

**CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN
THE MOKOLO AND MATLABAS CATCHMENT: LIMPOPO
WATER MANAGEMENT AREA (WMA) AND CROCODILE
(WEST) AND MARICO WMA: WP 10506**

**INFORMATION ANALYSIS REPORT: MOKOLO AND
MATLABAS CATCHMENTS: LIMPOPO WMA**

FINAL

REPORT NO: RDM/WMA1,3/00/CON/CLA/0112B

Directorate: Water Resource Classification

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**CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN THE MOKOLO CATCHMENT:
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WP 10506:** Information Analysis Report: Mokolo and Matlabas catchments: Limpopo WMA. Report No:
RDM/WMA1,3/00/CON/CLA/0112B

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EXECUTIVE SUMMARY

Thorough preparatory work, understanding of the status quo and information availability of the Mokolo and Matlabas catchments: Limpopo WMA is needed to effectively classify the significant water resources of the study area. The information analysis task was designed, as part of the study, to provide an analysis of the available water resource related data and information for the Mokolo and Matlabas catchments: Limpopo WMA in terms of water resource quality, ecological water requirements, hydrology, water quality and socio-economics. This information analysis task has been undertaken in compliance with the requirements of the study terms of reference that specify that the classification process is required to build from existing and current initiatives undertaken in support of integrated water resource management (IWRM). 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 classification process are met, and if not, what the gaps are.

For successful implementation of the Water Resource Classification System (WRCS) in the Mokolo and Matlabas catchment it is critical at the outset of the project to determine whether there is any key information that is outstanding. An information review has been undertaken and the outcomes of this are captured in this report. Previous studies undertaken for the Mokolo and Matlabas catchments have been sourced and reviewed. For parallel studies communication mechanisms will be established with other study teams to ensure ongoing liaison. These will be maintained to ensure that the transfer of information, data and reports takes place.

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

The task was undertaken as follows and is detailed in the sub sections of this report:

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

DOCUMENT INDEX

Reports as part of this study:

Bold type indicates this report.

Report Index	Report number	Report title
1	RDM/WMA1,3/00/CON/CLA/0111	Inception Report
2	RDM/WMA1,3/00/CON/CLA/0112A	Information Analysis Report : Crocodile (West) Marico WMA
3	RDM/WMA1,3/00/CON/CLA/0112B	Information Analysis Report : Mokolo and Matlabas catchments: Limpopo WMA

LIST OF ABBREVIATIONS AND ACRONYMS

AMD	Acid Mine Drainage
CD: RDM	Chief Directorate: Resource Directed Measures
DAFF	Department of Agriculture, Forestry and Fisheries
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DBSA	Development Bank of South Africa
EC	Electrical Conductivity
EIS	Ecological importance and sensitivity
EMC	Ecological Management Class
EMF	Environmental Management Framework
ESBC	Ecologically Sustainable Base Configuration
EWR	Ecological Water Requirements
GRU	Groundwater Resource Units
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
RDM	Resource Directed Measures
RHP	River Health Programme
RO	Regional Office
RQOs	Resource Quality Objectives
RQS	Resource Quality Services
RWQOs	Resource Water Quality Objectives
SAM	Social Accounting Matrix
STATS SA	Statistics South Africa
TDS	Total Dissolved Salts
WMA	Water Management Area
WRC	Water Research Commission
WRCS	Water Resource Classification System

Classification of significant water resources in the Mokolo and Matlabas catchments: Limpopo Water Management Area (WMA 1): WP 10506		Information Analysis Report
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WRYM	Water Resources Yield model
WRPM	Water Resources Planning Model

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1 INTRODUCTION

The Mokolo catchment is situated in the Limpopo Province, it covers an area of 8 387 km². The catchment stretches from the Waterberg Mountains through the upper reaches of the Sand River, and includes the Mokolo Dam and a number of small tributaries that join the main Mokolo River up to its confluence with the Limpopo River, including the Tambotie River, Poer-se- Loop, and the Rietspruit River.

Currently, water availability and water use are in balance. However, within the provisions of the National Water Act as stipulated in the National Water Resources Strategy, there is a need to meet the water requirements of the Reserve (Basic Human Needs and Ecological) in terms of water quantity and quality. Taking these requirements into account there is insufficient water to maintain the current balance. Added to this, it is anticipated that water demand will increase with new developments in the Mokolo Catchment, such as new or expanded mining activities and new power stations.

The Mokolo catchment is the most developed in the Limpopo WMA and has more surface water available than any of the other catchment in the WMA. Apart from the higher than average rainfall, the large Mokolo Dam is situated in this catchment, which provides water for a multitude of uses, the most important being the supply to the Matimba Power Station and Grootgeluk coal mine.

Water use in the catchment broadly comprises of 87% for agricultural activities and 13% for the industrial, mining, power generation and domestic water supply service sectors (municipalities). Irrigation is the largest present water user here. The area contributes significantly towards agricultural activity in the province, with produce including tobacco, sorghum, maize and sunflower. There are a large number of farm dams in the Mokolo catchment which has effectively moved much of the yield of the Mokolo Dam upstream where it is used to supply large areas of irrigation, with an estimated requirement of 68m³/annum. There is also a significant amount of irrigation from groundwater

The Mokolo catchment is a well developed catchment with industries, mines and extensive agricultural activities. The main industrial development relates to Eskom's Matimba Power Station. Associated with this power station is the Grootgeluk Coal Mine which supplies coal to the power station, local users, as well as for export. There are opportunities for further development of the substantial coal reserves and gas fields and other coal based industries and related development. The only towns of significance are Lephalale, Alma, and Vaalwater within the catchment (Figure 1).

