DETERMINATION OF RESOURCE QUALITY OBJECTIVES IN THE MIDDLE VAAL WATER MANAGEMENT AREA

WP10534

INFORMATION ANALYSIS AND DATA GATHERING REPORT

REPORT NO.: RDM/WMA09/00/CON/RQO/0213

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EXECUTIVE SUMMARY

In order for the Department to effectively develop the Resource Quality Objectives (RQOs) in the Middle Vaal WMA, a thorough understanding of the status quo and information availability of the WMA is needed to determine existing situation. The 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 Middle Vaal WMA, in terms of water quality, ecology and other supporting information such as water user sector information, water users in the catchment (and water quality requirements land use, water infrastructure and water allocation information, environmental information, biodiversity and conversation data are in the process of being sourced from various previous and parallel studies and from DWA.

As this study is solely 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.

It is also critical at the outset to determine if any key information is outstanding or absent for successful implementation of the RQOs WMA. An information review has been initiated and undertaken during the inception phase and the outcomes of this are captured in this report. All previous studies undertaken for the Middle Vaal WMA have been sourced and reviewed. For parallel studies ongoing liaison will be established with other study teams and will be maintained to ensure that the transfer of information, data and reports takes place.

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

The above have been used to identify any gaps and outstanding information. Specific recommendations have been made as to the collection of additional data and/or the extrapolation of existing data. These will be discussed with client and will be confirmed in finalisation of this task 2.

The information analysis has been undertaken as follows and is detailed in the sub-sections of this report:

- Previous Studies
- Parallel Studies
- Data Sources
- Models
- Other.

LIST OF ABBREVIATIONS AND ACRONYMS

AMD	Acid Mine Drainage
CD: RDM	Chief Directorate: Resource Directed Measures
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
EC	Electrical Conductivity
EIS	Ecological importance and sensitivity
EMC	Ecological Management Class
EMF	Environmental Management Framework
EWR	Ecological Water Requirements
IUA	Integrated Unit of analysis
IWRM	Integrated Water Resource Management
IWRMP	Integrated Water Resources Management Plan
MC	Management Class
NFEPA	National Freshwater Ecosystem priority areas
NWA	National Water Act
PES	Presentation Ecological State
QC	Quality Control
RDM	Resource Directed Measures
RHP	River Health Programme
RQOs	Resource Quality Objectives
RQS	Resource Quality Services
RUs	Resource Units
RWQOs	Resource Water Quality Objectives
WMA	Water Management Area
WRCS	Water Resource Classification System
WRPM	Water Resources Planning Model

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1 INTRODUCTION

The Middle Vaal WMA covers a catchment area of 52 563 km2, and includes parts of the Free State and North-West Provinces. The Vaal River flows in a westerly direction to the Lower Vaal WMA. It is the middle WMA within the Vaal River System. The following major tributaries drain into this section of the Vaal River and into the Bloemhof Dam: Renoster River, Vals River, Sand River, Vet River and the Schoonspruit River. The major dams in this sub-catchment are the Bloemhof, Erfenis, Allemanskraal, Koppies, Serfontein, Rietspruit, Elandskuil and Johan Neser dams. The dams in the Middle Vaal Sub-system are mainly used for irrigation water supply, although some urban/industrial and mining demands are also supplied from these dams. The dams on the tributaries are operated independently from the Vaal River and only the spillage from the dams is captured in Bloemhof Dam. The Middle Vaal WMA comprises eight sub-catchments as listed in **Error! Reference source not found.**. The WMA consists of the C24, C25, C41, C42, C43, C60 nd C70 tertiary catchments. See Figure 1 for location and general layout of the WMA.

Table 1: Sub-catchments and related quaternary drainage regions within the Middle Vaal WMA

PRIMARY CATCHMENT	SUB-CATCHMENT AREAS	QUARTENARY CATCHMENTS	AVERAGE GROSS AREA (Km^2)
C	Renoster	C70A-K	6656
	Vals	C60A-J	7871
	Schoon Spruit	C24C-G	5644
	Middle Vaal	C24A-B, C24H-J, C25A-C	8281
	Bloemhof	C25D-F	4959
	Allemanskraal	C42A-E	3628
	Erfenis	C41A-E	4724
	Sand	C42F-L	3927
	Vet	C41F-J, C43A-D	6873

The climate in the Middle Vaal WMA can vary considerably from west to east. The average temperature for the WMA is 16˚C, with the mean annual temperatures ranging between 18˚C in the west to 14˚C in the east. Mean annual precipitation per year ranges between 500mm in the west and 700mm in the east of the WMA. Mean annual evaporation ranges from 1800mm in the east to a high of 2600mm per year in the dry western parts of the WMA, and is well in excess of rainfall.

Land use in the WMA is characterised by extensive dry land cultivation in the central parts of the WMA. The largest urban areas are Klerksdorp (North West Goldfields) Welkom and Kroonstad (Free State Goldfields). Irrigation is practiced downstream of dams and along the main tributaries and at locations along the Vaal River. The WMA is characterised by a large number of goldmines.

The economy of the Middle Vaal WMA contributes about 4% of the GDP of South Africa with the most dominant economic activity being the mining sector, contributing more than 45% of the GDP in the WMA, trade (12,3%), and agriculture (8,9%) (DWAF, 2003). Due to a decline in gold mining activity, a decline in population is also projected for the WMA, with a concomitant effect on the

regional economy. Manufacturing activities in the WMA relate to the mining and agriculture sectors as well as items for local consumption. No dramatic changes to the economy of the WMA are foreseen for the medium term. The agricultural sector in the region is relatively stable and will continue to make an important contribution to the regional economy.

The Middle Vaal WMA's water quality and flow is mainly controlled by activities that take place in the Upper Vaal WMA. The Middle Vaal WMA is dependent on the Upper Vaal WMA for meeting the bulk water requirements of its mining, industrial and urban sectors. Large quantities of water are transferred into the WMA to augment local water resources. These upstream activities include releases from the Vaal Dam and Vaal River Barrage, waste water treatment works discharges, urban runoff and gold mining activities on the Witwatersrand. In the Middle Vaal WMA discharges and decants from gold mining activities in the Mooi and Koekemoer Spruits have an impact on the continued salinity build up in the Vaal River. These impacts are subject to many catchment studies that have been undertaken by DWAF as well as a current Integrated Water Quality Management Plan for the Vaal River system. Management of water quality and quantity in the Middle Vaal WMA is therefore integrally linked to both the Upper and Lower Vaal WMAs.

