water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Determination of Water Resource Classes and Resource Quality Objectives for the Lower Orange Catchment

Background Information Document: Project Steering Committee Meeting 4

November 2025

PURPOSE OF THIS DOCUMENT

The purpose of this Background Information Document (BID) is to provide Project Steering Committee (PSC) Members with information about the current study underway that will determine water resource classes and Resource Quality Objectives (RQOs) for all significant water resources in the Lower Orange River catchment, as well as the coastal F1-F6 secondary catchments between Alexander Bay and Malkopbaai, in the Northern Cape Province within the Vaal-Orange Water Management Area (WMA).

This BID contains information regarding study progress to date with the focus on process and methodology to develop RQOs.

It serves to provide feedback on the next study deliverable in preparation for the 4th PSC meeting to be held virtually on 18 November 2025, at which member input, guidance and review is required.

Further details or clarifications can be obtained from the DWS study team at the contact details provided below.

DWS Study Team Managers
Ms Lebogang Matlala
Director: Water Resource Classification
Tel: 012 336 6707
Email: matlalaL@dws.gov.za

Ms Mohlapa Sekoele: Study Manager
Tel: 012 336 8329
Email: sekoelem@dws.gov.za

Ms Nolusindiso Jafta: Scientist Manager
Tel: 012 336 6605
Email: jaftan@dws.gov.za

Project website:
https://www.dws.gov.za/wem/WRCS/lo.aspx

BACKGROUND

The National Water Act (NWA), Act No. 36 of 1998, is founded on the principle that National Government has overall responsibility for and authority over water resource management for the benefit of the public. It also requires that the nation's water resources be protected, used, developed, conserved, managed and controlled in an equitable, efficient and sustainable manner. To achieve this objective, Chapter 3 of the NWA provides for the protection of water resources through the implementation of Resource Directed Measures (RDM).

The Chief Directorate: Water Ecosystems Management (CD: WEM) of the Department of Water and Sanitation (DWS) is responsible for the determination of the RDM. The aim of determining the RDM is to ensure that a balance is sought between the need to protect and sustain water resources on one hand and the need to develop and use them on the other.

The DWS is underway with the process of classifying all river systems in South Africa and setting Resource Quality Objectives (RQOs). The DWS is currently undertaking the process to classify all significant water resources (rivers, dams, wetlands, estuaries, and groundwater) in the Lower Orange River Catchment, including the coastal F1-F6 secondary catchments, of the Vaal-Orange Water Management Area (WMA), simply referred to as the Lower Orange Catchment from here onwards. The study was announced to stakeholders through various platforms encouraging participation in the study.

The classification and determination of RQOs of water resources in the Upper Orange and Lower Orange River catchments are undertaken as separate projects; however, the studies are running in parallel to ensure relevant catchment links and continuity along the river system.

This Background Information Document (BID) relates to the Lower Orange Catchment and presents the outcomes of Step 5 of the RQO determination process, related to the draft RQOs that are being proposed. Step 6 of the process requires engagement with stakeholders on the proposed RQOs to obtain agreement.

The water resource classification and RQOs process is a consultative process that allows stakeholders to provide input in the setting of the water resource classes and RQOs. The outcome of the process in the Lower Orange Catchment will be the gazetting of the water resource classes and RQOs approved by the Minister of Water and Sanitation. The gazetted classes and RQOs will be binding on all authorities or institutions when exercising any power or performing any duty under the National Water Act, 1998.

The water resource class essentially describes the desired condition of the resource, along with the degree to which it can be utilised. A water resource class ranges from minimally used to heavily used (Figure 1).

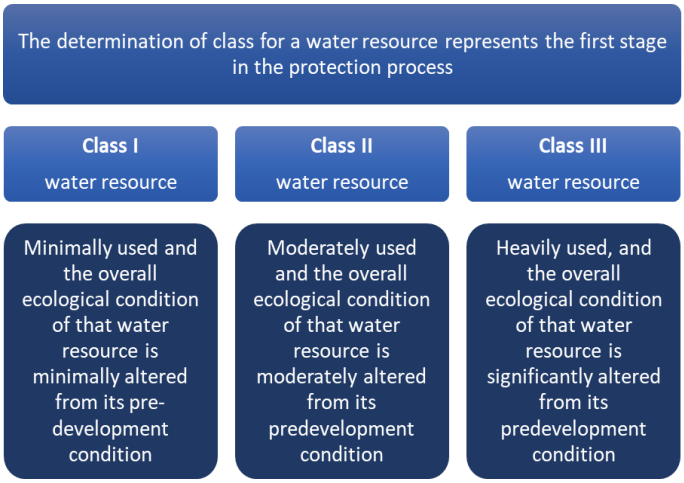

Figure 1: Water Resource Class descriptions

The class of a water resource sets the boundaries for the volume, distribution, and quality of the Reserve and RQOs and therefore informs the determination of the allocatable portion of a water resource for use.

