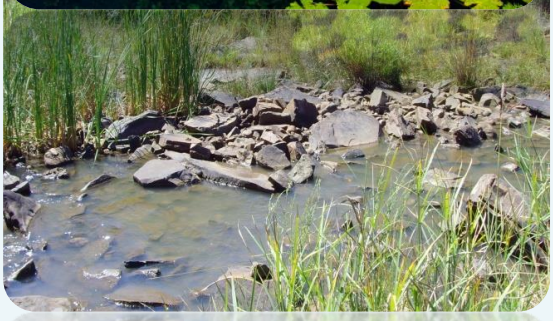

DETERMINATION OF RESOURCE QUALITY OBJECTIVES IN THE MOKOLO, MATLABAS, CROCODILE (WEST) AND MARICO CATCHMENTS IN THE LIMPOPO NORTH WEST WATER MANAGEMENT AREA (WMA 01)

WP10992

REPORT ON WATER RESOURCES INFORMATION AND DATA GATHERING AND ANALYSIS

REPORT NO.: RDM/WMA01/00/CON/RQO/0216

FINAL

Chief Directorate: Water Ecosystems

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Prepared by:

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DOCUMENT INDEX

Reports as part of this project:

Bold type indicates this report.

REPORT INDEX	REPORT NUMBER	REPORT TITLE
1.0	RDM/WMA01/00/CON/RQO/0116	Inception Report
2.0	**RDM/WMA01/00/CON/RQO/0216**	**Report on Water Resources Information and Data Gsthering and Analysis**

LIST OF ABBREVIATIONS

CD: WE	Chief Directorate: Water Ecosystems
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EC	Ecological Category
EIS	Ecological importance and sensitivity
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GRAII	Groundwater Resource Assessment Phase II
IUA	Integrated Unit of Analysis
IWRM	Integrated Water Resource Management
IWRMP	Integrated Water Resources Management Plan
MCWAP	Mokolo and Crocodile River (West): Water Augmentation Project
NCMP	National Chemical Monitoring Programme
NWA	National Water Act
PES	Present Ecological Sate
RQOs	Resource Quality Objectives
RDM	Resource Directed Measures
RHP	River Health Programme
RUs	Resource Units
WMA	Water Management Area
WMS	Water Management System
WRCS	Water Resource Classification System
WRPM	Water Resources Planning Model
WRYM	Water Resources Yield Model

EXECUTIVE SUMMARY

The Chief Directorate: Water Ecosystems (CD: WE) of the Department of Water and Sanitation (DWS) has recently commissioned the study "Determination of Resource Quality Objectives (RQOs) in Mokolo, Matlabas, Crocodile (West) and Marico catchments in the Limpopo North West Water Management Area (WMA)". Proposed water resource classes have been completed in these catchment areas and the determination of the RQOs follows on from this process. Establishment of RQOs is a mechanism through which the balance between sustainable and optimal water use and protection of the water resource can be achieved. RQOs are defined by the National Water Act as "clear goals relating to the quality of the relevant water resources" (DWAF, 2006).

In order for the Department to effectively develop the Resource Quality Objectives (RQOs) in the Mokolo, Matlabas, Crocodile (West) and Marico catchments thorough preparatory work, understanding of the status quo and information availability is needed. An information analysis task was designed, as part of the study, to provide a high level analysis of the available water resource related data and information for the catchment area as it pertains to the process. As this study is primarily reliant on existing and parallel studies for its information requirements, it is critical to determine if all the data components of the RQOs process are met, and if not, what the gaps that are present are.

An information review, data gathering and gap analysis has been undertaken and the outcomes of this are captured in this report. Relevant and applicable previous studies undertaken, data sources and related projects for the catchment area have been sourced and reviewed.

At this stage the water resources data gathering and information analysis is not considered to be exhaustive and the review will continue as new information and data come to light.

Determination of Resource Quality Objectives in the Mokolo, Matlabas, Crocodile (West) and Marico catchments

Report on Water Resources Information and Data Gathering and Analysis

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1 INTRODUCTION

1.1 BACKGROUND

Resource Directed Measures (RDM) is enabled through Chapter 3 of the National Water Act (Act No.36 of 1998) (NWA) which provides for the protection of water resources through the Classification of water resources, determination of Resource Quality Objectives (RQOs) and determination of the Reserve. These measures collectively aim to ensure that a balance is reached between the need to protect and sustain water resources on one hand and the need to develop and use them on the other.

Resource quality objectives have to be determined for a significant water resource as the means to ensure a desired level of protection. The purpose of the RQOs is to provide limits or boundaries (biological, physical and chemical attributes, etc.) which should be met in the receiving water resource in order to ensure protection.