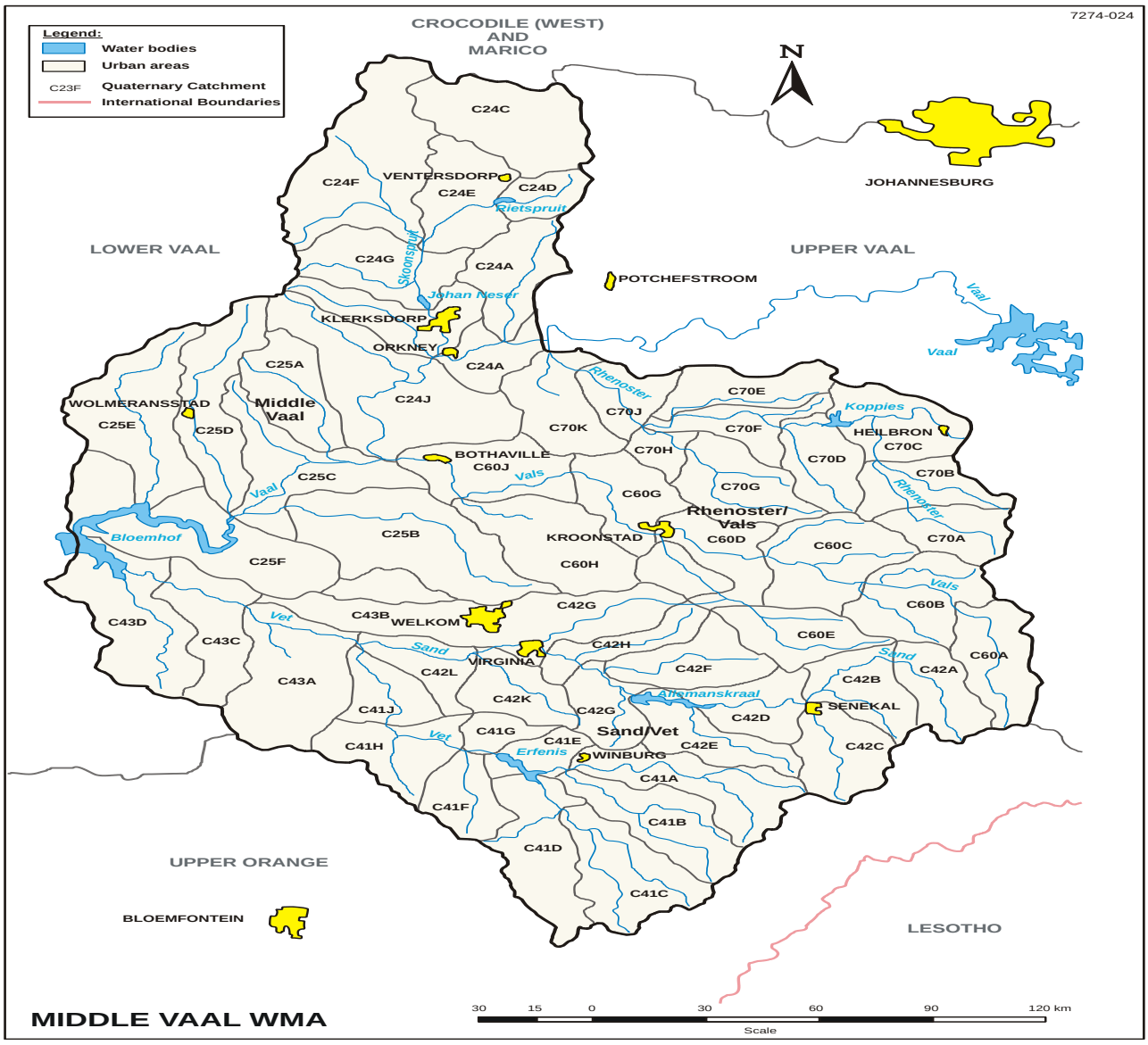

Figure 1: Location and general layout of the Middle Vaal WMA

A number of wetland types occur within the study area including:

- Peatlands associated with dolomitic eyes;
- Pans;
- Channelled and unchannelled valley bottom wetlands and hillslope seepage wetlands; and
- Floodplain wetlands;

A band of dolomite runs through the northern section of the study area which supports wetlands associated with dolomitic eyes. As a result, one Peat Wetland Eco-regions is represented in the study area, being the Highveld Peat Eco-region (Marneweck, Grundling and Muller, 2001). The water from the dolomitic eyes in this Eco-region is typically alkaline (pH range from 7.5 to 9.3) having picked up magnesium and calcium carbonates through solution from the parent dolomite. Being perennial, the wetland systems associated with, and downstream of, the eyes form peatlands. Peatlands are defined as peat-accumulating fresh water wetlands which develop in areas where there is a net surplus of water with an accreting substrate comprising a high percentage of undecomposed organic plant material (usually with more than 20 - 35% organic matter on a dry weight basis - Mitsch and Gosselink, 1986).

At least one such peatland occurs along the upper reaches of the Schoonspruit. This system, as with similar systems in the Highveld Peat Eco-region, would have developed over long periods ranging between 7000 to 15000 years (depending on peat depth) with peat accumulation rates of between 0.3 to 0.6mm/year (Grundling and Marneweck, 1999; Marneweck *et. al.*, 2001). Peatlands in general, and more specifically those associated with the dolomitic eyes, are rare in South Africa and southern Africa in general. Those associated with the dolomites in Rivers in particular comprise unique ecosystems.

A wetland type that is well represented in the study area is pans. Pans are recognized as being important for biodiversity support and more recently their links to other wetland systems in relation to landscape hydrology have also been highlighted. Pans are also unique in terms of their individual biogeochemical attributes. They also occur predominantly on the drainage divides forming an integral part of the watersheds of many of the rivers in the study area. Pan complexes or clusters (groups of pans) occur in patches throughout the study area, with an extensive cluster occurring around the town of Wesselbron. Other clusters occur to the south of Koster along the northern edge of the study area, north of Coligny in the watershed of the Taaibospruit, in the watershed of the Makwassiespruit, with an extensive cluster occurring along the watershed divide to the west of the Bamboesspruit.