RQOs are then determined for the water resources. RQOs are a set of narrative and/or numerical management objectives defined for any resource, and which are set to support the achievement of the water resource class. RQOs encompass four components of the resource:

- Water quantity
- Water quality
- Habitat integrity; and
- Biotic characteristics.

RQOs are important management objectives against which resource monitoring will be assessed.

LOWER ORANGE STUDY AREA

The Orange River Catchment, comprising of the Upper Orange and Lower Orange catchments, is the largest in the country covering 50% of the land area and forms part of the Orange-Senqu River Basin which straddles four International Basin States (Lesotho, South Africa, Botswana, and Namibia).

The Lower Orange River Catchment includes the main towns of Upington, Springbok, Pofadder, Kakamas, Keimoes, De Aar, Prieska, Kenhardt, Sutherland, Brandvlei and Williston. The catchment area can be subdivided by its 3 district municipalities (DM), *viz*. Pixley ka Seme DM, Z F Mgcawu DM and Namakwa DM.

The Lower Orange River portion includes the stretch of Orange River between the Orange-Vaal confluence, 20 km from Douglas, and Alexander Bay (Atlantic Ocean). The Lower Orange River, also forms the border between South Africa and Namibia, flowing over a distance of approximately 550 km.

The Lower Orange Catchment is the largest, but also the driest and most sparsely populated catchment in South Africa. The area is mostly arid with rainfall varying from 400 mm in the east to 50 mm in the west coast. The topography of the area is in general flat, including large pans or endorheic areas. The average mean annual evaporation for this area is 2600 mm/a.

The Orange River is the primary river in the catchment. The major tributaries along the Lower Orange River portion from the north include:

- the Molopo, Kuruman and Nossob rivers in Namibia, Botswana and the Northern Cape Province; and
- the Fish River draining the southern part of Namibia.

Major tributaries to the Lower Orange River from the south draining the Karoo include:

- the Ongers River,
- the Sak River, and
- the Hartbees River.

The catchment area includes the coastal seasonally draining rivers and estuaries along the Atlantic Ocean from Papendorp north towards Visagiesfontein, (F primary sub-catchment), with the Buffels, Holgat and Brak as the main rivers.

The study area for this undertaking comprises only the South African portion of the Lower Orange River Catchment that includes the tertiary and quaternary catchment areas of C92B-C92C (some parts), portions of D41, D42, D51 to D58, D61, D62, D71 to D73 (excluding some portions D73), D81, D82 and primary catchment F with some exclusions (**Error! Reference source not found.**), with a larger map of the study area included at the end of this document (see Figure 8).

Among the more valued natural resources in the river basin is a transboundary Ramsar protected wetland at the mouth of the Orange River. Important nature conservation areas include the Kgalagadi Transfrontier Park, the Ai-Ais-Richtersveld Transfrontier Park, and the Augrabies Falls National Park.