The Chief Directorate: Water Ecosystems of the Department of Water and Sanitation (DWS) has initiated the development of Resource Quality Objectives (RQOs) for the Mokolo, Matlabas, Crocodile (West) and Marico catchments. With the water resources in these catchment area having been classified, RQOs are to be determined as the next step of the protection framework.

1.2 PURPOSE OF THE STUDY

The main objective of the study is to determine Resource Quality Objectives (RQOs) for all significant water resources in the Mokolo, Matlabas and Crocodile (West) and Marico Catchments that must give effect to the Water Resources Classes that have been determined.

A key aim of this study is thus to undertake the implementation of the RQO determination procedure (7 step process) (DWA, 2011) (Figure 1) in the catchment area. The overall procedure involves defining the resource units, determining the components for which RQOs should be set, developing the RQOs and associated numerical limits and the gazetting. Once gazetting has been finaised, implementation, monitoring and review would then follow.

The implementation of the RQO procedure in the Mokolo, Matlabas and Crocodile (West) and Marico catchments will be undertaken using the following study approach:

- An assessment of the catchment areas to understand the status quo with regard to water resources in the catchment and the availability of necessary information and data to support RQO determination. The delineation of the catchments into Resources Units (RUs) based on the integrated unit of analysis (IUA) definition, identified criteria, system understanding and characteristics;
- The application of the RQO procedure (Steps 2 to 7) (Figure 1), *i.e*. determining the RQOs by capturing the water resource class and ecological requirements into measurable management goals, and
- Communication and engagement with stakeholders

The study approach is defined by 5 tasks depicted in Figure 2.

