Determination of the Water Resource Classes, Reserve and Resource Quality Objectives in the Lephalala, Mogalakwena, Sand, Nzhelele, Luvuvhu and Shingwedzi River Catchments

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PURPOSE OF THIS DOCUMENT

The purpose of this Background Information Document (BID) is to support the Project Steering Committee in preparing for the first meeting that will be held virtually on the 5 July 2022.

This document provides the following:

(i) Approach and outcomes of the delineation and status quo assessment of the Integrated Unit of Analysis (IUA).

(ii) Outline of the approach and outcomes that would be used to link the economic and social value and condition of the water resource.

(iii) Approach to the visioning process.

BACKGROUND

The purpose of this study is to determine water resource classes, the Reserve and Resource Quality Objectives (RQOs) for all significant water resources in the Lephalala, Mogalakwena, Sand, Nzhelele and Luvuvhu catchments in the Limpopo Water Management Area (WMA) and the Shingwedzi catchment in the Olifants WMA that will facilitate sustainable use of the water resources while maintaining ecological integrity.

The Integrated Framework for incorporating the gazetted steps for the Classification, Reserve and RQOs is being used to guide this study (Figure 1).

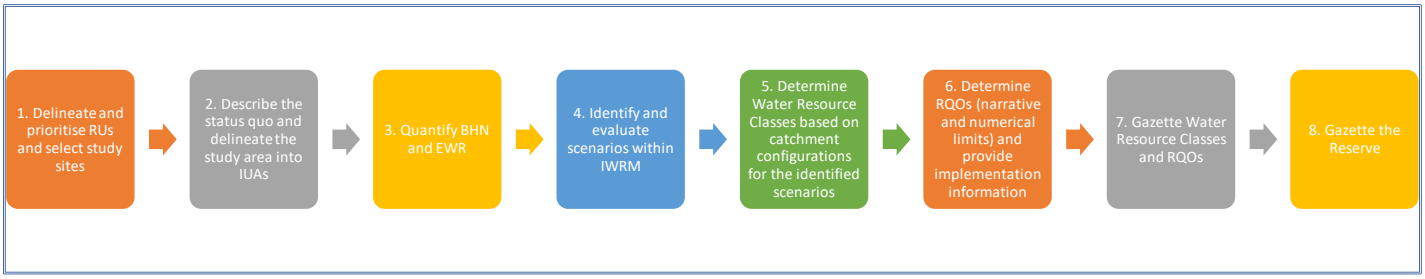

Figure 1. Integrated Framework

DELINEATION OF THE STUDY AREA

The delineation process was aimed at combining the river, wetland, and groundwater Resource Units (RU); the infrastructure, land use and socio-economic information into areas of interest. One of the key considerations in the delineation process was to maintain separate river basins such that the IUAs are hydrologically independent.

A total of twelve IUAs have been defined in the study area by combining socio-economic conditions with river, wetland, and groundwater RUs. These are shown in the map of the study area given below and in the associated Table 1 which summarizes the river, groundwater and wetland resource units and quaternary catchments.

The biophysical nodes were defined through sequentially analysing and applying rules to eleven tiers of ecological and infrastructure-related information. A total of seventy-four (74) nodes were identified in the study area and are illustrated in Figure 2.

DESCRIBING THE CURRENT CONDITION OF THE IUA

The current condition of the water resources in the study area were defined in terms of the hydrological conditions and infrastructure developments, the ecological integrity, the socio-economic conditions, and the community well-being. These findings are provided for each IUA in the accompanying IUA status quo summary document.