The Matlabas catchment is a largely undeveloped catchment with limited water resources and limited water use. The area covers approximately 6 014 km². The catchment is dry with non-perennial flow and hence no sustainable yield from surface water. The limited water use in this catchment is mostly from groundwater, which is under-exploited.

There are no significant dams in this catchment and a significant portion of the water use is from groundwater due to the low assurance of the run-off-river yields. New allocations in the Matlabas catchment can only be made from groundwater or from additional yield which could conceivably be created by the construction of farm dams.

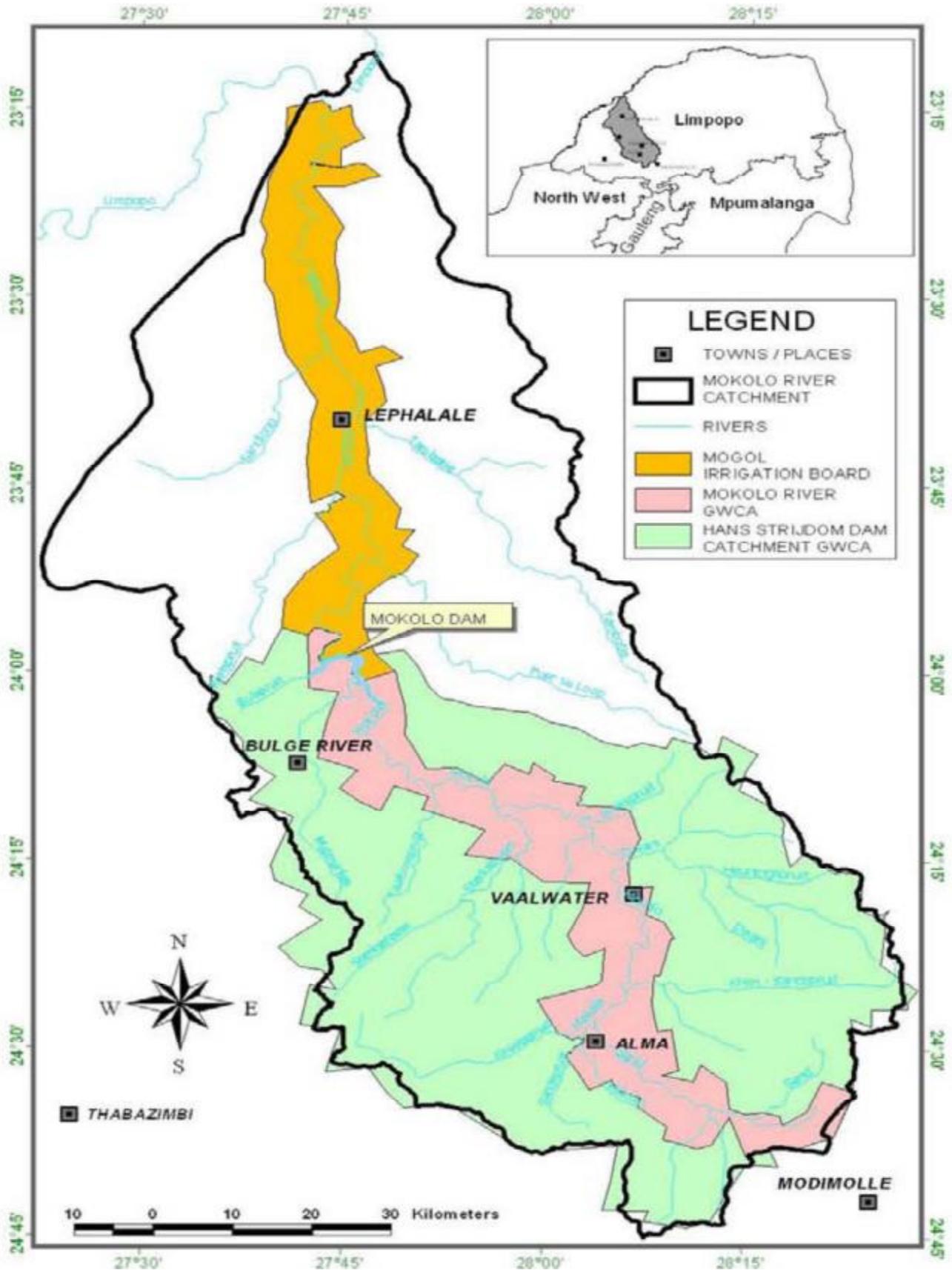


Figure 1: Map showing Mokolo catchment Limpopo WMA (Intermediate Reserve Determination Study, June 2010)