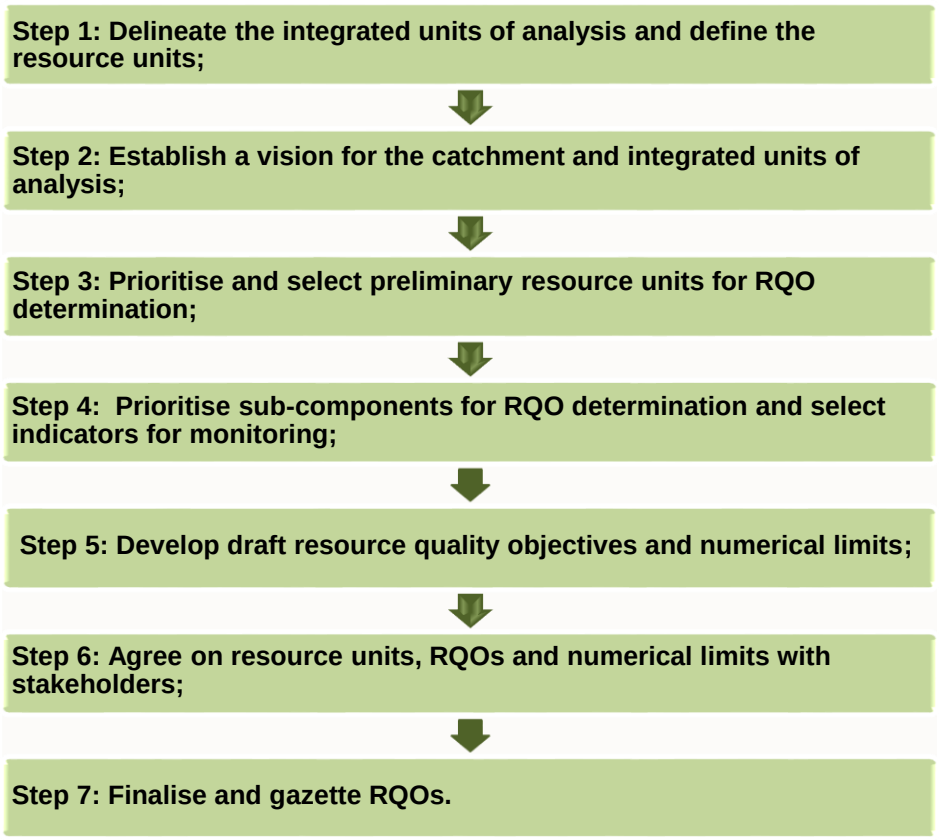

Figure 1: Seven step process for RQO determination

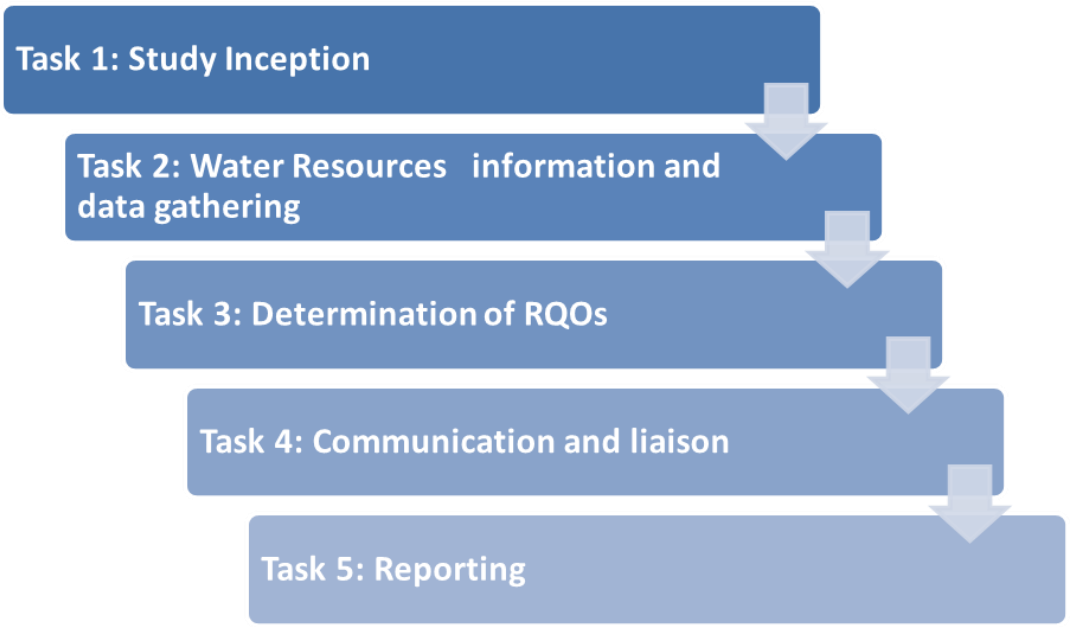

Figure 2: Study tasks

1.3 STUDY AREA

The study area for the RQO Determination study is the Mokolo, Matlabas and Crocodile (West) and Marico Catchments (Figure 3) in the Limpopo North West Water Management Area (WMA). The spatial extent of the area includes tertiary drainage regions A10, A21 to A24, A31, A32, A41, A42 and quaternary drainage region D41A (Table 1).

Table 1:Sub-catchments and related quaternary drainage regions comprising the Mokolo, Matlabas and Crocodile (West) and Marico Catchment areas

Sub-catchment	Catchment Area (km^2)	Quaternary catchments
Upper Crocodile (A21)	6 336	A21 A – L
Elands (A22)	6 221	A22 A – J
Apies/Pienaars (A23)	7 588	A23 A – L
Lower Crocodile (A24)	9 204	A24 A – J;
Marico (A31 and A 32)	12 030	A32 A – E; A31 A – J
Ngotwane (A10)	1 842	A10 A – C
Upper Molopo (D41)	4 300	D41 A
Matlabas (A41)	6 014	A41A – E
Mokolo (A42)	8 387	A42 A – J