Table 1. Composition of provisional IUAs delineated for the study area

SOCIO-ECONOMIC ZONE	RIVER RESOURCE UNITS	GROUNDWATER RESOURCE UNITS	WETLAND RESOURCE UNITS	IUA NAME	QUATERNARY CATCHMENTS
1. Upper Lephalala	Upper Lephalala	Upper Lephalala	RU 3	Upper Lephalala	A50A, A50B, A50C, A50D, A50E, A50F
2. Lower Lephalala	Lower Lephalala	Middle Lephalala Lower Lephalala	RU 5	Lower Lephalala	A50G, A50H
3. Kalkpan se Loop	Kalkpan se Loop	Kalkpan / Maasstroom	RU 6	Kalkpan se Loop	A50J,A63C
4. Upper Nyl & Sterk	Upper Nyl/Sterk Middle Nyl Lower Nyl	Nyl River Valley, Sterk Upper Mogalakwena	RU1 RU 2	Upper Nyl & Sterk	A61A, A61B, A61C, A61D, A61E, A61F, A61G, A61H, A61J
5. Mogalakwena	Mogalakwena	Klein Mogalakwena Matlala Steilloop Lower Mogalakwena	RU 4 RU 7	Mogalakwena	A62A, A62B, A62C, A62D, A62E, A62F, A62G, A62H, A62J, A63A, A63B, A63D
6. Mapungubwe	Mapungubwe/Lower Sand	Kolope	RU 8	Mapungubwe	A63E, A71L
7. Upper Sand	Upper Sand	Upper Sand Middle Sand Hout	RU 9	Upper Sand	A71A, A71B, A71C, A71E, A71F
8. Lower Sand	Lower Sand	Middle Sand Hout Lower Sand Sandbrak	RU 10 RU 11 RU 12	Lower Sand	A71D, A71G, A71H, A71J, A71K, A72A, A72B
9. Nzhelele/Nwanedi	Upper Nzhelele/Upper Nwanedi Lower Nzhelele/Upper Nwanedi	Nzhelele Lower Nzhelele Nwanedi	RU 13	Nzhelele/Nwanedi	A80A, A80B, A80C, A80D, A80E, A80F, A80G, A80H, A80J
10. Upper Luvuvhu	Luvuvhu Headwaters Upper Luvuvhu	Upper Luvuvhu	RU 14	Upper Luvuvhu	A91A, A91B, A91C, A91D, A91E, A91F, A91G
11. Lower Luvuvhu/Mutale	Upper Mutale/Middle Luvuvhu Lower Mutale/Lower Luvuvhu Luvuvhu KNP	Mutale/Luvuvhu	RU 15	Lower Luvuvhu/Mutale	A91H, A91J, A91K, A92A, A92B, A92C, A92D
12. Shingwedzi	Shingwedzi	Shingwedzi	RU 16	Shingwedzi	B90A, B90B, B90C, B90D, B90E, B90F, B90G, B90J