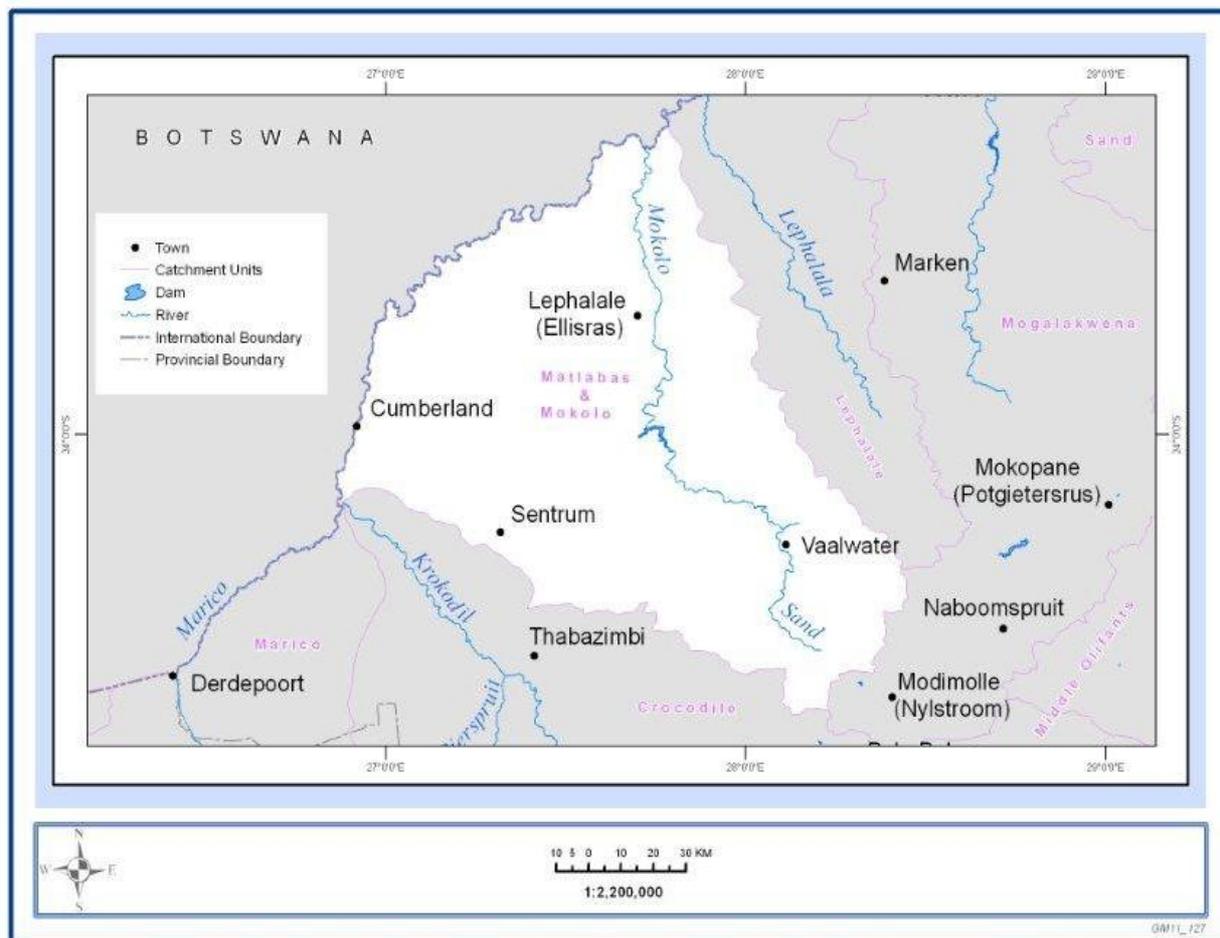


Figure 2: Map showing Matlabas catchment: Limpopo WMA (Intermediate Reserve Determination Study, June 2010)

2 CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN THE MOKOLO CATCHMENT (LIMPOPO WATER MANAGEMENT AREA)

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). As part of the RDM, a management class (MC) has to be determined for a significant water resource, as the means to ensure a desired level of protection. The purpose of the MC is to establish clear goals relating to the quantity and quality of the relevant water resource.

The classification system, the Reserve and 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 Chief Directorate: Resource Directed Measures (CD: RDM) of the Department of Water Affairs

(DWA) is tasked with the responsibility of ensuring that the water resources are classified in terms of the Water Resource Classification System (WRCS) 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 CD: RDM has identified the need to undertake the classification of significant water resources (rivers, wetlands, groundwater and lakes) in the Mokolo and Matlabas catchments: Limpopo Water Management Area (WMA) and Crocodile (West) and Marico WMA in accordance with the WRCS.

The MC and associated resource quality objectives (RQOs) will assist the DWA make more informed decisions regarding the authorisation of future water uses, operation and management of the system and the evaluation of the magnitude of the impacts of the present and proposed developments.

The purpose of this study is to coordinate the implementation of the 7 step process of the WRCS to classify all significant water resources in the Mokolo and Matlabas catchments: Limpopo WMA in order to determine a suitable MC for the relevant water resources and in so doing deliver the IWRM template with recommendations for presentation to the delegated authority.

The determination of the MC is necessary to facilitate a balance between protection and use of water resources. In determining the class, it is important to recognise that different water resources will require different levels of protection. In addition to achieving ecological sustainability of the significant water resources through classification, the process will allow consideration of the social and economic needs of competing interests by all who rely on the water resources. The WRCS will be applied taking account of the local conditions, socio-economic imperatives and system dynamics within the context of the South African situation. The process will also require a wide range of complex trade-offs to be assessed and evaluated at a number of scales.

There study approach for the determination of the MC includes:

- An assessment of the Mokolo and Matlabas catchments to understand the status quo in regard to water resource issues such as water resource quality, existing monitoring programmes, infrastructure, institutional environment, socio-economics and sectoral water uses and users.
- The delineation of the WMA into integrated units of analysis (IUAs) is based on identified criteria and system understanding and characteristics;
- The application of the WRCS within each IUA, *i.e.* establishing the MC by integration of the economic, social and ecological goals through a suitable analytical decision-making system (trade-offs); and
- Population of the classification templates.