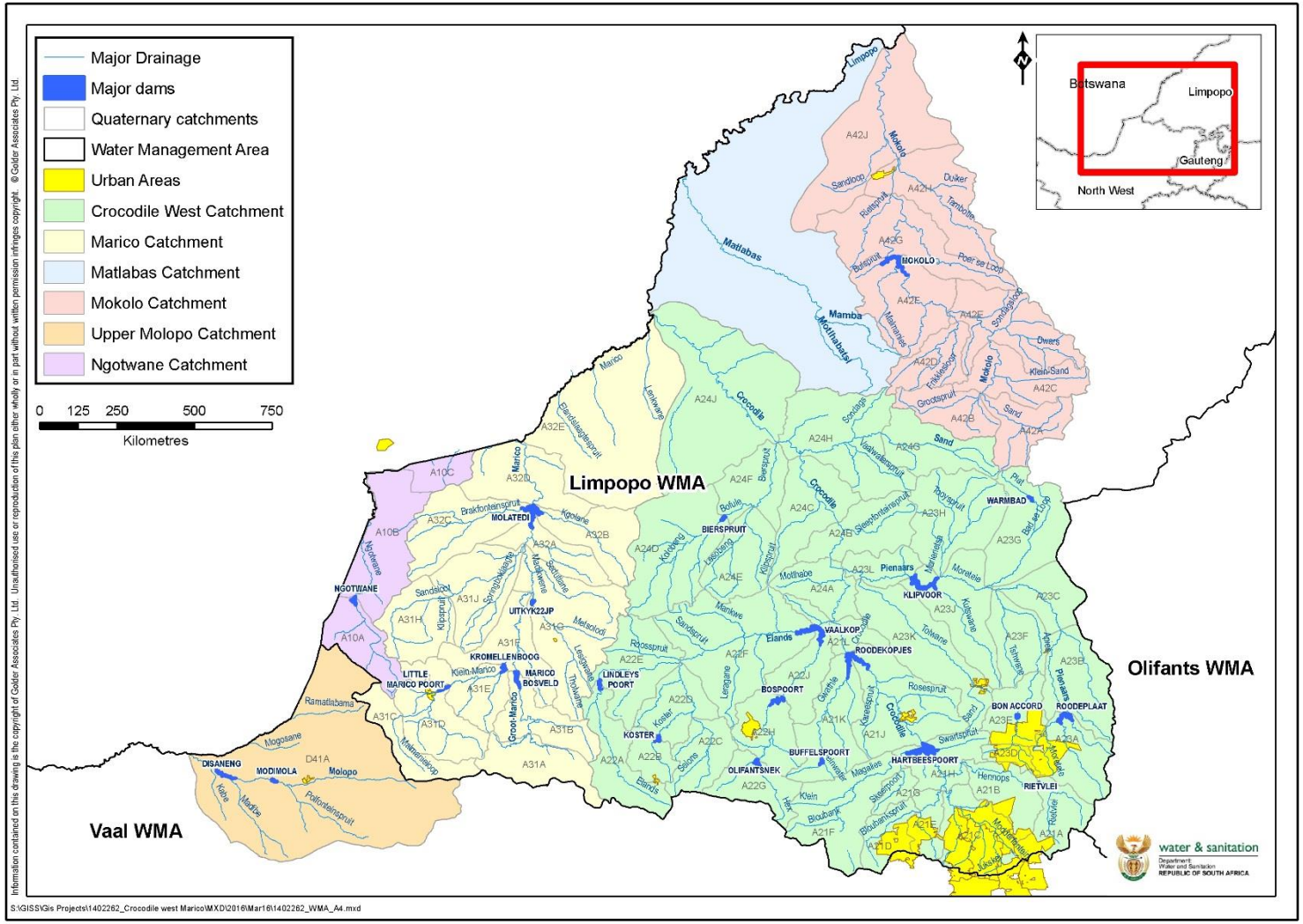

Figure 3: The Study Area - Mokolo, Matlabas, Crocodile (West) and Marico catchments

1.4 THE WATER RESOURCE INFORMATION AND DATA GATHERING TASK

In order to determine the RQOs for significant water resources of the catchment area, a thorough understanding of the status quo and information and data availability for the area is needed to determine if any gaps exist. While the RQO procedure should be closely followed, implementation of the 7 step process is largely based on the availability of necessary information such as may be provided by water resource classification and the Reserve. This task has been undertaken in compliance with the requirements of the study of the terms of reference that specifies that the process is required to build from existing and current initiatives.

In addition water resource, water use and land use information related to the study area is required to define resource units and develop RQOs. Information analysis was therefore focussed on understanding the availability, accessibility and usefulness of the information and data sources applicable to RQO process requirements for the study area. Previous studies undertaken for the Mokolo, Matlabas and Crocodile (West) and Marico Catchments and specific detailed studies for the sub-areas have been sourced and reviewed.

The information analysis task also included a gap assessment and appropriate recommendations on how to deal with the potential information and data gaps.

1.5 PURPOSE OF THE REPORT

The purpose of this report is to assess and review whether the information requirements of the study are met based on the information and data that is currently available through previous and parallel studies and to identify gaps that may be present which could influence the study process and progress.

2 INFORMATION REVIEW

This study is mostly reliant on existing results, assessments and information from previous studies and outcomes from parallel studies. Information analysis was therefore focussed on understanding the outputs of the water resource classification study, preliminary Reserve studies, water resource planning studies, ecological information and national databases, what can be applied and where the key gaps/priorities exist. The Classification outcomes bear key relevance to the RQOs and were reviewed to understand what needs to be achieved within the framework of protection measures. It is necessary to determine if any key information is outstanding or absent, in order that these may be addressed as to the best degree as possible.

2.1 INFORMATION AND DATA REQUIREMENTS

Table 2 lists the primary information and data required for the execution of the work in terms of achieving the outputs of the study. An assessment of the data and information received for the Mokolo, Matlabas and Crocodile (West) and Marico Catchments indicate that a large percentage of the data and information elements that are necessary for the execution of the work is available for the main stem rivers. However, EWR information and biological data for some of the smaller tributaries in the study area is lacking, such as in the Bierspruit (A24), Groot Marico (A31) and Elands (A22). EWR information for quaternary catchment D41A, Upper Molopo and the Ngotwane River,

quaternary catchment A10A and A10B is also lacking however these areas are important largely from a groundwater and wetland perspective and it is foreseen that EWRs may not be required.