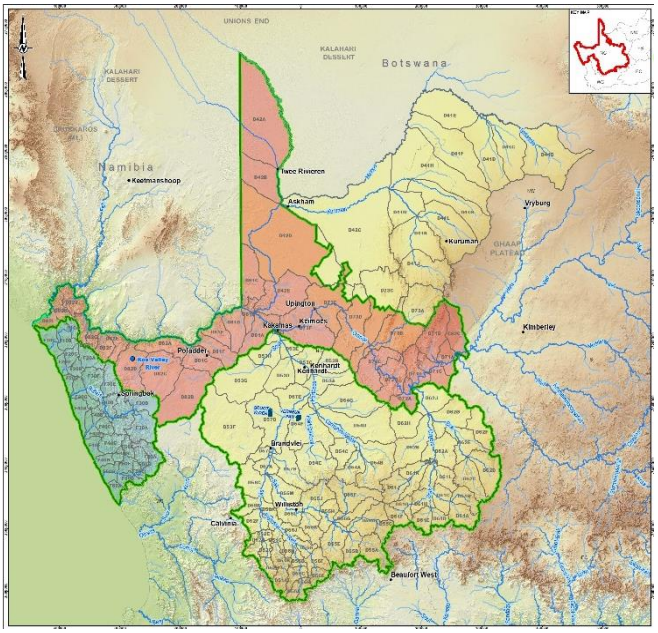

Figure 2: Lower Orange catchment – study area

Six main wetland types have been identified in the Lower Orange River catchment including depressions (pans), unchanneled valley bottom, channelled valley bottom, floodplain and flats, which are associated with major rivers Orange, Molopo, Auob and Nossob) in the catchment. There are wetlands systems also associated with the Orange River Mouth, mainly saltmarshes.

Groundwater is an extremely valuable source in the Lower Orange catchment. It is the most important source of bulk water supply to local towns and rural settlements. Several towns and villages are solely dependent on groundwater resources and in some cases potable water is piped from farms several kilometres from the town/village. Groundwater quality is variable depending on the geology of the area and the land-use activities.

The Lower Orange River serves as a significant resource to the Northern Cape Province, and is used for industrial, agricultural, recreational and domestic purposes. While most of the catchment is unsuitable for dry land cropping, the Orange River Valley, especially around Upington, Keimoes and Kakamas, has extensive grape and fruit cultivation. Water is abstracted for irrigation, urban and mining use along the main stem of the Orange River at various points, and for stock watering in the Kalahari.

There are many well-structured irrigation schemes located within the study area. However, there is also a large component of individual irrigators abstracting water directly from the river, farm dams and boreholes to supply irrigation developments. The Orange River Project is the largest water supply scheme and comprises several sub-schemes that are all supplied from the Gariep and Vanderkloof dams in the Upper Orange River catchment. Approximately 75 million m^3/a is supplied from the Lower Orange River to Namibia for irrigation purposes.

Boegoeberg, Neusberg and Vioolsdrift storage weirs are used for the regulation of flows into canal systems for irrigation purposes, and two small dams are located in the Orange River tributaries' sub-areas *viz*. Smartt Syndicate Dam on the Ongers River; and Rooiberg Dam on the Hartebeest River. Water is also transferred via pipelines to the Aggenys mines and the town of Springbok. Mining operations in the Lower Orange include underground and surface mines as well as quarries.

WHERE ARE WE IN THE STUDY PROCESS?

As part of the study, Steps 1 to 6 of the water resource classification process (Figure 3) have been completed. The outcomes of these steps were presented at PSC meetings 1, 2 and 3 and the reports were distributed to members for comment. Stakeholder engagement for the technical process has been completed, with draft water resource classes being proposed and presented at PSC meeting 3 in May 2025.

The water resource classes proposed for the Lower Orange catchments are Class III for rivers and predominantly Class II for groundwater (Figure 4).