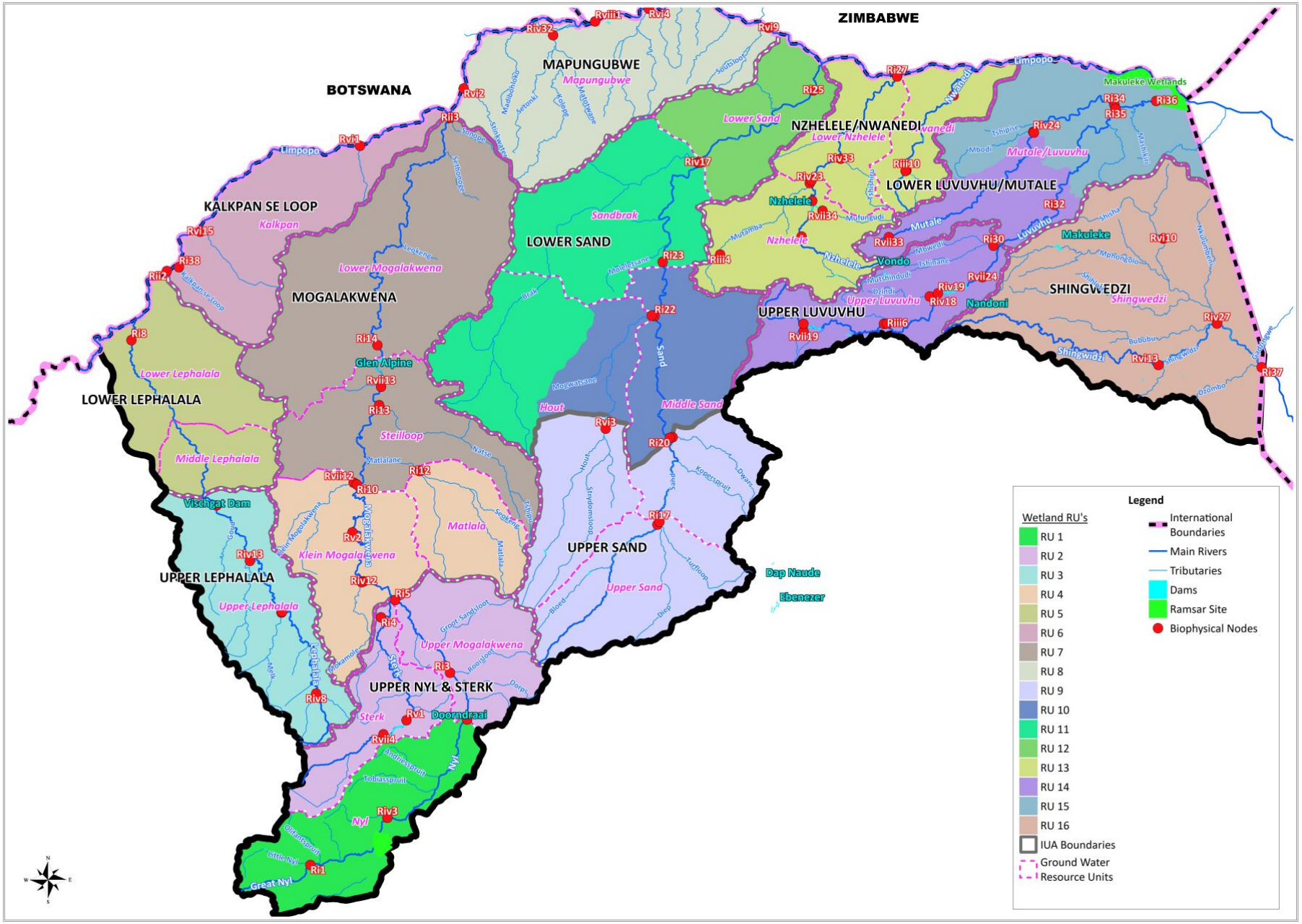

Figure 2. Delineation of Integrated Units of Analysis

LINKING THE VALUE AND CONDITION OF THE WATER RESOURCE

Following the delineation and status quo determination, linking the value and condition of the resource is the next step required in terms of the classification procedure for water resources. The objective of this step is to define the relationship that will link the change in the configuration of the management class scenario to a resulting economic value and social wellbeing across the study area. This is done using scenario analysis.

The overarching aim of the scenario evaluation process is to find the appropriate balance between the level of environmental protection possible and the use of the water resource to sustain socio-economic activities.

The sequential activities (Figure 3) carried out to evaluate the scenarios starts with the vision setting per Integrated Unit of Analysis (IUA) and describing the scenarios to be analysed. The status quo information is applied to identify the components requiring evaluation and defining the relevant parameters to be quantified. Water availability analyses are carried out for the scenarios, and this feeds into the activity to determine the consequences on water quality, ecology, ecosystem services, economy, and society. The scenarios are ranked, first, for the individual variables and then as an overall integrated ranking based on multi-criteria analysis methods.

A range of Classification Scenarios will be defined that describe alternative Water Resource Classes and Ecological Category (EC) configurations for the study area.

The outcomes of these scenarios will be analyzed over a defined time period, under a range of assumptions regarding projected population and economic growth, climate, water demand management measures and overall water demand. The result will be to estimate the costs of additional water supply measures that would need to be brought online to meet the demands. This cost will be compared to the benefits of the Reserve.