Extensive wetland systems comprising a mixture of large channelled valley bottom wetlands and hillslope seepage systems occur along the upper reaches of the Otterspruit and its associated tributaries. Pan systems also occur along the drainage divides in this area. The Otterspruit wetland system therefore comprises a network of pans, hillslope seepages and valley-bottom systems, rendering this an important water resource in the study area. The wetlands associated with this system are considered to have a high ecological importance and sensitivity and form part of the Dry Highveld Grassland Group 3 Wetland Type (NFEPA, 2011). They are considered Vulnerable.

A number of valley bottom and hillslope seepage wetland systems are also associated with the Valsrivier. A wetland complex including Swartpan and Hertzogsvlei also occur in the study area forming an interesting and important system with what appears to be an outflow pan (rather than endorheic or inward draining pan) linked to a drainage line and valley bottom wetland.

An extensive floodplain system occurs along the Vetrivier forming one of the most important and largest floodplain systems in the study area. This system is considered to have a high ecological importance and sensitivity. Floodplain systems are also associated with the Heuningspruit which includes the Grootvlei wetland system towards the upper reaches. This system together with extensive reaches of the Rietspruit form tributaries of the Renosterrivier which itself comprises extensive areas of floodplain wetland. This system forms a key wetland complex in the region and has a high ecological importance and sensitivity, forming part of the Dry Highveld Grassland Group 3 Wetland Type (NFEPA, 2011), and is considered Vulnerable.

Two dolomite aquifer systems, the Ventersdorp-Grootpan DWA and the Klerksdorp-Orkney-Stillfontein-Hartebeesfontein (KOSH), are present in the upper reaches of the Schoonspruit and Mid Vaal sub-catchments (viz, C24C, E, F and C24A & -B) See Figure 2 below. These dolomite water resources are extensively used for irrigation (Schoonspruit groundwater and surface water systems) and impacted by mining activities (KOSH area). Several studies have reviewed the status of these systems pre-2004; although recent impacts due to drought conditions and mining activities may not be well incorporated into the total hydrological context.
Groundwater in the remaining part of the Mid Vaal Catchment is related to Karoo type aquifer systems which may have been impacted on a localized scale due to poor management of the quantities and qualities.

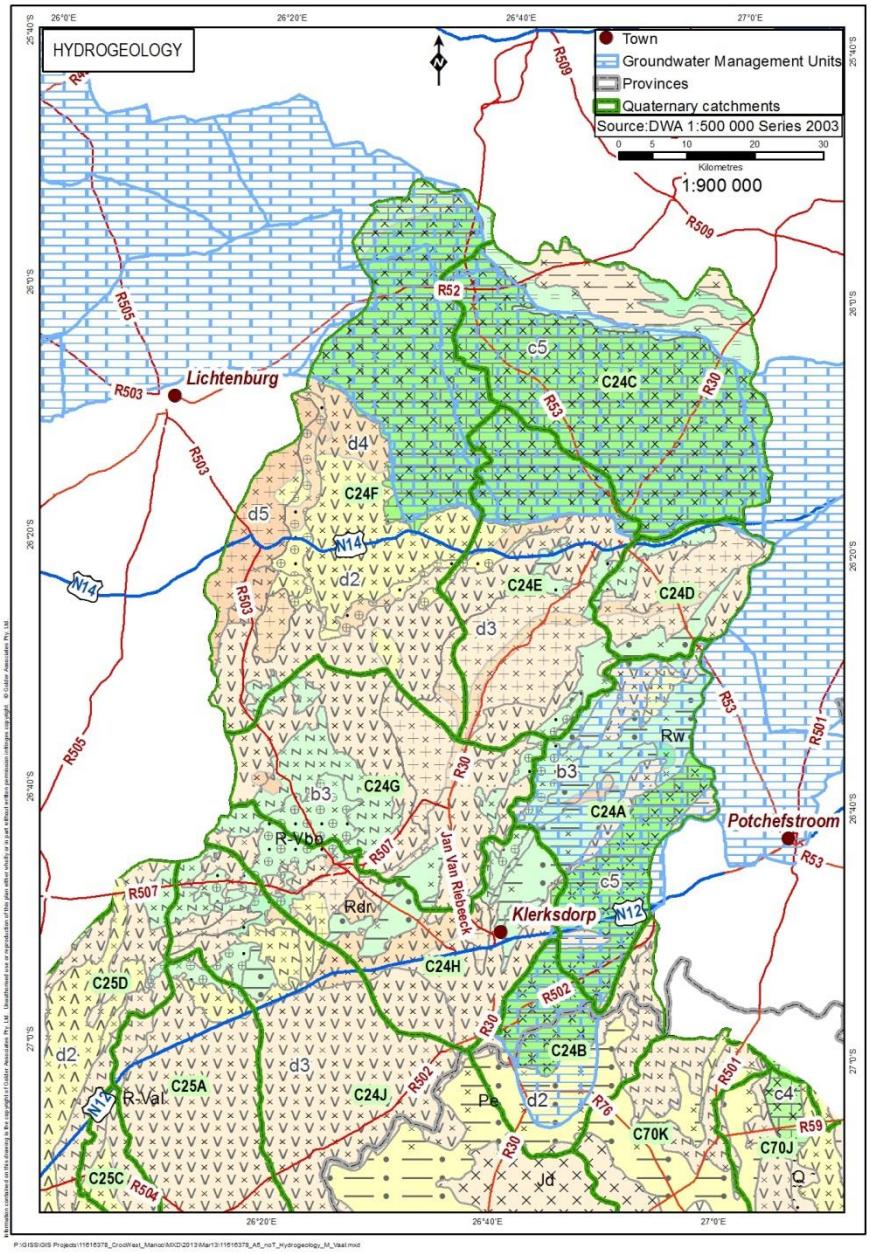

Figure 2: Location of Dolomite Aquifer Systems in the C24A-C and E-F within the Middle Vaal WMA.