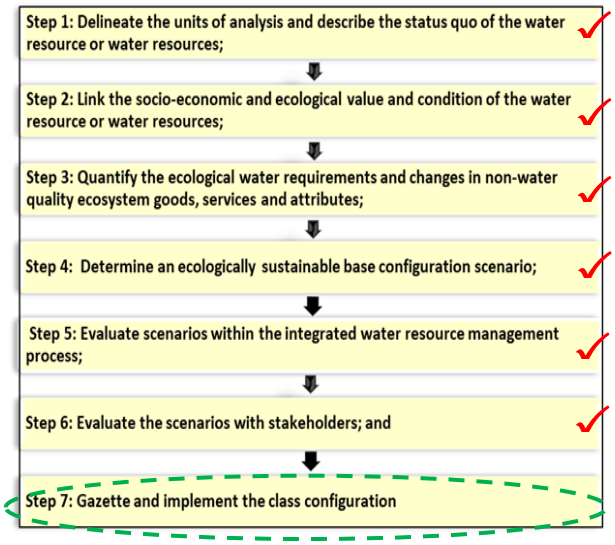

Figure 3: Steps for determining water resource classes

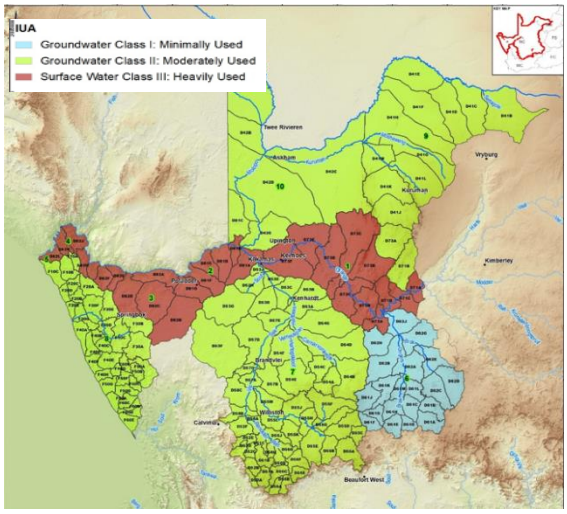

Figure 4: Proposed water resource classes

The RQO determination process is integrated with water resource classification process, with the process steps indicated in Figure 5. With the water resource classes having been proposed, the process of RQO determination has advanced, with the completion of Steps 4 and 5 achieved recently. We are at Step 6 where stakeholders are now being engaged on the draft RQOs. These RQOs will be discussed at the upcoming PSC meeting 4.

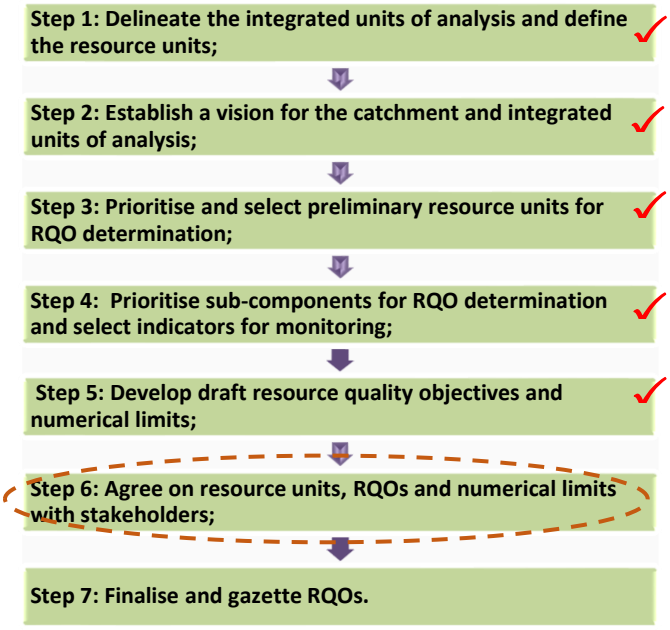

Figure 5: Steps to determine RQOs

RESOURCE QUALITY OBJECTIVES

Integrated Units of Analysis (IUAs) form the basis of setting water resource classes. As part of the classification process, the IUAs for catchment were delineated. These IUAs form the basis for the classes and RQO determination. Resource units (RUs) the scale at which RQOs are set are delineated within an IUA boundary. As part of the RQO determination process the first step was to delineate RUs based on the IUAs. This was undertaken and reported on in the Status Quo and delineation of Integrated Units of Analysis Report, RDM/WMA14/00/CON/CLA/0224. Ten IUAs with 27 river and estuary RUs (**Error! Reference source not found.** and Figure 7) were delineated and are detailed in the report.

While the RQO determination process proposes that RQOs be set for each RU, this is not always possible due to the potentially large number of RUs that could be delineated for a catchment. A rationalization process applying a decision support tool is therefore followed in order to prioritize and select the most useful RUs for RQO determination.

Based on the prioritization undertaken, 23 river RUs, 14 groundwater units have been identified with areas of high stress index and aquifers of strategic importance identified, 20 wetlands/complexes and 6 estuaries were selected for RQO determination.

Prioritizations was based on position of RUs within an IUA, importance of the RU to users, threat posed to water resource quality for users and the environment, ecological considerations, practical constraints, and management considerations.