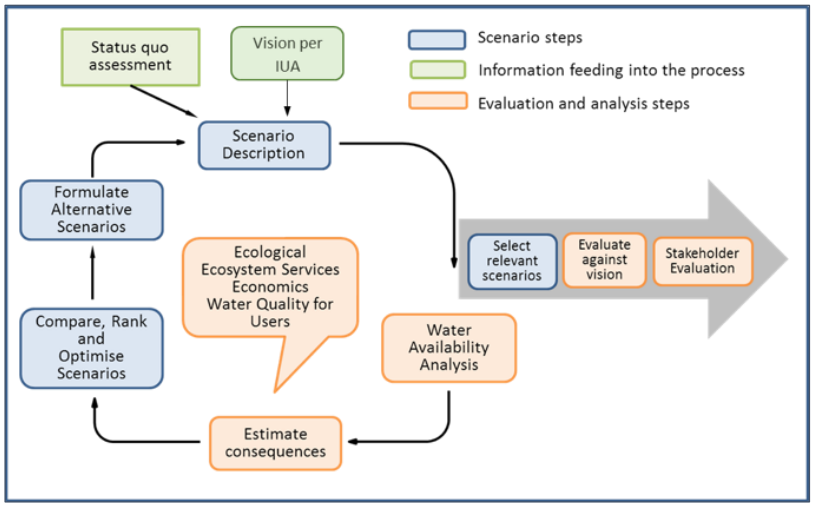

Figure 3. Schematic presentation of the scenario evaluation process. Source: DWS, 2017

Given the objectives of the study, most scenarios are likely to be set in terms of the EC configurations, from which the available water for use will be determined. Available water for use is based on the Ecological Water Requirements (EWRs) for the specified ECs. It is also possible that some scenarios could be development-focused, in which case the water requirements for development will be met and the resultant ECs will be determined. The definition and evaluation of scenarios are undertaken in the context of the prevailing and proposed water resource management activities in the study area. The preliminary list of scenarios (presented in Table 2) will be discussed with the stakeholders, after which a final list will be compiled for evaluation in the Ecological Base Configuration Scenarios Report.

The approach for establishing the suite of scenarios to be provided for hydrological analysis will consider different Ecological Category configurations in which environmental flows vary spatially and in their overall levels. Some of the spatial configurations would be driven by conservation priorities for rivers and wetlands. The only variation to the scenarios will be (a) the EWR requirements and (b) the water demands that must be met. This will allow evaluation of the trade-offs between ecological and socio-economic consequences. Table 3 lists the variables and associated components that will be evaluated and provides a brief description of the evaluation method and purposes.

Table 2. Preliminary Scenarios

#	SCENARIO	DESCRIPTION
1A	Maintain Present Ecological Status (PES) + low growth (=Baseline)	River and wetland systems are maintained in their present condition.
1B	Maintain PES + high growth	
2A	Bottom line + low growth	The maximum volume of water is made available for abstraction from the system for economic activities, with the proviso that all water resources are maintained in a D class (the ecological "bottom line").
2B	Bottom line + high growth	
3A	Recommended Ecological Category (RECs) + low growth	The RECs determined for rivers and wetlands based on present health and conservation importance (but without any consideration of socio-economic effects) are applied in these scenarios.
3B	RECs + high growth	
4A	Targeted conservation + low growth	High ECs are given to areas of high conservation importance, but for other areas, the ECs can be below REC. It may end up that this scenario set is similar to the above.
4B	Targeted conservation + high growth	
5A	High conservation + low growth	This scenario represents the situation where conservation targets are met, with an emphasis on an eco-tourism-based economy, with most resources in a good condition and a significant proportion in Classes A or B.
5B	High conservation + high growth	