2 DETERMINATION OF RESOURCE QUALITY OBJECTIVES IN THE MIDDLE VAAL WMA

The National Water Act (Act No. 36 of 1998) (NWA) is founded on the principle that National Government has overall responsibility for, and authority over, water resource management for the benefit of the public without, seriously affecting the functioning of the water resource systems. In order 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 classification system, the Reserve and Resource Quality Objectives (RQOs) together are intended to ensure comprehensive protection of all water resources. An important consideration in the determination of RDM is that they should be technically sound, scientifically credible, practical and affordable. The first stage in the protection of water resources, according to the NWA, is the development of a system to classify the nation's water resources. The Water Resources Classification System (WRCS) (DWAF, 2007) is a key framework into which the Reserve and RQOs both fit.

As part of the RDM, RQOs has 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 from which it can be deduced whether the resource is being stressed by existing management practices or not. The NWA also requires that in determining RQOs, a balance be sought between the need to protect and sustain water resources and the need to protect them.

The Chief Directorate: Resource Directed Measures (CD: RDM) of the Department of Water Affairs (DWA) is tasked with the responsibility of establishing clear goals relating to the quality of the relevant water resources (*i.e.* determination of the RQOs). The CD: RDM has identified the need to undertake the determination of RQOs for significant water resources in the Middle Vaal WMA.

The purpose of this study is to implement the RQO determination procedures in the Middle Vaal WMA and in so doing determine the RQOs of the significant resources for presentation to the delegated authority. The capturing of information from stakeholders is considered important to the RQO Process. The determination of RQOs for the Middle Vaal WMA will thus require the selection of appropriate points in the technical process that allow for optimisation of stakeholder involvement with the resources. The level of stakeholder engagement will range between consultation and involvement.

The determination of RQOs is guided by a seven step process that has been developed by the DWA (DWA, 2011) (Figure 3). The overall procedure involves defining the resource, setting of a vision, determining the RQOs and setting numerical limits, gazetting, and then moving onto implementation, monitoring and review.

Figure 3: Seven step process for RQO determination

The implementation of the RQO procedure in the Middle Vaal will be undertaken using the following study approach:

- An assessment of the Middle Vaal WMA 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 WMA into integrated units of analysis (IUAs) and definition of Resources Units (RUs) based on identified criteria and system understanding and characteristics;
- The application of the RQO procedure (Steps 2 to 7), *i.e.* determining the RQOs by capturing the management class and ecological requirements into measurable management goals

The study approach is defined by 5 tasks depicted in Figure 4.

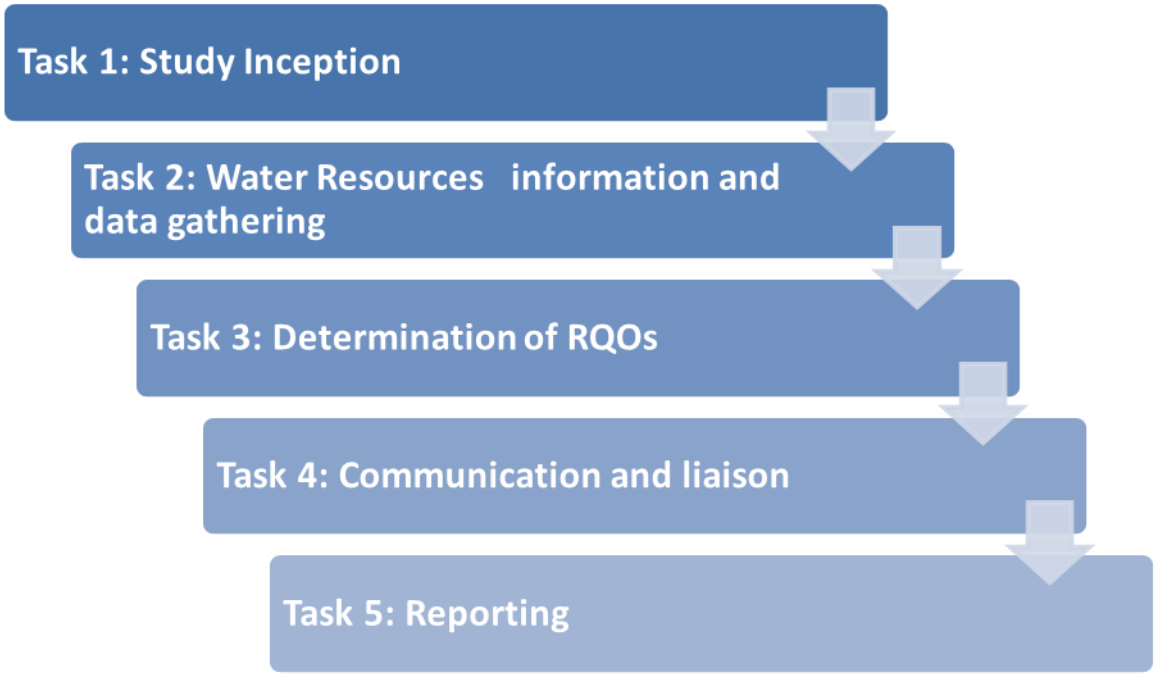

Figure 4: The study tasks

2.1 THE INFORMATION ANALYSIS AND DATA GATHERING TASK

In order for the Department to effectively determine and implement the RQOS for significant water resources of the Middle Vaal WMA, a thorough understanding of the status quo and information and data availability for the WMA is needed to determine existing situation. 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 undertaken in support of integrated water resource management. The determination of the RQOS is preceded by an information and data gathering component which supports the state of knowledge that is needed for the definition of the water resources and WMA. The state of knowledge required involves the review and assessment of previous and parallel studies, data, information, reports, models, etc., that will form the departure point from where further analysis can proceed.

2.2 OBJECTIVES OF THE INFORMATION ANALYSIS TASK

The information analysis and data gathering task has been included to provide a high level analysis of the available water resource related data and information for the Middle Vaal WMA in terms of water resource quality, ecological water requirements, hydrology, water quality and socio-economics.

The specific objectives of the task are:

- To review previous studies and related reports and assess information availability and applicability;
- To assess available data and data sources (e.g. water quality, hydrology, hydraulics,

economics data, water use information, etc.);

- To assess the status of parallel studies to determine the information availability as it relates to the Middle Vaal RQOs determination process;
- To review set-up of the models to be applied;
- To assess the relevant gaps and how they may be addressed, and
- To confirm that the information available is applicable, adequate and reliable to undertake the determination of RQOs for significant water resources in the Middle Vaal WMA.