The study approach is defined by 6 tasks depicted in Figure 3.

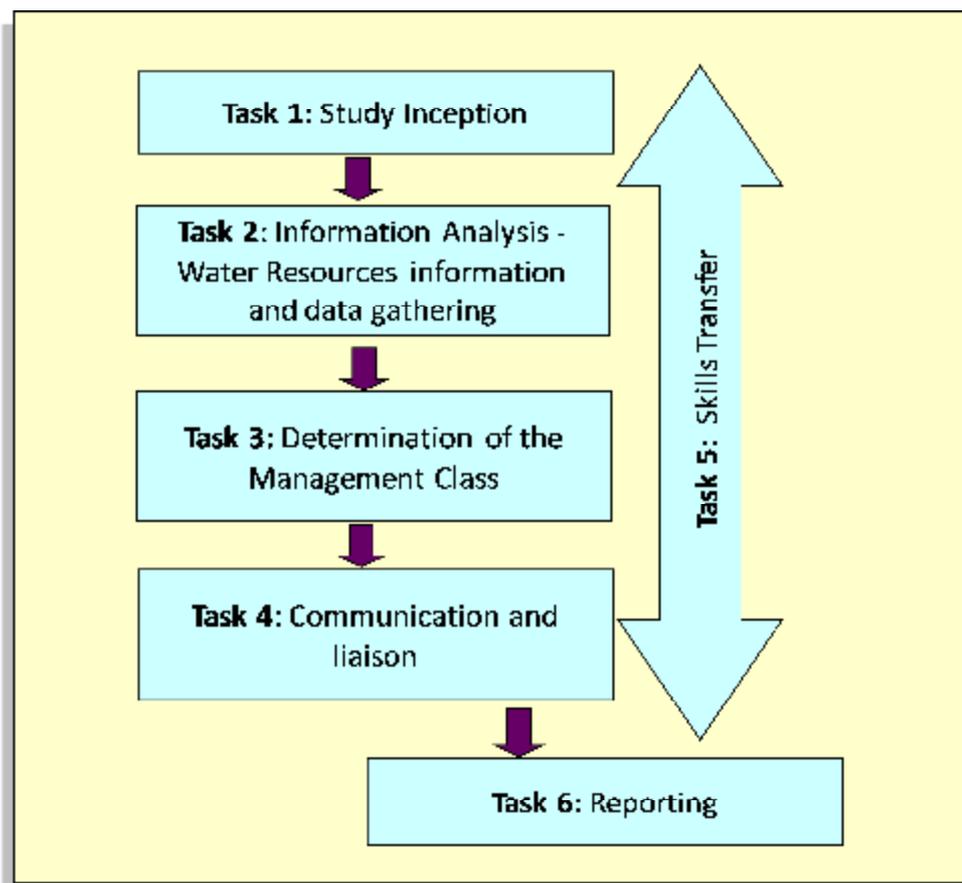


Figure 3: The study tasks

2.1 THE INFORMATION ANALYSIS TASK

In order that the Department is able to effectively classify the significant water resources of the Mokolo and Matlabas catchments a thorough understanding of the status quo and information availability of the catchment is needed to determine existing situation. The determination of the MC and application of the WRCS task is preceded by an information and data gathering component which supports the state of knowledge that is needed for the implementation of the classification process steps. The state of knowledge required involves the review and assessment of existing and parallel studies, data, information, reports, models, etc., that will form the departure point from where further analysis can proceed.

This scoping task is therefore focussed on understanding the availability, accessibility and usefulness of the information and data sources applicable to the Mokolo and Matlabas catchments that is required for the implementation of the WRCS.

2.2 SPATIAL EXTENT OF STUDY

The spatial extent for the classification study of Mokolo and Matlabas includes tertiary drainage regions A41 and A42. Matlabas catchment (A41) includes quaternary catchments A41A-A41E and Mokolo catchment is comprised of the following quaternary sub-catchments::

- Alma sub-area, which comprises the Alma area (A42A to A42C).

- Vaalwater sub-area, which comprises the upper Mokolo River upstream from the Mokolo Dam excluding the Alma area (A42D to A42F).
- Lephalale sub-area, which comprises the lower Mokolo River downstream from the Mokolo Dam to the confluence with the Limpopo River (A42G to A42J).

The study area is depicted in Figure 4 and is shown by the red outlined block to the north of the Crocodile (West) and Marico WMA.

2.3 OBJECTIVES OF THE INFORMATION ANALYSIS TASK

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 Mokolo and Matlabas catchments in terms of water resource quality, ecological water requirements, hydrology, water quality and socio-economics. 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 classification process are met and if not what are the gaps that are present.

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, economics data, water use information, etc.);
- To assess the status of parallel studies to determine the information availability and relation to the Mokolo study classification 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 classification of significant water resources in the Mokolo and Matlabas catchments.

2.4 PURPOSE OF THE REPORT

The purpose of the 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.

3 INFORMATION ANALYSIS

This study is almost entirely reliant on existing results and information from previous studies or soon to be made available information and results from parallel studies. Information analysis is therefore focussed on understanding the availability, accessibility and usefulness of the information and data sources applicable to the Mokolo catchment that is required for the implementation of the WRCS. It is critical to determine if any key information is outstanding or absent. Previous studies undertaken for the Mokolo and Matlabas catchments, including water resource planning, Reserve determination, water quality, socio-economic, augmentation and reconciliation strategies and specific detailed studies for WMA sub-areas have been sourced and reviewed. For parallel studies ongoing liaison must be established with other study teams and maintained to ensure transfer of information, data and reports takes place. This task has also included the assessing of the models that are to be used for the classification of the water resources in the Mokolo and Matlabas catchments.