During the execution of the activities in the future tasks an evaluation of the validity/consistency and of the data will be carried out as a matter of course and any irresolvable anomalies and deficiencies will be brought under the attention of the Client for clarification or guidance required.

Data sources to be used for the assessment of the significant groundwater resources will be from existing hydrological studies, water use data from WARMS or the current Validation and Verification studies, appropriate groundwater characteristics data from the GRAII and other countrywide databases, geological maps, and detail studies carried out in the areas.

Publications and data sources relating to the wetlands in the study area are available and accessible for large sections of the study area. However there are gaps in information for sections of the study area, specifically in the Matlabas catchment, with respect to the wetland systems in the lower catchment towards the confluence with the Limpopo River.

The hydrological analysis and modelling undertaken for water resource analysis of Mokolo, Matlabas and Crocodile (West) and Marico systems are adequate and available to the support the information needs of RQOs determination. The Water Resource Planning and Water Resource Yield Models (WRPM and WRYM) have been set up for the Mokolo, Matlabas and Crocodile (West) and Marico Catchments as part of the respective catchment reconciliation strategy studies and may be applied for the modelling of flow requirements in respect of proposed resource water quality objectives for flow (at EWR sites and identified nodes in the system).

At this stage the information analysis is not considered to be exhaustive and review will continue as new information and data come to light. The study team will liaise with the responsible persons/organisations to obtain the required data sources. However if necessary, the assistance of the Department may be required to facilitate the acquisition of some of data sources, specifically with obtaining some of the ecological-related data sources.

Table 2: Information and data requirements

RQO Component	Information/ Data component	Source	Requirement	Suitability	Comment
Defined Integrated Units of Analysis (IUAs), Resource units and node locations	IUAs Hydro nodes Catchment information and characteristics Land use information Socio economic zones Water use information and data Water resource information Biophysical information Ecological data System operation	Water Resource Classification Study reports	Required	Sufficient High confidence	Available Resource units will be delineated through this current project based on IUA delineation.
Catchment Vision	Water resource classes	Water Resources Classification Study	Essential	Sufficient Medium confidence	Available Attained through water resource classification process. Vision will be aligned to the water resource class set and related ecological categories.

RQO Component	Information/ Data component	Source	Requirement	Suitability	Comment
Resource Units selection and Prioritisation (1) Position of RU (2) Importance for users (cultural, livelihoods, strategic uses, regulating services, economic) (3) Threat posed to users (4) Ecological importance (5) Threats to ecological component (6) Management considerations (7) Practical considerations (monitoring data/site, accessibility, safety risks)	Resource Unit Prioritisation Tool Delineated IUAs, water resources class information Economic information Land use information System Analysis and operation Ecosystem services information Ecological Water Requirement (EWR) sites and ecological data Desktop Present Ecological state (PES)/ Ecological Importance and Sensitivity Data (EIS) National Freshwater Priority Areas Wetland coverage maps Land cover/land use maps Groundwater data River Health Programme Data Status Quo of water resources Water Management System, Hydrological Information	Water Resources Classification Study Reserve Determination Studies FEPA maps/data Reconciliation Strategy Documents Integrated Development Plans Conservation plans/studies Biodiversity data Wetlands /land use Aerial imagery Water use Authorisations information Monitoring data Dam management information Groundwater maps, geological maps, hydrogeological maps, DWS National Groundwater Assessment, GRA II Census data Stakeholder consultation	Required	Sufficient Medium to High confidence	Available Data/literature to support cultural and regulating ecosystems services maybe uncertain. Scale and applicability per resource unit will have to be determined. Surrogate information may have to used where required. Availability of census data aligned to catchment and resource unit boundaries is a limitation (to support understanding of reliance of communities on water resources). Economic information, conservation plans, land use information, status quo assessments and strategic water use information available at an IUA/catchment level. Will have interpreted in the context of the resource units.