2.3 PURPOSE OF THE REPORT

This report describes the information analysis and data gathering component which comprises task 2 of the study. The purpose of the report is to document:

- the review of existing literature, reports, maps and any other relevant information on the study area that is supportive and required for the determination of RQOs in the Middle Vaal WMA;
- 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;
- gaps that may be present which could influence the study process and progress, and implementation of the RQO procedure.

3 TASK 2: INFORMATION ANALYSIS AND DATA GATHERING

This study is extensively reliant on existing results and information from the previous Water Resources Classification Study, other studies and soon to be made available information and results from parallel studies related to the Middle Vaal WMA. 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 Middle Vaal WMA and its tributaries, including water resource planning, Reserve determination, water quality, socio-economic, augmentation, reconciliation strategies, Water Resources Classification and specific detailed studies for WMA sub-areas have been sourced and reviewed. For parallel studies (Table 4) on-going liaison will be established with other study teams and will be maintained to ensure transfer of information, data and reports takes place. The above have been used to identify any gaps and outstanding information.

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

3.1 THE APPROACH ADOPTED TO CONDUCT THE INFORMATION ANALYSIS TASK

To achieve the objective of the information analysis, the following was considered in the assessment and evaluation of the related data and information for the Middle Vaal WMA:

- Identification of information/data required and availability?
- Identification and review of key studies
- Identification and information requirements from parallel studies
- Determination of the applicability and usefulness of the information/data
- Gap analysis to identify information/data that is not available and how the gaps will be addressed.
- Mitigation measures in terms of identified risks.

The information analysis has been undertaken in terms of the above and is detailed in the sub-sections below.

3.2 IDENTIFICATION OF INFORMATION/DATA REQUIRED

The *information requirements* of each of the steps of the RQOs (as per the procedures to develop and implement RQOs); as applicable/relevant to the Middle Vaal WMA (study area), are summarised in Table 2.

Table 2: Information requirements for the steps of the RQOs

Output	Information Requirements	Sources	RQO Step
Defined IUAs	Catchment information and	• Comprehensive Reserve	Step 1

Output	Information Requirements	Sources	RQO Step
Preliminary RUs and Water Resource Classification river nodes	characteristics Land use information Socio economic status and zones Water use information and data Water resource information Biophysical information Water resource – habitat/biota System operation	Determination Study • Water Resource Classification Study • Middle Vaal WMA: Overview of Water Resources and Utilisation. • Reconciliation Strategy for the Integrated Vaal River System	
Catchment Vision	Baseline information used in step 1	• Water Resources Classification Study	Step 2
Defined Resource Units	, Resource Unit Prioritisation Tool Delineated IUAs, Land use information, Ecosystem services information, Ecological Water Requirement (EWR) sites and monitoring points, Present Ecological state (PES), National Freshwater Priority Areas. Ecosystem Services information • Wetland coverage maps	• Comprehensive Reserve Determination Study • Water Resources Classification Study • NFEPA maps/data • SA Water Quality Guidelines • Vaal River Reconciliation study • Integrated Development Plans • Catchment Management Strategy? • WARMS • Water use Authorisations information • Monitoring data and information (Water Management	Steps 3 and 4

Output	Information Requirements	Sources	RQO Step
	• Land cover/land use maps Relevant data (discharge data)	System) • National Microbial Monitoring Programme • National Eutrophication Programme • DWA – relevant Directorates • Data – water uses/water institutions • Provincial Conservation plans • Local expert knowledge • River Health Programme • National Water Resource Monitoring Programmes • National Toxicity and Toxicant Monitoring Programme	
RQOs	RU evaluation tool Water Quality Water users information (abstraction and discharges) Water requirements (volume and quality) PES / fitness for use information Impacts within the study area Land use information Water Quality Guidelines Present state for selected indicators – monitoring data Relevant maps (land use, topographical, wetlands, etc)		Steps 4, 5, 6 and 7

The information analysis has been undertaken in terms of the above information requirements and is detailed in the sub-sections below.

3.2 IDENTIFICATION AND REVIEW OF KEY STUDIES

Table 3 lists the relevant key studies that have been identified and reviewed as part of the previous studies undertaken in the Middle Vaal WMA.

Table 3: Review of identified key studies undertaken in the Middle Vaal WMA of relevance to the RQOs determination study

No	Report Title	Report Details/Reference	Brief Summary	Usefulness/Applicability to determination of Middle Vaal RQOs
1	Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10: Status Quo Report	DWA, Directorate Resource Directed Measures, 2011, Report No: RDM/WMA8,9,10/00/CON/CLA/0211	This report describes the status quo of the water resources within each of the selected IUAs in terms of the Water resource infrastructure and availability; Ecological status; Socio-economic conditions (including framework for impact assessment); and Goods and services (communities and their well-being).	The study provides good baseline and background information on the IUAs.
2	Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10: Water Resource Analysis Report	DWA, Directorate Resource Directed Measures, 2011, Report No: RDM/WMA8,9,10/00/CON/CLA/0411	The report provides information on studies and data reviewed for the Classification study. Approach to identification of IUAs.	The report provides information on studies and data reviewed for the Classification study. IUAs are delineated – to be used as the basis for steps 1 and 2.
3	Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10: Scenario Evaluation Report	DWA, Directorate Resource Directed Measures, 2011, Report No: RDM/WMA8,9,10/00/CON/CLA/0112	This report described the ecological and socio-economic consequences of a range of operational scenarios, i.e. the impact on the Ecological Category of the Ecological Water Requirement (EWR) sites where applicable, based on the output from the water resource planning analyses.	It provides information needed for Step 3, 4 and 5 of the RQOs process.
4	Classification of Significant Water Resources (River, Wetlands, Groundwater and	DWA, Directorate Resource Directed Measures, 2011, Report No:	This report describes the process in determining the Management Classes (MCs) and the rationale	The results of the study form the basis of the ecological information and data to be used during the RQOs