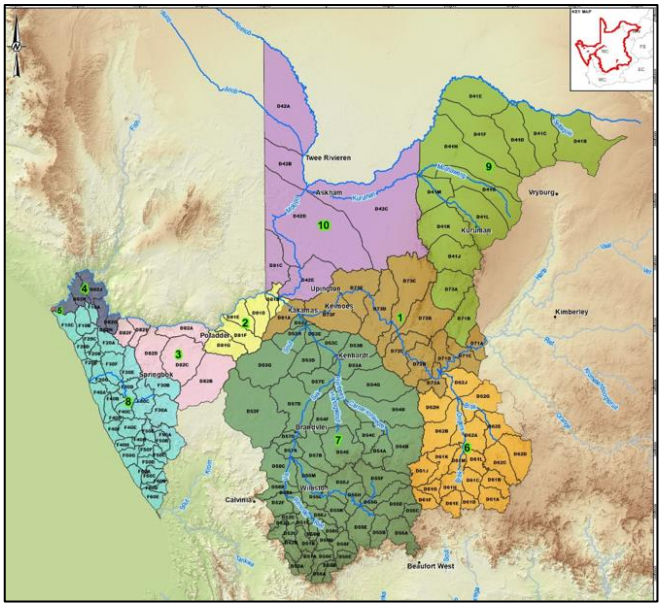

Figure 6: IUAs delineated in the Lower Orange Catchment

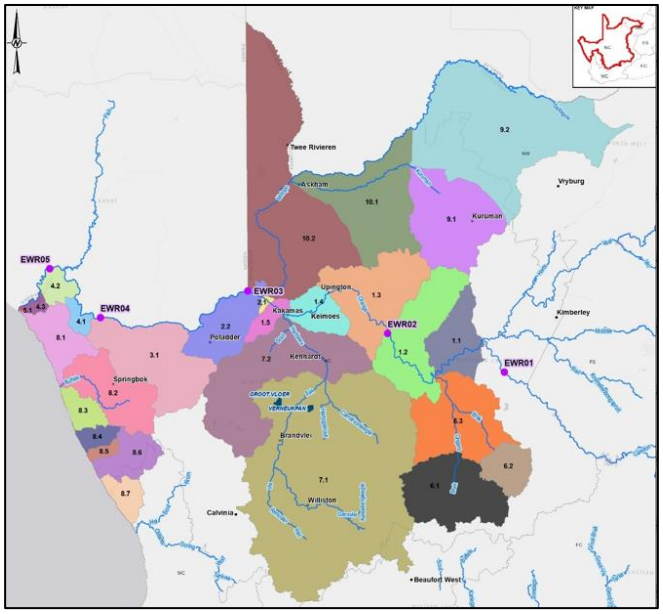

Figure 7: Resource Units delineated in the Lower Orange catchment

Based on the prioritization of sub-components undertaken in Step 4, RQOs have now been developed for rivers, wetlands, groundwater and estuaries in the Lower Orange River Catchment. The selection of components and the identification of proposed sub-components and indicators for which RQOs are set had two key objectives:

- To identify and prioritise sub-components including habitat, quantity, quality, and biota, or water level, hydrodynamics (etc.) that may be important to users or the environment; and
- To select those sub-components and associated indicators such as flow, salinity, fish, and invertebrates, for which RQOs and numerical limits should be developed.

Components that may be important to either the users or the environment were prioritized.

APPROACH TO SETTING RESOURCE QUALITY OBJECTIVES

RQOs have to be determined for significant water resources as the means to ensure a desired level of protection. The outputs of the abovementioned steps have all informed the draft RQOs which include a narrative and, where applicable, a numerical limit. Numerical limits translate the narrative RQOs into numerical values which can be monitored and assessed for compliance.

In determining RQOs it is important to recognise that different water resources will require different levels of protection. In addition to support achieving the water resource class, the RQOs determined will ensure that the needs of all users and competing interests who rely on the water resources are considered.

The basic approaches to the development of the RQOs for rivers, wetlands, groundwater and estuaries are briefly outlined below. The draft RQOs proposed will be updated and refined based on stakeholder consultation currently underway.

Rivers

The drafting of the RQOs for rivers included the following aspects which were applied accordingly in the context of each RU:

- Understanding of the catchment context and priorities, as well as the impacts and drivers of resource condition,
- Collation and assessment of available data and information (present state and historic),
- Assessment of ecological classification and river health information,
- Assessment of water quality information,
- Incorporation of the requirements of the water resource classification,
- Present Ecological State,
- Incorporation of flow specifications (summaries of required flow durations (tables) and summary tables of drought, low and high flow requirements per month (tab tables) as specified in the Water Resource Classification and Reserve Studies),
- Incorporation of any direction of change required for any sub-components,
- Consideration of land-based impacts and catchment drivers,
- Stakeholder and water user requirements,
- Feasibility of achievement of desired state,
- Alignment between RUs,
- Specification of quantifiable numerical limits in line with the draft RQOs, and
- Determination of appropriate measures, sampling methods and frequencies, and associated resourcing.