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 Mokolo and Matlabas catchments: Limpopo WMA:

- Identification and review of key studies
- 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.
- Grouping of relevant information sources
- Mitigation measures in terms of identified risks.

In terms of the analysis, the assessment criteria applied to the study/information/data review comprised of the *information requirements* of each of the seven steps of the WRCS (as per the classification Guidelines); as applicable/relevant to the Mokolo and Matlabas catchments: Limpopo WMA, summarised in **Error! Reference source not found.**

Table 1: Information requirements of each of the 7 steps of WRCS

Information Requirements	WRCS Component Supported	WRCS Step
Water quality, water quantity, ecological status, resource quality baseline information. Water use allocation data. Status of infrastructure. Spatial data. Ecological Water Requirement (EWR) sites	<ul style="list-style-type: none"> • Status of the catchment significant water resources; • Delineation of IUAs; • Establishment of the network of significant water resources 	Step 1
Socio-economic data for the catchment (per IUA defined): Macro-economic data, micro-economic data; population information; land use information; social data	<ul style="list-style-type: none"> • Socio-economic status/socio-economic framework; • Social well-being; • Decision analysis framework; • Linking of the value and condition of the water resources 	Step 1, 2 and 5
Information/data on ecological condition of water resources	<ul style="list-style-type: none"> • Significant water resource network establishment; • Establishment of nodes; 	Step 1, 2 and 3
Ecosystem Goods, Services and Attributes (EGSAs) information/data; social data; water use data per sector per socio economic zone.	<ul style="list-style-type: none"> • Valuation of the use of the water; • Social well-being; • Linking of the value and condition of the water resources 	Step 2, 3 and 5
Biological and eco-regional information; hydrology data; water quality data; Ecological Importance and Sensitivity (EIS); Present Ecological Status (PES); Resources Directed Measures data; Ecological Water Requirement; Conservation data and information	<ul style="list-style-type: none"> • Status of the catchment significant water resources • Delineation of IUAs; • Establishment of the network of significant water resources • Quantification of the WR changes in the non-water quality EGSAs • Establishment of nodes; • Establishment of the Ecologically Sustainable Base Configuration Scenario (ESBC) • Establishment of RDM configuration scenarios • Evaluation of scenarios 	Step 1 to 5

Information Requirements	WRCS Component Supported	WRCS Step
Planning information (water requirements/needs)	<ul style="list-style-type: none"> Establishment of the Ecologically Sustainable Base Configuration Scenario (ESBC) 	Step 4
Water Resources Yield Model (water yield data)	<ul style="list-style-type: none"> Quantification of the EWR changes in non-water quality EGSAs Establishment of the Ecologically Sustainable Base Configuration Scenario (ESBC) Evaluation of scenarios 	Step 3, 4 and 5

3.2 IDENTIFICATION AND REVIEW OF KEY STUDIES

Table 2 lists the relevant key studies that have been identified and reviewed as part of various previous studies undertaken in the Mokolo and Matlabas catchments: Limpopo WMA. Where identified the details of the reports/studies are to be consulted and used during the course of the study to support the information needs.

Table 2: Review of identified key studies undertaken in the Crocodile West-Marico WMA of relevance to the Classification study

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
1	Limpopo Water Management Area: Overview of water resources availability and utilisation.	Prepared by AJ van Vuuren, H Jordaan and E van der Walt for Department of Water Affairs, Pretoria, South Africa. 2003	The report gives a general description , current and expected future ware requirements in the Limpopo water management area; <ul style="list-style-type: none"> its natural characteristics, national perspective economic activity and population water requirements water resources reconciliation of requirements and availability 	The study provides a good baseline information on the Mokolo catchment for the status quo assessment and understanding the catchment	The water availability and utilisation information will have to be updated for the Mokolo catchment classification study
2	Limpopo Water Management Area: Water Resources Situation Analysis.	Conningarth Economists, in association with In Association with Naledi Development Restructured (Pty) Ltd and Tlou Consulting (Pty) Ltd on behalf of the Directorate: Water Resources Planning. 2003	The study was done as a desktop investigation using data from water resource planning reports, associated studies, local authority and DWA. It gives a brief overview on the; <ul style="list-style-type: none"> Physical characteristics of the WMA development status Water related infrastructure (Mokolo regional water supply scheme) Water requirements for ecological component of the Reserve, Water resources and groundwater use and potential for further development, Water balance Cost of water resources development 	The study provides baseline information which will be used in understanding the Mokolo catchment situation in terms of water requirements by the users STEP 1	The water availability and utilisation information will have to be updated for the Most recent water use and requirement information is required for Mokolo catchment Classification study
3	River Health Programme. State-of-Rivers Report: The Mokolo River System.	Department of Environmental Affairs and Tourism, Pretoria. ISBN No. 978-0-620-38215-1 (2006)	The report is based on assessing the condition of biological communities of rivers (such as fish, aquatic invertebrates and riparian vegetation) as well as river habitats to provide an integrated measure of the integrity or health of river	The report is a good reference for the state of the aquatic health of the Mokolo river system. Its provides the indices for; <ul style="list-style-type: none"> ecoregions and river 	The results of the assessment although useful it may be that the habitat may have been altered since then due to current activities within