No	Report Title	Report Details/Reference	Brief Summary	Usefulness/Applicability to determination of Middle Vaal RQOs
	Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10: Management Classes of the Vaal River Catchment Report	RDM/WMA8,9,10/00/CON/CLA/0212	for each IUAs selection within the Middle Vaal WMA. The REC and PES were determined and recommended.	determination process. Provides a management class for each IUA which will be used as the vision for the IUAs (Step 2). Defines the river nodes to be used in Step 1 of the study.
5	Potential savings through WC/WDM in the Upper and Middle Vaal WMAs	DWA, Directorate National Water Resource Planning and Directorate Water Use Efficiency. 2007. Report No: P RSA C000/00/4406/02	This study was to investigate the potential influence on future water requirements in the Vaal River System of WC/WDM activities and to assess the current and planned WC/WDM measures within the Vaal River Basin	Provides information on future water requirements. It provides information needed for Steps 4 and 5 of the RQOs process.
6	Middle Vaal WMA Water Resources Situation Assessment	DWAF, Directorate National Water Resource Planning. 2004	This report is a desktop assessment of the available water resources and quality in the WMA. It also addresses patterns of water requirements that existed during 1995. The report highlights the principal water related issues, identifies water shortages and most importantly provides information that is necessary to formulate future strategies to ensure best sustainable water utilization.	The study provides good baseline and background information on the WMA.
7	The Internal Strategic Perspective for the Middle Vaal WMA	DWAF, Directorate National Water Resource Planning. 2004. Report No. P WMA 09/000/00/0304.	The ISP for the Middle Vaal WMA provides a framework for DWA's management of water resources. The ISP details the strategies for water resource management and	The report provides good perspective of the water resources situation and the key water resource management issues facing the WMA. It includes good background and water resource

No	Report Title	Report Details/Reference	Brief Summary	Usefulness/Applicability to determination of Middle Vaal RQOs
			related water resource issues and concerns in the WMA.	related information on the WMA for the status quo assessment. The strategies highlight the focus areas that need to be considered.
8	Middle Vaal WMA: Water Resources Situation Assessment – Main Report, Volume 1 of 3.	DWAF, Directorate National Water Resource Planning. 2002. Report No: P09000/00/0101.	This report provides a desktop assessment of the available water resources and quality and also patterns of water requirements that existed during 1995 in the Middle Vaal Water Management Area. This report also highlights the principal water related issues, to identify existing water shortages, to provide information that is necessary to formulate future strategies.	
9	Integrated Water Quality Management Plan for the Vaal River System: Water Quality Management Strategy	DWAF, Directorate National Water Resource Planning. 2009. Report No. P RSA C000/00/2305/7.	This report assesses the water quality status and outlines the process followed in setting the RWQOs for the Vaal main stem.	Provide information on the water quality impacted areas within the WMA and approaches for management. It provides baseline information for Step 4 and 5 of the RQOs process.
10	Integrated Water Quality Management Plan for the Vaal River System: Water Quality Status Assessment Report	DWAF, Directorate National Water Resource Planning. 2009. Report No. P RSA C000/00/2305/1.	This report provides an overview of the water quality status of the water resources of the Vaal River catchment in terms of chemical and biological quality.	Provide information the status of the water quality within the area.
11	Comprehensive Reserve determination study for selected water resources in the Middle Vaal Water Management Area. Main Integration Report	DWA, Directorate Resource Directed Measures, 2010. Report Number: RDM/ WMA09C000/ 01/CON/ 1207	This report summarises the main components of the intermediate assessment of the Ecological Water Requirements (EWR) component of the Reserve.	Provides information on the process and rationale for RUs and EWR sites selected. To be used for Step 1 of RQO process in association with Water Resource

No	Report Title	Report Details/Reference	Brief Summary	Usefulness/Applicability to determination of Middle Vaal RQOs
				Classification Study results.
12	Comprehensive Reserve determination study for the integrated Vaal River system, Middle Vaal Water Management Area, Ecoclassification report.	DWA, Directorate Resource Directed Measures, 2010. Report Number: RDM/ WMA09C000/ 01/CON/ 0607.		
13	Comprehensive Reserve determination study for selected water resources in the Middle Vaal Water Management Area. Ecological Specifications and Monitoring Report	DWA, Directorate Resource Directed Measures, 2010. Report Number: RDM/ WMA09C000/ 01/CON/ 1007		This report provides the quantifiable and enforceable descriptors of the RQOs as they pertain to the ecological objectives for a particular resource (in this case a particular river reach). The Ecological specifications will be used as input to steps 4 and 5 of the RQO process.
14	Middle Vaal WMA: Overview of Water Resources and Utilisation.	DWAF, Directorate National Water Resource Planning. 2003. Report No. P WMA 09/000/00/0203.	The report provides an overview of the current and expected future water resources situation in the Middle Vaal WMA as was the situation in 2002. It also highlights the key issues of relevance and provides broad strategies with regards to the management of water resources in the WMA. The report was compiled in support of the development of the National Water Resource Strategy.	The study provides good baseline and background information on the WMA for the status quo assessment and understanding the WMA.
15	Development of a Reconciliation Strategy for the	DWA, Directorate National Water Resource Planning	Water supply and use information, water demands and requirements,	

No	Report Title	Report Details/Reference	Brief Summary	Usefulness/Applicability to determination of Middle Vaal RQOs
	Vaal Integrated System		projections and water infrastructure information. Updated hydrology Water Resources Planning Model (WRPM)	
16	National Freshwater Ecosystems Priority Areas (NFEPA) Project	(CSIR, DWA, Department of Environment Affairs, south African National Biodiversity Institute, World Wildlife Fund, 2010)	Identification of National Freshwater Ecosystems Priority Areas - to support delineation and prioritisation of RUs.	
17	A collection of geohydro-logy reports in the pre-2000 period	By DWAF.	Various geohydrology studies of the Ventersdorp area (Schoonspruit Eye catchment).	Could provide good information on the historical status of the systems in terms of quality and quantities.
18	A Catchment Management Plan for the Schoonspruit and Koekemoerspruit Catchments,	PHD and Darcy Groundwater Consultants, 2002, Ref #'s 2.2 (241 & 640 resp.).	Not reviewed	Not reviewed i.t.o. Groundwater RQO's for dolomitic water areas.
19	A Methodology for Groundwater Management in Dolomitic Terrains with Schoonspruit Dolomitic Compartment as Pilot Area,	S Veldman (DWAF), 2004	A detailed report on the groundwater conditions in the Schoonspruit dolomitic compartment	Will provide good information on the management protocols of dolomitic water areas and the management of the resources in terms of quantity and quality (viz. RQO's).
20	Provincial Conservation plans			
21	River Health Reports			
22	Integrated Development Plans			
	Specialist reports: mining,			

No	Report Title	Report Details/Reference	Brief Summary	Usefulness/Applicability to determination of Middle Vaal RQOs
	ecology, etc, Dr Jan Roos may be aware of any specialist studies done in the WMA.			