The RQOs developed for the Orange River relate to and are based on/or derived from the following:

- The water resource classes and associated ecological categories as per the specifications of the water resource classification.
- The instream flows are prescribed as specified at ecological water requirement (EWR) sites and biophysical nodes:
  - Flows were determined as part of water resource classification process and included EWRs also considering strategic/user demands which are high in the Lower Orange Catchment.
  - High Flows (Freshets) or Low Flows (Maintenance and Drought Flows) or both were selected based on prioritisation in the specific RU.
  - RQOs are specified in terms of flow requirements at nodes and EWR sites (meeting ecological requirements and user specifications
- The presence and concentration of substances in the water resource (more stringent value of either the ecological category (PES or Class) or present water quality state), and based on the land use and current state, the sub-components of salts, nutrients, pathogens, toxics (ammonia, metals and pesticides), and system variables were selected when water quality was prioritised per RU. The following key parameters have been included where applicable per RU for rivers:
  - Orthophosphate as P
  - Total Inorganic Nitrogen as N (TIN)
  - Electrical Conductivity
  - Total Dissolved Salts
  - *Escherichia coli*
  - Dissolved Oxygen
  - pH
  - Turbidity
  - Ammonia as N
  - Pesticides including endosulfan, atrazine and glyphosate, and
  - Metals (aluminium and iron), specifically in the
  - Diatoms as an integrated water quality assessment.
- RQOs were then set, and numerical limits specified based on one or more of the above decision criteria. The water quality RQOs were set based on the present state quality or the most stringent user (which includes ecological requirements). The limit that was the stricter of the two was adopted as the RQO numerical limit.
- The characteristics and quality of the water resource including instream and riparian habitat (maintenance or improvement of ecological state):
  - Instream and/or Riparian component of the habitat was prioritised for a RU,
  - Ecological categories per component, Ecostatus, habitat integrity and the land use activities and available data were considered,
  - Maintenance or improvement of a component was recommended based on Present State and Recommended Ecological Category (REC)

specified. Any potential threats were considered,
    - Vegetation components were assessed (general vegetation structure and composition, invasion by alien species, abundance of terrestrial species) to determine the overall state of the riparian zone, and
    - RQOs were specified in terms of meeting the Target Ecological Category (TEC).

- The characteristics and distribution of aquatic and semi-aquatic biota (maintenance or improvement of ecological state):
    - Fish, macroinvertebrates, or diatoms were selected based on relevance to a specific RU,
    - Ecological categories per component, Ecostatus and habitat integrity, land use activities present, and relevant, available data were considered,
    - Maintenance or improvement of the biotic sub-component was recommended based on Present Ecological State (PES) and TEC. Any important species as well as potential threats were also considered.
    - RQOs were specified in terms of meeting the TEC (and water resource class), recommended condition and monitoring,
    - Threats to the biota and relevant species were assessed to specify RQOs.
    - For Fish, available information provided by the PES/EIS project, the 2016 Reserve Determination Study, the ORASECOM Joint Basin Survey (2 and 3), the Frequency of Occurrence (FROC) guideline (WRC 2008, Eco classification Tool) as well as the rapid Reserve surveys conducted through the Lower Orange water resource classification were used as sources of information. Limited information was obtained through the River EcoStatus Monitoring Programme (REMP). Aerial footage (Google Earth), and all relevant information were used to determine the expected present suitability of each reach for each species. This was transferred to the Fish Response Assessment Index (FRAI) and refined based on expert judgement and additional information. The FRAI results were then used to describe narrative RQOs and numerical limits for each sub-component indicator, and

- For macroinvertebrates, available information provided by the PES/EIS project, the ORASECOM Joint Basin Survey (2 and 3), data obtained through the River EcoStatus Monitoring Programme (REMP) and macroinvertebrate data retrieved from the Rivers Database, as well as the rapid Reserve surveys conducted through the Lower Orange water resource classification were used as a key source of information. Narrative RQOs were set according to the specific ecological category as determined by the Macroinvertebrate Response Assessment Index (MIRAI) for a specific site representative of the RU or area considered. Numerical limits were then set for the specific MIRAI Ecological Category, and for the SASS5 (South African Scoring System Version 5) total score and ASPT (Average Score Per Taxon).