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
			systems. The Mokolo river system was divided into six ecological study units, based on catchments, ecoregions, river and tributary importance from an ecological and land-use perspective and available information. Then 31 biomonitoring sites were selected and then assessed using standard River Health Programme (RHP) biomonitoring protocols. The present ecological state of the Mokolo River Catchment was found to be predominantly in a Fair to Good Ecological Class in 2006	characteristics <ul style="list-style-type: none"> • The present ecological state for each ecoregions • Drivers of ecological change and • The desired ecological state STEP 1, 2, 3,	the Mokolo catchment
4	Internal Strategic Perspective: Limpopo Water Management Area	Goba Moahloli Keeve Steyn (Pty) Ltd, in association with Tlou & Matji (Pty) Ltd and Golder Associates (Pty) Ltd. on behalf of the Directorate: National Water Resource Planning. Report No. P WMA 01/000/00/0304. 2004	The ISP for the Limpopo WMA provides a framework for DWA's management of water resources. On overview on water availability, water requirements, water quality and future scenarios for the number of planned developments within each catchment. It details strategies for water resource management and related issues in the WMA	The report provides good background of the water resources situation in the Mokolo catchment. STEP 1	The report is only a DWA internal perspective.
	Economic Boom Strains Waterberg Resource	The Water Wheel November/December 2006	The short communication is about economic developments that will occur in the catchments and the expected increased demand for water resources I give a summary of several options to augment water resources within the Mokolo River Catchment, in Limpopo, in anticipation of a surge in economic development in the area.	The report provides good background of the water resources situation in the Mokolo catchment. STEP 1, 2, 5	Not enough detail is provided to because it is a short communication.
5	The Mokolo River Catchment: Validation	Department Of Water Affairs and Forestry,	The study was aimed at the validating registered water users to manage and control the water	The report provides good background of	-

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
	of the Existing Lawful Use of Water	Directorate: National Water Resource Planning (2007)	resources because the lack of leads to over allocation and unfair use of water. The information compiled was used to verify lawful water user from unregistered water users. The Mokolo River catchment is currently in balance based on the available information but there are a number of planned developments that will require additional water resources. The Mokolo Dam situated in the catchment is not performing satisfactorily due to the alleged possible over abstraction by water users.	lawful water users in the Mokolo catchment. STEP 1, 4	
6	Status on monitoring and Surface water level trends.	D Viljoen for Department of Water Affairs, Water Resource Information, and Limpopo Province, South Africa. 2009.	The purpose of the study was to assess storage levels in dams in the Limpopo province and to give a broader picture of water storage and status in the sub drainage catchments. The Mokolo Dam was used as no other dam exists in the A4 hydrological monitoring network.	The report will be relevant for the water resources baseline information and water quantity data. STEP 1,2	
7	Adopt-a-River Programme Phase II: Development of an Implementation Plan. Water Resource Quality Situation Assessment.	H. Hendriks and J.N. Rossouw for Department of Water Affairs, Pretoria, South Africa. 2009.	This study gives a brief overview of the developments within the Mokolo River Catchment such as industries, mines and extensive agricultural activities. A summary of water resource quality issues and concerns such as; water quantity, water quality issues and aquatic ecosystem health issues. The greatest impacts of concern are centred on the current and future areas of coal mining, power generation, and related activities.	The report will be relevant for the water resources baseline information STEP 1, 2	

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
8	Intermediate Reserve Determination Study for the Surface and Groundwater Resources in the Mokolo Catchment, Limpopo Province: Main Report.	Compiled by Delana Louw, Rivers for Africa. Report no. 26/8/3/10/14/014. Department of Water Affairs, South Africa. (DWA) 2010.	RDM identified the Mokolo River catchment in the Limpopo Province as requiring an intermediate Reserve assessment due to proposed developments (particularly in the mining and power generation sectors) and the associated increased water demands in the catchment.	The study resulted in EWRs and the study will be useful in classification process. STEP 1, 2, 3, 4	-
9	Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) - Phase 1: Augment Supply from Mokolo Dam - Amended Plan of Study for Environmental Impact Assessment – MCWAP Phase 1	Compiled by D. Henning of Nemaï Consultants (Pty) Ltd behalf of the Directorate: Integrated Water Resources Planning. 2010	The report is a plan of study for the EIA report on the proposed project. It highlights the potential issues or impacts which were identified during the scoping phase of the augmentation project. It details a plan on how the project managers plan to mitigate the impacts, have identified specialist to do studies on the terrestrial and aquatic ecology, socio-economics, social impact, Heritage impact assessment, social impact assessment in relation to the study area and the project. All the specialist studies will be part of the EIA report	The report will be relevant for the water resources baseline information. Any potential impacts the classification study area will have to be considered. STEP 1, 2	-
10	MCWAP PHASE 1: Wetlands & Watercourse Survey	Compiled by Matthew and Tahla Ross Henning of Nemaï Consulting. 2010	The report assessed the watercourse crossings for the Phase 1 pipeline indicated in the 1:50000 topological maps and the potential impacts of the pipeline crossing each point.	The report will be relevant for the water resources baseline information. Any potential impacts the classification study area will have to be considered. STEP 1, 2	-
11	MCWAP PHASE 1: Draft Social Impact	Prepared by Dr. Neville Bews & Associate and	The report assesses the negative impacts associated with the activities of the Project. The	The report will be relevant for the water	