3.3 INFORMATION REQUIRED FROM PARALLEL STUDIES

Table 4 lists the relevant information and reports from parallel studies that will support the information needs of the Middle Vaal RQOs determination study.

Table 4: Parallel studies underway in the Middle Vaal WMA that support the information needs of the RQOs determination study

No	Study underway	Information Source	Information needs supported	Status of information	Possible risk
1	Implementation of the WCDM	DWA, Directorate National Water Resource Planning	Water use information (re-use, water treatment, water requirements, costs)	Still to be sourced	
2	Waste Discharge Charge System	DWA,	Information on abstractions and return flows especially from the sewage works. Water quality and quantity to assist with information needs quality and flow patterns.	At various stages of collation	Delays in information could impact on Determination of RQOs.
3	Eradication of unlawful irrigation water use in the Vaal	DWA, Directorate National Water Resource Planning	Abstraction and return flows	Still to be sourced	Delays in information could impact on Determination of RQOs.

3.4 RELEVANT/INFORMATION DATA SOURCES

Data and information available from various sources will form data inputs or base information to various steps in the RQOs process. Table 5 outlines the data and information sources, the status of collation and their applicability to the RQOs process.

Table 5: Data sources supporting information needs of study

Information/Data required	Status of Collation	Applicability to process
Delineated IUAs (supporting baseline information)	Obtained	Used as basis for defining RUs
Management Classes for IUAs	Obtained	Vision for catchment; provision of ecological information and status (Step 2)
NFEPA maps	Obtained	Status quo description; RUs delineation; RU prioritisation
Water Resources Planning Model (which includes water demands, future requirements)	Obtained	Required for the WRPM - to be used in scenario analysis (Step 5)
Updated water quality data and information from the Water Management System of the Department.	Some information in hand. Additional data to be sourced on an ongoing basis. However need to confirm selected indicators to finalise data collation	Required for delineation and prioritising RUs, determination of present state.
Water use information/data – water users (abstraction and discharge information; water requirements; key water users); Ecosystem Services data	Information collation ongoing	Selection of indicators, RQO development (Prioritisation of RUs – Step 3 and Prioritisation of sub-components – Step 4)
Present state determination of water resources	Still to be sourced (only at Step 5)	Development of Draft RQOs and numerical limits – Step 5)
Ecological Water Requirements (Information, data, models, indices)	Obtained	Required for delineation and prioritising RUs
Ecoclassification models	Still to be sourced	
PES/EIS database for the Middle Vaal WMA	Data and models to be sourced (currently being populated)	Required prioritising RUs
Land use, population data, socio-economic data; macro and micro economic data. (Collated as part of classification study)	Various stages of collation	To be used in determining RUs this contributes to the economy.
River Health Programme Studies: Middle Vaal WMA	Information collation ongoing	To enhance data collected for delineation of RUs.

Information/Data required	Status of Collation	Applicability to process
DWA Airborne magnetic data	Obtained,, Requires processing and geophysical interpretation of linear structtures	To update and improve delineation of dolomite compartments
Groundwater management studies of the Schoonspruit dolomite compartment.	Reports available from DWA Geo-Library.	To evaluate water quantity and quality status.

From a preliminary assessment undertaken, availability of the information/data does not prove to be problematic; however the following components may prove to be a challenge to obtain 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

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 the above data sources, specifically with obtaining some of the ecological-related data sources, water use information and some economic information.

3.4.1 Hydrology

The WR90 (Water Resources 1990) study was the first national study initiated by the Water Research Commission (WRC) which provided comprehensive hydrological information at quaternary catchment level for the entire country. Since the WR90 study (WRC, 1990) only included information up to the year 1989, the need for updating this database was identified and culminated in the commissioning of the WR2005 study. The final results of the WR2005 Study were not available at the time when assessments were done for the Reserve Study and it was decided to use the WR90 database as source of information at quaternary catchment level. Different studies to update the hydrology of the Renoster and Schoonspruit catchments were undertaken and the updated results for the two catchments were used during the Reserve study.

Functioning of the dolomite aquifer systems is well known from previous investigations and reports. Demarcation of boundaries of the Ventersdorp-Grootpan dolomitic water area in terms of the Mid Vaal Catchment boundaries needs to be clarified especially on the upper portion of the C24F quaternary catchment (Grootpan dolomite compartment(s). Airborne magnetic data from DWA is to be processed to identify linear structures (dykes) and update conceptual groundwater flow and compartment sub-boundaries

Several studies were done on the Schoonspruit dolomite compartment; the most recent ones focussed on the management requirements for dolomite aquifer systems using the Schoonspruit compartment as pilot study area.

3.4.2 Water Quality

The Department of Water Affairs Resource Quality Services (RQS) water quality database will be used as the source of the water quality data for this analysis. Again wide range of information is available regarding the water quality of the Vaal River System, and a number of previous studies have analysed water quality to a fine resolution.

If necessary, further data sources will be investigated to obtain additional water quality monitoring data such as those of the local municipalities and mines in the WMA. This data will be useful in understanding local sub-catchment water quality status and related impacts. Discharge information would be useful wherever this can be sourced.

We also need to understand the requirements; 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.

An update of the groundwater quality and use in the dolomitic water areas is required for the dolomite aquifer systems. Although the status of the Ventersdopr-Grootpan aquifer systems is probably not impacted, the Klerksdorp-Orkney-Stillfontein-Hartebeesfontein aquifer systems might be significantly impacted by mining activities. Interaction between the dolomite aquifer, the Koekemoer Spruit (C24A) and the Vaal River (C24B) needs to be clarified due to possible pollution in the KOSH area.