Table 3. Variables to be considered in the scenario evaluation

Variable	Components	Evaluation method and purpose
Ecological	Overall state of aquatic ecosystem health. % Freshwater conservation targets met (national obligation).	Determine the EC and indicate the degree in which the scenario achieves the REC.
Water quality for users	Empirical impacts on salinity and nutrient enrichment. Qualitative impacts on constituents of concern in a particular IUA.	Consider the consequences of having to achieve elevated water quality standards for users other than the ecology (fitness for use). This may involve determining the economic implications of such elevated standards.
Economic	Losses/gains in Value Added + Costs saved/incurred. Losses/gains in Total Employment.	Determine the economic benefit of utilising the available water (abstractions) in terms of Gross Domestic Product (GDP) and Employment (number of jobs).
Society	Impact on livelihoods. Income to poor households. Intangible benefits to society.	Determine the extent that each scenario changes the livelihoods, income to poor households, and intangible benefits to society.

VISIONING

Visioning forms part of Step 2 of the Integrated Framework (Figure 1), to help guide the formulation of scenarios (Figure 3).

It is a process of articulating society's aspirations for the future state and benefits to be derived from the water resources and aquatic ecosystem services. The visioning will help to link management actions to the vision and ensure that societal values and management objectives are linked and realized.

The Project Steering Committee will be afforded the opportunity to express their vision for each IUA at the meeting on the 5 July 2022. A summary of the current condition of the water resources in each IUA and a visioning form will be provided to assist with the visioning exercise.

DEFINITIONS

Ecological Water Requirements (EWR): The flow patterns (magnitude, timing, and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components. The EWRs as determined during preliminary Reserve studies will be applied in this study.

Integrated Units of Analysis: The basic unit of assessment for the classification of water resources. The IUAs incorporates socio-economic zones and is defined by catchment area boundaries.

Significant Water Resources: Water resources that are deemed to be significant from a water resource use perspective, and/or for which sufficient data exist to enable an evaluation of changes in their ecological condition in response to changes in their quality and quantity of water. Water resources are deemed to be significant based on factors such as, but not limited to, aquatic importance, aquatic ecosystems to protect and socio-economic value.

Resource Quality Objectives: RQOs provide numerical and narrative descriptors of quality, quantity, habitat and biotic conditions as a basis from which management actions can be implemented for the sustainable use of all water resources.

Reserve: According to the NWA, the Reserve is the quantity and quality of water required to satisfy basic human needs and to protect aquatic ecosystems, to secure ecological sustainable management of significant water resources. The Reserve, therefore, consists of two distinct components: (1) basic human needs and (2) the EWRs. The basic human needs provide for the essential needs of people that are dependent on the water resource for their livelihood and who are not supplied with water through formal reticulation systems. The ecological component of the Reserve (EWR) relates to the quantity, quality and variable flow of water required to protect the aquatic ecosystem of the water resource.

Resource Unit: An area of ecological similarity for which a distinct ecological Reserve and present state are determined.

Biophysical Nodes: These are modelling or evaluation points in the river system, representative of the upstream reach or area of an aquatic ecosystem for which a suite of relationships apply. A node is typically set at the outlet of a quaternary catchment where the flow and water quality need to be met for a particular scenario. The flows set at the node are based on the relevant ecological categories defined at that point in the river

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DWS STUDY MANAGERS

Ms Esther Lekalake	Water Resources Classification	Tel: 012 336 8671	Email: Lekalakee@dws.gov.za
Ms Vuledzani Thenga	Surface Water Reserve Determination	Tel: 012 336 6735	Email: thengav@dws.gov.za
Mr Tichatonga Gonah	Groundwater Reserve Determination	Tel: 012 336 7191	Email: gonaht@dwa.gov.za

STAKEHOLDER ENGAGEMENT OFFICE

Mr Rajesh Manilall Tel. 012 336 9800. Email: limpopoolifantswrcs@myraconsulting.co.za

Technical Enquiries

Adhishri Singh Project Manager Tel. 012 336 9800 Email: adhishri@myraconsulting.co.za

PROJECT WEBSITE: https://www.dws.gov.za/rdm/WRCS/Default.aspx