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
	Assessment Draft Report	submitted to Nema Consulting.DEA Reference Number: 12/12/20/1465. 2010	social impacts such as access issues, crime and security, job creation, relocation, SMME opportunities, HIV and AIDS risk, fencing, dust, pollutants and possible alternatives on how these impacts can be minimised	resources baseline information. Any potential impacts the classification study area will have to be considered for the report on the socio-economic situation of the study area. STEP 1, 2	
12	Economic Impact Assessment of the Proposed Mokolo River Water Augmentation Project- Draft 1:	Conningarth Economists, in association with In Association with Naledi Development Restructured (Pty) Ltd and Tlou Consulting (Pty) Ltd on behalf of the Directorate: Option Analysis. 2010	The report was done to determine the specific local and regional economic and socio-economic impacts of the augmentation option. It investigated the expected impact of population growth trend in the catchment area and the urban developments around the dam.	The report will be relevant for the water resources baseline information. Any potential impacts the classification study area will have to be considered for the report on the socio-economic situation of the study area. STEP 1, 2	
13	MCWAP PHASE 1: COMMENTS & RESPONSE REPORT	Nema Consulting.2010	The Comments and Response Report summarizes the salient issues and queries raised, as well as statements made, by I&APs during the Scoping and Environmental Impact Assessment Process.	Identification of stake holders for the classification process	
14	Investigation of potential water quality and quantity impacts	M Bester and P. D. Vermeulen. 2010. Water SA Vol. 36 No. 5	The report investigated gives a brief background on the groundwater resources of the Waterberg coalfields study area which includes the Mokolo river. The different aquifers in the study are, pre-	The report will be relevant for the water resources baseline information. Any	

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
	<p>associated with mining of the shallow Waterberg coal reserves,</p> <p>west of the Daarby Fault, Limpopo Province, South Africa</p>		<p>mining water quantity and quality of water resources associated with the Waterberg Coalfield. It is predicted that the mining in the area will have a great impact on the groundwater quality and quantity, and that careful monitoring is needed to ensure that a balance is maintained..The small volumes of water that is available in the study area will be reduced by the excavation of new mines.</p>	<p>potential impacts the classification study area will have to be considered. The water quality information will be useful for the EWRs study in step 3</p> <p>STEP 1, 3</p>	
15	<p>Scoping level assessment of how water quality and quantity will be affected by mining</p> <p>method and mining of the shallow Waterberg coal reserves west of the Daarby fault.</p>	<p>PD Vermeulen, M Bester, L-M Cruywagen and GJ van Tonder, for Water Research Commission</p> <p>January. 2011.</p> <p>WRC Report No. 1830/1/10</p>	<p>The report is a comprehensive version on the investigated on the groundwater resources of the Waterberg coalfields study. It has details on the methodology used in the study, background on the different types of mining operations occurring in the area, information on groundwater management in the Waterberg Coalfields, overall conclusions and recommendations and the groundwater quality and quantity</p>	<p>The report will be relevant for the water resources baseline information. Any potential impacts the classification study area will have to be considered. The water quality information will be useful for the EWRs study in step 3</p> <p>STEP 1, 3</p>	
16	<p>An overview of the impact of mining and Mineral processing operations on Water resources and water quality In the Zambezi, Limpopo and Olifants catchments in Southern Africa</p>	<p>Ashton, P.J., D. Love, H. Mahachi, P.H.G.M. Dirks (2001). Project, by CSIR Environmentek, Pretoria, South Africa and Geology Department, University of Zimbabwe, Harare,</p>	<p>The report gives an over view of the Limpopo Basin sub catchments. Summary of impacts of mining operations on water resources and water quality in the area.</p>	<p>The report will be relevant for the water resources baseline information. Any potential impacts the classification study area will have to be considered.</p> <p>STEP 1, 2</p>	

No	Report Title	Report Details	Brief Summary	Applicability to Mokolo Classification study	Possible Limitations
		Zimbabwe. Report No. ENV-P-C 2001-042. xvi + 336 pp			
17	Environmental Management Framework for the Waterberg District: DRAFT Desired State Report	Environomics Environmental Consultants and NRM Consulting. Report number: 2010/014/PC019. July 2010	This report is a draft report around what should be achieved in the district in terms of the future desired state of the environment. The report includes the a summary of the desired state of the environment as expressed by stakeholders and the public a sensitivity analysis of environmental factors and the preliminary identification of potential environmental management zones and their desired state of the environment.	The report will be relevant for the water resources baseline information. Any potential impacts the classification study area will have to be considered. STEP 1, 2	

3.3 INFORMATION REQUIRED FROM PARALLEL STUDIES

Table 3 lists the relevant information and reports from parallel studies that will support the information needs for the classification study in the Mokolo and Matlabas catchments.