RQO Component	Information/ Data component	Source	Requirement	Suitability	Comment
Prioritise sub-components for RQO determination and select indicators for monitoring (1) Assess activities that impact on the water resource (2) Assess protection requirements and water resource dependent activities of the resources (3) Selection sub-components (4) Establish desired direction of change of sub-components	RU evaluation tool Water Quality baseline data Flow data EWR data and Reserve information Current and Future Water Use information Water requirements (volume and quality) Fitness for use information Eco-classification models Desktop Present Ecological state (PES)/ Ecological Importance and Sensitivity Data (EIS) Impacts within the study area Land use information Water Use Authorisations Relevant maps (land use, topographical, wetlands,	Water Resource Classification Study Intermediate Reserve Determination Study Rapid Reserve determinations Biological surveys and assessment data Wetland mapping, classification data, monitoring data Groundwater studies Reconciliation Strategy Documents Internal Strategic Perspective Status Quo data and information Catchment studies Monitoring data and information (Water Management System) National Microbial Monitoring Programme National Eutrophication Programme Data – water uses/water	Required	Sufficient Medium to High confidence Largely available	Limitation in water use information (WARMS data) Limitation (low availability) of water quality data and biological data specifically within tributary catchments to understand impacts sufficiently Low availability of conservation data/biodiversity status at resource unit level. Gaps in wetland assessment data (flow and quality) Limitation in groundwater monitoring and quality data

RQO Component	Information/ Data component	Source	Requirement	Suitability	Comment
	groundwater etc)	institutions WARMS Data GRA II			
Development of draft resource quality objectives and numerical limits	Water resource classes and target ecological categories Ecological Water Requirements Assessment: Technical input into the water resource classes Applicable Preliminary Reserve Templates MIRAI and FRAI Model outputs Flow data Hydrology data - Mokolo, Matlabas and Crocodile (West) and Marico systems Water Resource Planning Model Water Resource Yield Model Applicable Dam data – operation and constraints, key uses, users	SA Water Quality Guidelines Water Quality Guidelines/Water Quality Objectives Determination of the Water Quality Component of the Ecological Reserve report PES/EIS 2013 – Catchment A1-A4, D41 Water Resource classification study Intermediate Reserve Determination Study Rapid Reserve determinations Reconciliation Strategy models and hydrology	Required	Sufficient Medium to High confidence Largely available	Limited water quality status quo (monitoring) data (rivers, wetlands and groundwater) – in parts of the catchment areas Insufficient biological data to understand protection requirements in some catchment areas (indices, monitoring data) No EWRs in the Molopo and Ngotwana catchments

RQO Component	Information/ Data component	Source	Requirement	Suitability	Comment
	Updated water quality data and information Biological monitoring data Present state data for selected indicators – monitoring data Data on the wetlands Intermediate Groundwater Reserve Determination Groundwater monitoring data	data Monitoring data and information (Water Management System) National Microbial Monitoring Programme National Eutrophication Programme River Health Programme Studies: River Health Programme Study data Wetland inventory databases Applicable studies and catchment information.			
Agree on resource units, RQOs and numerical limits with stakeholders	Present and revise resource units, sub-components, indicators, proposed RQOs and numerical limits Obtain agreement	Consultation with DWS (regional Offices and National office directorates) Project Committees (Project Management Committee, Project Steering Committee, task	Required	Sufficient Medium to High confidence	Process dependent on stakeholder involvement and buy in – willingness to be involved in process. Limited input into proposed RQOs and

RQO Component	Information/ Data component	Source	Requirement	Suitability	Comment
		groups) Stakeholder databases Workshops and meetings Information documents			numerical limits. Possible risk due to stakeholder fatigue
Finalise and gazette RQOs	Final proposed RQOs and numerical limits Populated RQO Templates DWS: Legal Services Review and advisement	DWS Chief Directorate: Water Ecosystems Final format of templates	Required	-	Possible time delays due to Directorate Legal Services review process and specifications of formatting

2.1.1 Supporting studies and information sources

The following previous and parallel studies will support the RQO determination process for the Crocodile (West), Marico, Mokolo and Matlabas catchments. These reports and information sources have been preliminary reviewed and will be further consulted and used to support the specific information needs of this study as required. As further studies are identified these will be included.

