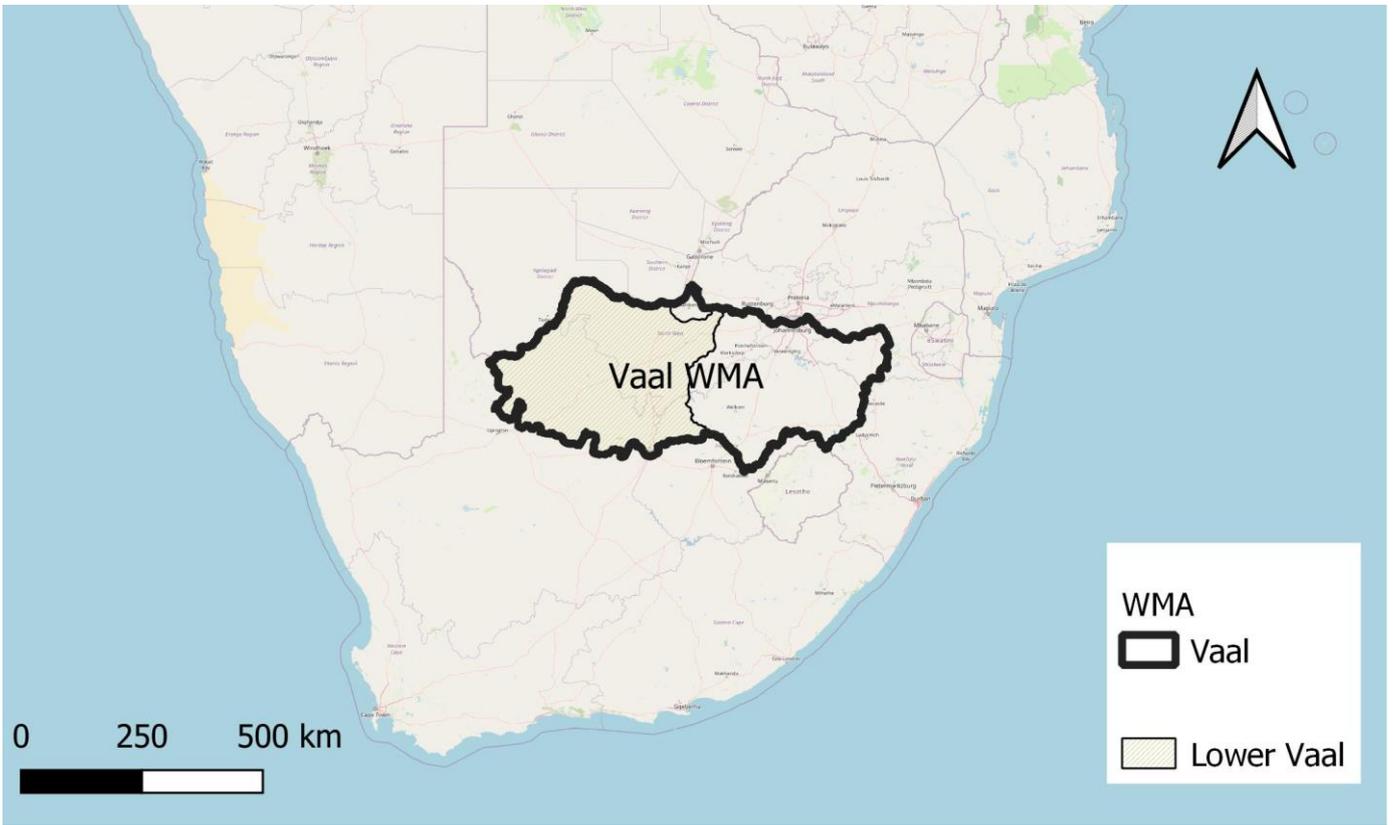
The Lower Vaal catchment (former WMA 10) lies in the north-eastern part of the Northern Cape Province, the western part of Northwest Province, and a part of the northern Free State Province. It contains the Molopo, Harts and Vaal (below Bloemhof dam) catchments. Included in these basins are the Dry Harts, and Kuruman catchments. The Molopo River forms an international boundary between South Africa and Botswana and its catchment contains transboundary aquifers, such as the Bray Dolomitic aquifer.

The Lower Vaal includes Tertiary catchments C31-C33, C91-92, D41, and Quaternary catchments D73A, D42C-D, D73B-E. These catchments include dolomites, where interaction can be significant. The main rivers are perennial and most of their tributaries are ephemeral. The main source of surface water is the Vaal River, which flows into the study area below Bloemhof Dam, before its confluence with the Orange River. The main dams are Wentzel, Taung, Spitskop, Vaalharts Weir, Douglas weir and Bloemhof. The only pan is Barbaspan, located in the Harts sub-catchment. The stretch of Vaal River considered here is the reach between Bloemhof Dam and the Orange and Vaal River confluence. The total catchment area is almost 22 500 km².