Groundwater

The proposed groundwater RQOs that have been established are based on the following set of measurable hydrogeological sub-component parameters:

- Groundwater Quantity (million m^3/a as measures and limits)– based on:
    - Groundwater recharge: million m3/a - Time series of daily rainfall depths. (Merely from chloride mass balance methodology);
    - Groundwater Use – million m3/a (estimated from WARMS dataset and hydro-census surveys;)
    - Groundwater Stress Index (calculation indicating the aquifer stress factor – 65% indicated a Poor Conditions is regarded as the limit for sustainable aquifer usage);
    - Aquifer water level depth (metres below ground level obtained from hydro-census surveys and groundwater monitoring programs);
    - Water depth and water level depth trend (indicator and measure) is (i) an indicator for aquifer depletion due to abstraction and should be followed by (ii) an aquifer recharge replenishment during periods of aquifer recharge events; and
    - Limits can be set for aquifer water level depths, e.g., to “metres above master water strike”.

- Groundwater Quality – (mg TDS/L and specific hydro-chemical constituent concentrations as measures and limits):
    - Total Dissolved Solids – provides a direct indicator of the groundwater quality status
        - TDS as a baseline aquifer water quality-type indicator; and/or
        - TDS trend (indicator) and gradient (measure of rising/recessing trend) for aquifer water quality status indicating (i) recharge/refreshing conditions, or (ii) deteriorating conditions due to pollution and up-coning of deeper saline water, or marine water intrusion at the coastline(s).
    - Water quality dissolved constituents present and concentrations:
        - Aquifer water quality type: A measure of specific baseline-aquifer water quality type(s), i.e., Ca/Mg-HCO_3, Na-HCO_3, Na-Cl, Ca/Mg-SO_4 – the measure is to remain aquifer water type to the baseline water type by preventing hydro-chemical pollution or other deteriorating sources.

- Water quality trend (indicator) and gradient (measure of rising/recessing trend over time) using specific hydro-chemical constituents like Na-Cl or Ca/Mg-SO_4; and
- Specific constituents of concern (CoCs) like nitrate, fluoride, ammonium or ortho-phosphate.

- Aquifer Vulnerability – specific indicators that arise from primary or secondary conditions that may impact on the aquifer system posing a concern/threat for the health/aesthetic status of the aquifer system. Several Aquifer Vulnerability attributes have been included as indicators with proposed measures to impose specific protection protocols for the groundwater resource(s).
  - Depth to water level – Shallow aquifer system (<60 mbgl).
    - Measure: radius of influence to protect groundwater driven wetlands, dolomite eyes from depleting water levels.
    - Preferential recharge of dolomite (karst) aquifer systems having potential pollution risk; and
    - It could also indicate a limit for groundwater level depletion to protect indigenous flora (such as the Kathu Camelthorn Forest in the Northern Cape Province.
  - Water level depletion (m/a) (deeper trend)
    - Measure of the arial coverage (ha's) and groundwater level impact of uncontrolled alien tree population expansion along drainage channels (rivers) and large veld areas; and
    - Measure: expansion of hectares used for groundwater irrigation schemes in river flood plains and large aquifer systems (dolomites).
  - Aquifer Recharge (mm/a) and Aquifer Abstraction (groundwater use).
    - Measure: annual estimations of recharge volumes to specify annual "allocable yield" volumes; and
    - The Kalahari Group Aquifer System should receive a special Class 1 Vulnerability Index due to it's being recharge only during flush flooding in the Molopo, Kuruman, Gamagara, Nossob and Auob Rivers during periods of episodic high rainfall events – a 1 in 10-15-Years recurrence. This aquifer systems are also extremely vulnerable to the depths of drilled boreholes as the system can be bypassed by drilling into the underlying saline Pre-Kalahari Floor Aquifer Systems (Nama and Karoo Supergroup Sequences) that hosts a large regional and pressurised paleo-saline aquifer system.
  - Hydraulic Conductivity (HC) (overrated yields):
    - As an indicator some aquifer formations (fractured and weathered thick sandstone formation, thick dolomite/karst formations and fractured banded ironstone formations) have high hydraulic conductance's that may allow high-yielding boreholes that could allow over-abstraction of the aquifer water balances.
    - Measure: aquifers with high hydraulic Conductivity susceptible to significant lateral impacts (i.e. dolomite and sandstone aquifer types) due to high groundwater flux in aquifer and storativity (storage) that may enhance the migration of unwanted polluted substances to enter the deeper parts of the aquifer system.