- Classification of significant water resources in the Mokolo and Matlabas catchments: Limpopo Water Management Area (WMA) and Crocodile (West) and Marico WMA (DWA, 2014) – study reports
- Maintenance of the Reconciliation Strategy of the Crocodile West Water Supply System (DWS: National Water Resource Planning, 2015).
- Development of a Reconciliation Strategy for the Limpopo North Water Water Management Area (DWS: National Water Resource Planning, 2015).
- PES and EIS (2013) of South African Rivers (DWA Chief Directorate: RDM);
- Crocodile West and Marico Intermediate Reserve Determination study (DWA Chief Directorate: RDM); and
- Reconciliation Strategy for the Crocodile West water supply system (DWAF, Directorate National Water Resource Planning. July 2008);
- North West Province, Report on the State of the Environment. (2008);
- Adopt-A- River Programme Phase II: Development of an Implementation Plan Water Resource Quality Situation Assessment (DWA RQS, 2009);
- Framework and Manual for the evaluation of aquatic ecosystems services. Water Research Commission, 2010)
- A Systematic Conservation Plan for the Freshwater Biodiversity of the Crocodile West Marico WMA;
- Freshwater Ecosystems Priority Areas (FEPA) Project (CSIR, DWA, Department of Environment Affairs, south African National Biodiversity Institute, World Wildlife Fund, 2011);
- Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) Directorate: Integrated Water Resources Planning
- Hydrology and Yield Analyses as undertaken for the Mokolo, Matlabas and Crocodile (West) and Marico Catchments
- Determination of the Groundwater component of the Reserve: Limpopo Water Management Area , RDM/WMA1/02/CON/COMP/0111
- River Health Programme. State-of-Rivers Report: The Mokolo River System (Department of Environmental Affairs and Tourism, Pretoria, 2006);

- Intermediate Reserve Determination Study for the Surface and Groundwater Resources in the Mokolo Catchment, Limpopo Province: Main Report. (Department of Water Affairs, South Africa, 2010)
- MCWAP PHASE 1: Wetlands & Watercourse Survey (Compiled by Matthew and Tahla Ross Henning of Nemai Consulting. 2010);
- Reserve Models
- Intermediate Ecological Reserve Determination Pilot Study, Pienaars River Wetland. Department of Water Affairs and Forestry (DWAF) 1999.
- Intermediate Reserve determination study for the Groot Marico and Crocodile West River Systems, Draft Wetland Scoping Report. Department of Water Affairs and Forestry (DWAF) 2009.
- National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affair.
- Mapping and characterisation of Highveld peatland resources Agricultural Research Council and Directorate of Land and Resource Management, Department of Agriculture.
- Defining and classification of peat wetland eco-regions in South Africa. Report to the Institute for Soil, Climate and Water (ISCW), Agricultural Research Council for the Directorate for Land and Resources Management (DLRM), Department of Agriculture..

2.1.2 Data availability and accessibility

- The existing Water Resource Planning Model (WRPM) and Water Resources Yield Model (WRYM) will be used to undertake the flow modelling for the quantity sub-component. The models will be adjusted to incorporate all the final EWRs and flows required.
- The latest available naturalised hydrology from the reconciliation strategy studies will be used without any re-calibration or simulation. The Water Resources Yield Model will be applied if required.
- The existing DWS water quality database; *i.e*. DWS Water Management System will be used as the primary source of water quality data. This will be supplemented by other external sources of water quality data.
- Existing EWRs will be utilised and adjusted where required. The Desktop Reserve Model (DRM) will be used for the determination of flow requirements if identified for key nodes.
- The MIRAI and FRAI models will used to review survey data that has been collected for biological monitoring undertaken in the catchments.
- Groundwater Baseline groundwater data is available from the National Groundwater Archive (NGA), time series related data (water levels and quality) is available from Hydstra and the Water System Management platform and time series groundwater quality from the CHART system. Several DWS reports of the groundwater potential and availability are available for

references. Although the WARMS dataset is regarded as incomplete in some respect, the information is valuable, especially in terms of surface water allocations.

- Baseline wetland data is available from various sources including several DWS and other reports on the wetlands as well as wetland inventory databases. Available information on wetlands from the National Spatial Biodiversity Assessment (NSBA), the South African National Biodiversity Institute (SANBI) wetland probability map for South Africa, and the NFEPA wetland coverage of South Africa will be used.
- Other supporting information such as water users in the catchment (and water quality requirements), land use, water infrastructure and water allocation information, environmental information, biodiversity and conservation data will also be reviewed. Data from the River Health programme will also be used to supplement biological information where needed.

3 INFORMATION AND GAP IDENTIFICATION

In terms of the information analysis undertaken key information gaps that have been identified for the study is the unavailability of the vision for the study area, to some extent to the water quality information, and it is envisaged that present state data to support some of the sub-components and indicators selected will be lacking.

The gaps in information that are present are detailed below.

3.1 Vision

Lack of the Vision for the area may limit a full understanding of the stakeholder's aspirations for management of the specific components identified and the desired direction of change for selected sub-components.

3.2 Ecological

The water resource classification study outputs will, *viz*. Ecological Water Requirements (EWR) and ecological categories proposed at the key nodes will be used as input to the RQO development process. These however focused on the main stem and major tributaries. For some rivers, no or limited surveyed biological data is available. Thus, all RUs will not have a EWR present as a result the ecological status may not be available. Base data on the habitat and biota for which the RQOs must be set, may also not be available for all RUs.