Major towns in the study area include Kimberley, Lichtenburg, Kuruman, Vryburg and Postmasburg.

Rainfall is strongly seasonal with most rain occurring in the summer period (October to April). The peak rainfall months are December and January. Rainfall occurs generally as convective thunderstorms and is sometimes accompanied by hail. The overall feature of mean annual rainfall over the study area is that it decreases uniformly westwards from the western parts of the North-West Province to the eastern parts of the Northern Cape Province. The overall range of the Mean Annual Precipitation (MAP) for the entire study area is 100 mm to 600 mm while the overall range of the Coefficient of Variation over the entire study area is 25 % to 40 %.

Due to the extremely arid nature of the Lower Vaal catchment, groundwater plays a very important role in the water resources of this catchment. In many areas the only source of water is groundwater since there are no sustainable surface water resources. A large portion of the central and north-east corner of the Lower Vaal catchment is underlain by the Transvaal Supergroup consisting of the dolomite, chert, and subordinate limestone. This area is characterised by a high potential for groundwater with a 50 to 75% probability and accessibility throughout the dolomitic area.



The Vaal WMA



Lower Vaal catchment

3. DURATION OF THE STUDY

The duration of the contract is from November 2021 to October 2023. During the two-year period a number of tasks as per the Terms of Reference for this study will be completed.

4. STUDY ROLE PLAYERS

A Project Management Committee (PMC) was established to provide technical input and guide progress. The members of the PMC are key DWS role players representing the various directorates and the Regional Office which could impact on the eventual implementation of the study objectives. The PMC must be supported by a stakeholder group with a larger and more representative interest base, and therefore the DWS is establishing a Project Steering Committee (PSC).

The PSC will meet three times during the course of the study and the first meeting will be on 10 March 2022. The PSC consists of representatives from relevant sectors of society, e.g., national, provincial, and local government, agriculture, environment, conservation, and the civil society.

The DWS and the PSC are supported by a consortium of Professional Service Providers under WSM Leshika (Pty) Ltd.

5. CONTEXT OF THE STUDY

This study is not taking place in isolation. A major study towards the improved management of water resources in the area is also taking place. This study is the Development, updating and review of strategies to reconcile water availability and requirements in the Planning Area Central comprising the Mangaung, Orange, Integrated Vaal River Systems and all other town and clusters of villages (Central Region Recon). The objective of this study is to undertake the development and continuation phases of the reconciliation strategies for the catchments in Central Planning Area over at least a 25-year planning horizon.

The modelling and results from this study will feed into the Central Region Recon project, using the same modelling systems.

The Rapid Reserve for the Lower Vaal was undertaken in 2009. Groundwater RQOs and numerical limits were set in 2014 based on a project to determine Resource Quality Objectives and Numerical Limits. These are based on maximum water level fluctuations, but do not consider borehole location.

Resource Quality Objectives were gazette on 17 July 2015, and Reserve Determinations for the catchments of the Lower Vaal were gazetted on 25 September 2020, and priority wetlands were identified. However, these were not linked to integrated to existing surface water-groundwater models.

6. PROJECT PLAN AND PROGRESS

The project process involves the completion of various tasks. These steps, outcomes, progress and status are summarized in the table below.

Table 1: Summary of the proposed steps to be followed in the study, the anticipated outcomes, progress and status

Step	Description	Outcomes	Progress	Status
1	Study Inception	Inception report: <ul style="list-style-type: none">• Work programme• Capacity building plan• Expenditure projections		Outcomes of this step were completed and will be discussed at this meeting. Report: RDM/WMA05/00//GWSW/0122: Inception Report

Step	Description	Outcomes	Progress	Status
2	Review of Water Resource Information <ul style="list-style-type: none"> • Literature Review and data gathering • Hydrocensus • Resource Assessment 	Hydrogeological Report covering: <ul style="list-style-type: none"> • Groundwater resources including Harvest Potential, Recharge, Baseflow and groundwater use • Conceptual model of aquifers and aquifer types • Water balance and stress index • Identification of interaction zones • Identification of other potential studies to improve results 		This phase has started and results will be presented at the 2n ^d PSC meeting.
3	Surface - Groundwater Interactions <ul style="list-style-type: none"> • Quantity groundwater recharge and baseflow contributions to rivers • Quantify losses from rivers to groundwater • Categorize groundwater quality • Groundwater levels and their fluctuations • Determination relevance of groundwater contribution to surface water and identify protection zones • Groundwater conceptual model and maps • Present status of groundwater • Compilation of a monitoring programme 	<ul style="list-style-type: none"> • Surface-subsurface interactions using WRSM2000/Pitman and GRDM Methodology • Map of protection zones • Map of groundwater levels 		This phase has not started
4	Capacity Building	<ul style="list-style-type: none"> • Trained officials • Summary document of training process and defining any further training that may still be required • Training workshop • Training manuals 		This phase has not started