Wetlands

Wetlands in the study area provide a range of services including support of endemic plant species, sediment trapping, erosion control, habitat provision and water quality enhancement services. Maintenance and enhancement of wetland functioning is therefore required to ensure that these key ecosystem services necessary to meet societal and environmental requirements are not undermined or lost at a catchment scale. Prioritisation of sub-components is based on no net loss principles, conservation plans, wetland types (inferred functionality) and species targets; as well as being related to ecological specifications (protection, management, mitigation, and monitoring).

Very limited monitoring information is available for the Lower Orange wetland systems to set numerical limits. The specification of RQOs is primarily qualitative and has been based largely on the PES and REC where available and some extent of groundtruthing that was conducted through this study. Many of the wetland systems in the catchment are at risk of becoming drier with climate change and overuse of aquifer and river systems that drive the flow regime. The PES serves as an easy measure of condition, as the approach is repeatable, it's measurable and should reflect any significant changes to both hydrology and water quality.

Estuaries

The character and function of estuaries tend to differ substantially from those of the rivers component, so estuaries are managed as individual RUs. RQOs specified measurable specifications of ecological attributes (hydrodynamics, sediment dynamics, water quality, and different biotic components) that define a specific ecological category, which was decided upon by the regulator utilising environmental, social and economic criteria. Numerical limits represent the thresholds of potential concern (TPCs) and are defined as measurable endpoints related to specific abiotic or biotic indicators that, if reached, prompt management action. RQOs are set for the short to medium term, for the following abiotic (drivers) and biotic (responses) components:

Abiotic drivers

- Hydrology - Quality, quantity and timing of instream flow.

- Hydrodynamics - Mouth condition.
- Water quality.
- Physical habitat.

Biotic responses

- Characteristics and condition of biota, microalgae, macrophytes, invertebrates, fish, and birds.

PROPOSED DRAFT RESOURCE QUALITY OBJECTIVES

The tables of the proposed draft RQOs for rivers, groundwater, estuaries and wetlands are available in the Resource Quality Objectives and Numerical Limits Report - Report No: RDM/WMA14/00/CON/CLA/0325

(which has been circulated to the PSC members)

The report details the proposed RQOs for rivers, groundwater, wetlands, and the estuaries in the Lower Orange Catchment. Details are given per RU and IUA and include the context and rationale, where applicable, for the proposed RQOs and numerical limits, to guide the reader and provide understanding of the reasoning and context behind the proposed RQOs.

STAKEHOLDER CONSULTATION

The classification and RQO determination study is supported by comprehensive stakeholder engagement throughout the process aligned to the technical steps of the study. Stakeholders representing relevant interests and sectors of society, as well as organs of state in the catchment, form part of the process and have been invited to participate. One of the key platforms is a PSC.

PSC meetings are being held to present information of key milestones in the study process. The 4th meeting of the PSC at which the next study milestone will be presented and discussed is scheduled as follows.

Virtual
Date: **Tuesday, 18 November 2025**
Time: **10h00 to 13h30**
Platform: **Online MS Teams**

DEFINITIONS AND ACRONYMS

ASPT	Average Score per Taxon
DWS	Department of Water and Sanitation
CoCs	Constituents of concern
EI-ES	Ecological Importance – Ecological Sensitivity
EWR	Ecological Water Requirements
FIFHA	Fish Invertebrate Flow Habitat Assessment Model
FRAI	Fish Response Assessment Index
FROC	Frequency of Occurrence
GRU	Groundwater Resource Unit
ha	hectares
HC	Hydraulic Conductivity
IUAs	Integrated Units of Analysis
IHI	Index of Habitat Integrity
mbgl	Meters below ground level
MIRAI	Macro Invertebrate Response Assessment Index
PES	Present Ecological State
PSC	Project Steering Committee
RDM	Resource Directed Measures
REC	Recommended Ecological Category
REMP	River EcoStatus Monitoring Programme
RQOs	Resource Quality Objectives
RU	Resource Unit
SASS5	South African Scoring System Version 5
SI	Stress Index
TEC	Target Ecological Category
TPC	Threshold of potential concern
WEM	Water Ecosystems Management
WMA	Water Management Area

Figure 8: Lower Orange Catchment – Study area