A gap therefore potentially exists for tributary catchments where RQOs would need to be set. At these sites the PES/EIS/ES desktop study of DWS, 2013 will be relied upon as well as other biological databases and specialist studies.

A gap in ecological information exists in quaternary catchment D41A, Upper Molopo and the Ngotwane River, quaternary catchment A10A and A10B.

3.3 Water Quality

The Department's Resource Quality Services (RQS) water quality database will be used as the source of the water quality data for this analysis. In terms of water quality data assessment the WQ

monitoring stations and related information are mainly concentrated on main stem rivers and tributaries. Data gaps could potentially exist for the smaller tributary catchments which are identified as high PES and ecological importance and sensitivity. Monitoring points may not be located in prioritised RUs and also the adequacy and reliability of data might be a gap.

We also need to understand the user requirements and impacts; therefore some quality related information will have to be confirmed. This is key to the development of RQOs numerical limits. Lack of recent monitoring information may impact on the process. In addition the lack of available baseline water quality monitoring data in some catchment areas is seen as a gap.

3.4 Wetlands

The wetland classification and identified priority wetlands as determined through the water resource classification study will serve as the basis for the setting of the RQOs. Additional review based on desktop delineation of wetland signatures observed on available aerial imagery will be used to update the existing coverage and provide better information on the priority wetlands within the study area that have not been covered. The available information on the wetlands of the study area is restricted to that captured as part of the national inventory dataset and what is contained in the FEPA database. Data gaps on wetland clusters are therefore expected to occur for some of the systems but a literature survey will be conducted to establish this and fill in gaps where possible.

The available information is adequate to support the determination of wetland RQOs for the study area for the exception of the Matlabas catchment, which was not sufficiently covered through previous studies.

3.5 Groundwater

Based on the availability of groundwater quality trends obtained from water quality monitoring programmes, gaps in data and trends for aquifer units are noted. Reference conditions for groundwater resources are a limitation, especially in terms of water levels.

3.6 Present State data – RQO development and Numerical limits

Present state monitoring data on the selected indicators is required for Step 5. At this stage of the process it is not possible to identify the indicators thus an assessment of data availability cannot be confirmed. Where data is available and suitable it will be used to establish the Present State for each of the selected indicators. However where there is no available data or the data is deemed inadequate it may be necessary to collect data. The most appropriate method will be selected prior to collection. However this may be a constraint.

From the information analysis undertaken, availability of the information/data does not prove to be problematic for the determination of resource quality objectives, for however the following components some data gaps may exist and may not be available to the extent required:

- Habitat integrity/Biota Monitoring data/information
- Ecosystem services – data and information
- Water Quality monitoring data – reliable – long term monitoring in sub-catchments
- Water Use information – WARMS Registrations (abstractions and discharge data)
- Wastewater discharge data from water users
- Details of future water use

4 MEASURES TO ADDRESS GAPS

Potential gaps identified are listed in Table 3.

Table 3: Identified gaps and proposed measures

Gap/Limitation	Measure to Address Gap
Vision is not available to the extent required.	To use the Water Resource Class determined in the Classification process as our "Vision". The Stakeholder engagement process will support this as it will identify stakeholder aspirations to some extent.
Ecological/Eco classification data may not be available or adequate for all RUs and for the sub-components and indicators	The Reserve studies and Classification data will be used as a basis. River Health Programme National Water Resource Monitoring Programmes; National Microbial Monitoring programme, National Toxicity and Toxicant Monitoring Programme Extrapolation.
Water quality data may not be available for smaller tributaries and/or priority RUs	Extrapolation, Reliance on expert knowledge.
Present state data may not be available or adequate for sub-components and indicators	Extrapolation, Reliance on expert knowledge. Specialist studies

Gap/Limitation	Measure to Address Gap
Groundwater quantities and qualities of dolomitic water areas may not be updated	Review of information generated through DWS and other monitoring programmes.
Limited data for wetlands clusters	A literature survey will be conducted to try and source available data on some of the priority systems. As new information becomes available it will be included should it be within the study budget and timeframes. Limited field verification will be used to supplement existing data where possible.

5 CONCLUSION

Based on the information review that has been undertaken on understanding the availability, accessibility and usefulness of the information and data sources applicable to Mokolo, Matlabas and Crocodile (West) and Marico catchments, it is evident that sufficient data does exist for the determination of resource quality objectives.

It can be concluded that the Mokolo, Matlabas and Crocodile (West) and Marico catchments are fortunately, well studied and a wide range of experts, with first-hand knowledge of the system, are available both in the project team and within the networks of the project team. Best available and reasonable data and information sources will be relied upon to meet the objectives of the study.

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