3.4.3 Ecological

The ecological assessment for the IUAs was undertaken and documented in the Status Quo Report (Report No: RDM/WMA 8, 9, 10/00/CON/CLA/0211) produced as part of the Classification process. More ecological information is contained in the Reserve Study (Report Number: RDM/ WMA09C000/ 01/CON/ 1007).

a) Comprehensive Reserve determination study

The results from recently completed (2011) Reserve determination study will form the basis of the ecological information and data to be used during the RQOs process. The main results from the study are summarised in Table 6 and Table 7 below.

Table 6: **Selected EWR sites for the Middle Vaal catchment**

EWR Site number	EWR site name	River	National RHP site	Coordinates	Ecoregion (Level II)	Geomorphic zone	RU	Quaternary catchment
EWR12	Vaal River: Vermaasdrift	Vaal	C2-Vaal Orkne	S26.93615 E26.85025	11.01	E: Lower Foothills	MRU Vaal F	C24A
EWR13	Vaal River: Regina bridge	Vaal	C2-Vaal Orkne	S27.10413 E26.52185	11.08	E: Lower Foothills	MRU Vaal G	C24J

EWR Site number	EWR site name	River	National RHP site	Coordinates	Ecoregion (Level II)	Geomorphic zone	RU	Quaternary catchment
EWR14	Vals River: Proklameersdrift	Vals	C6-Vals-Prokl	S27.48685 E26.81320	11.07	E: Lower Foothills	MRU Vals B	C60J/C60G
EWR15	Vet River: Fisantkraal	Vet	C4-Vet-Hoops C4-Vet-Erfen	S27.93482 E26.12569	11.08	E: Lower Foothills	MRU Vet C	C43A
RE-EWR3	Klein-Vet, just downstream of Winburg	Klein Vet	C4GVet-V4	S28.564708 E26.943946	11.03	E: Lower Foothills	MRU Vet A	C41A

Table 7: Summary of PES, EIS, REC and MC for the Middle Vaal WMA

EWR Site number	EWR site name	PES	EIS	REC	MC
EWR12	Vaal River: Vermaasdrift	D	Moderate	D	II
EWR13	Vaal River: Regina bridge	C/D	Moderate	C/D	III
EWR14	Vals River: Proklameersdrift	C/D	Moderate	C/D	III
EWR15	Vet River: Fisantkraal	C/D	Moderate	C/D	III
RE-EWR3	Klein-Vet, just downstream of Winburg	C	Moderate	C	II

b) Ecological Water Requirements (EWR) sites

The evaluation of the selected EWR sites was undertaken during the recently completed Reserve determination study. Details are provided in the Report Number RDM/ WMA09C000/ 01/CON/ 0210.

3.4.4 Supporting information

Other supporting information such as water user sector information, water users in the catchment (and water quality requirements land use, water infrastructure and water allocation information, environmental information, biodiversity and conversation data are in the process of being sourced from various previous and parallel studies (discussed in the previous sections) and from DWA. As primary data collection is not part of this study a synthesis of available will be prepared for use in this study. Where data is not available conservative assumptions will be made.

3.5 MODELS

The Water Resource Planning Model (WRPM) of the DWA, Directorate National Water Resource Planning will be relied upon for scenario analysis.

3.6 OTHER

Data available from the River Health Programme (RHP), the NFEPA project, WMS, water quality assessments and the updated PES, EIS and NEC will be used to populate the RU Tool so as to assess, evaluate and prioritise Resource Units. This information will enhance the data collected for the study and will assist the specialist to make proper recommendations.

4 IDENTIFICATION OF POTENTIAL INFORMATION GAPS

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.

4.1 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.

4.2 Water quality

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.

The groundwater resources of the water management encompass typical Karoo rock aquifer systems with local perched water unit that may support isolated wetlands. Although the groundwater quality of these systems is not impacted on a regional scale, a review of the groundwater quality may be required using DWA's national groundwater monitoring information.
Dolomitic aquifer systems occur in the northern and eastern regions of the C24 catchment which drives large dolomitic eye's, e.g. the Schoonspruit Eye. Several studies in past have been done on these dolomitic aquifer systems which may require some review and perhaps updates on the sustainability in terms of quality and quality of these eye's. Flow paths in the northern part of C24F (the Grootpan Area) is directed towards the north; thus representing a loss to the MidVaal groundwater budget. The dolomitic aquifer systems occurring on the east, viz. the KOSH area is probably impacted by the local mining activities which may require special review.

4.3 Wetlands

The available information on the wetlands of the study area is mostly restricted to that captured as part of the national inventory dataset and what is contained in the NFEPA database. Although general Google Imagery is available, there is limited air photo coverage of the study area. Data gaps on wetland clusters are therefore expected to occur for most of the systems but a literature survey will be conducted to establish this and fill in gaps where possible.

4.4 Ecological data

All RUs will not have a EWR present as a result the eco classification data (ecostatus) 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.

4.4 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 key constraint.

5 MITIGATION MEASURES FOR RISKS IDENTIFIED

Potential risks/limitations identified are listed in Table 8.

Table 8: List of possible identified risks and limitations with proposed mitigation measures

Risk/Limitation	Mitigation Measure
Vision is not available to the extent required.	To use the Management 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.
Parallel studies may not deliver the required information as per the study schedule. (e.g. WDCS; WCDM).	Information available at the time will be used. As new information becomes available it will be included should it be within the study budget and timeframes.
Ecological/Eco classification data may not be available or adequate for all RUs and for the sub-components and indicators	The Reserve study 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	Once off monitoring.
Groundwater quantities and qualities of dolomitic water areas may not be updated since last assessments done in early 2000.	Review of information generated through DWA and other monitoring programmes.
Data for most of the wetlands clusters is limited	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.

6 CONCLUSIONS ON INFORMATION APPLICABILITY AND ADEQUACY FOR RQOS STUDY

From the information analysis that has been undertaken on understanding the availability, accessibility and usefulness of the information and data sources applicable to the Middle Vaal WMA that is required for the Determination of RQOs, it is evident that sufficient data does exist WMA to enable the delineation of RUs and the setting up of the RQOs.
However it is envisaged that some constraints maybe experienced during Step 5, with respect to the present state data required for the sub-components and indicators.

It can be concluded that the Middle Vaal WMA is part of a well-studied system 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 to successfully undertake the RQO development study.

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