Table 3: Parallel studies underway in the Mokolo catchment: Limpopo WMA that support the information needs of the Classification study

No	Study underway	Information Source	Information needs supported	Status of information	Possible Risk
1	Economic Impact Assessment of the Proposed Mokolo River Water Augmentation Project	DWA, Directorate: Option Analysis	Economic Impact Assessment of the Proposed Mokolo River Water Augmentation Project final report	In the process of being collated	Delay of the report could impact on the Classification study programme
2	Draft Social Impact Assessment Proposed Mokolo River Water Augmentation Project	DWA, Directorate: Option Analysis	Social Impact Assessment of the Proposed Mokolo River Water Augmentation Project final report	In the process of being collated	Delay of the report could impact on the Classification study programme
3	Mokolo and Crocodile River (West) Water Augmentation Project (MCWAP) Phase 1: Augment Supply from Mokolo Dam Environmental Impact Assessment - MCWAP Phase 1	DWA, Directorate: Integrated Water Resources Planning.	Environmental Impact Assessment of the Proposed Mokolo River Water Augmentation Project final report	In the process of being collated	Delay of the report could impact on the Classification study programme
4	Review and update of the 1999 EIS and PES of South African Rivers including expansion to priority tributaries and wetlands according to quaternary catchments	DWA Chief Directorate: RDM	Updated PES/EIS for all sub-quaternary catchments in Croc West Marico. Identification of nodes.	Report still under review	Delay in the WRC study.

3.4 RELEVANT/INFORMATION DATA SOURCES

Data and information available from various sources is required to undertake the classification of significant water resources in the study area. These sources will form data inputs or base information to various steps in the classification process. The data/information required is at various stages of collation. Table 4 outlines the data and information sources, the status of collation and their applicability to the classification process. Sections 3.4.1 to 0 describe the requirements further.

Table 4: Data sources supporting information needs of study

Data required	Status of Collation	Applicability to process
Key previous studies applicable to the Mokolo and Matlabas catchments	Obtained (see Table 1)	Status quo description; IUA delineation; establishment of network of significant water resources
Updated hydrology for the Mokolo and Matlabas catchments	To be sourced	Required for the WRPM/WRYM - to be used in determining flows at the node, for the EBSC and the scenario assessment (socio-economic)
Updated water quality data and information from the Water Management System of the Department.	Obtainable from WMS	Required for the EBSC and scenario assessment
NFEPA maps, shapefiles and metadata	Obtained	Status quo description; IUA delineation; establishment of network of significant water resources
Ecological Water Requirements (Information, data, models, indices)	To be sourced from D:RR	Required for ecological water requirements determination, for the ESBC and the assessment of scenarios
PES/EIS Updated – Excel database for the Mokolo and Matlabas catchments	Still under review by D:RR	Required for delineating IUAs and significant water resources and determination of nodes and sub-nodes
The value of aquatic ecosystem services of the Mokolo catchment	Information available from the Intermediate Reserve Determination Study	To be used in socio-economic decision-analysis framework development and in assessment
Yield Model	Obtained	Required for the quantification of the EWR changes in non-water quality EGSA's; establishment of the ESBC and evaluation of scenarios

Data required	Status of Collation	Applicability to process
Water Resources Planning Model (which includes water demands, future requirements)	Obtained	Required for the WRPM/WRYM - to be used in determining flows at the node, for the EBSC and the scenario assessment (socio-economic)
Land use, population data, socio-economic data and related information from Stats SA	Land use data obtained	To be used in socio-economic decision-analysis framework development and in assessment
Statistics SA's Water Resource Accounts	Data available as per WMA not catchment	To be used in socio-economic decision-analysis framework development and in assessment
The Millennium Ecosystems Assessment framework of ecosystem services	Data available as a National framework	To be used in determination / identification of ecosystem system services of value
Best practice resource economics	To be sourced	To support socio-economic decision-analysis framework and methodology development and in assessment of scenarios
Social accounting analyses	Data available for the Limpopo province not the catchment	To be used in socio-economic decision-analysis framework and methodology development
The Social Accounting Matrix (SAM) models of the Development Bank of South Africa (DBSA)	Data available for the Limpopo province not the catchment	To be used in socio-economic decision-analysis framework and methodology development
River Health Programme Studies: Mokolo River	Obtained, the information may be outdated	To enhance data collected for the Reserve determination and PES/EIS

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.

3.4.1 Hydrology

Updated hydrological information is required, together with the hydraulic profiles and biotic information and models. The information is obtainable from the Intermediate Reserve Determination study of Mokolo catchment. Updated geohydrology information is obtainable from the Groundwater Reserve Determination study of the Limpopo WMA.

3.4.2 Water Quality

The Department of Water Affairs (DWA) Resource Quality Services (RQS) water quality database will be used as the source of the water quality data for this analysis. Some further data sources will be investigated to obtain additional water quality monitoring data such as those of the local municipalities and irrigation boards. This data will be useful in understanding local sub-catchment

water quality status and related impacts.

A challenge posed for the classification study is the determination of the water quality status at more remote sites where no monitoring is currently undertaken.

All the DWA long term monitoring sites include the monitoring of electrical conductivity, pH, the major ions (Mg^+ , Na^+ , Ca^+ , K^+ , SO_4^- and Cl^-), total alkalinity and nutrients (PO_4-P , NH_3 , NO_2 , NO_3).

There appear to be only two monitoring points in this area:

- A4H014; and
- A4H013Q01.

(a) Reserve determination study

The results from the Intermediate Reserve Determination will form the basis of the ecological information and data to be used during the classification process. Table 5 summarises the EWR sites in the Mokolo catchment.

Table 5: Summary of EWR sites for the Mokolo catchment

EWR site	River: Site name	Quaternary catchment	PES	Coordinates	Level of determination
Mokolo River system					
1a	Mokolo: Vaalwater	A42C	C/D	S24 17.362 E28 05.544	Intermediate
1b	Mokolo: Tobacco	A42E	B/C	S24 10.697 E27 58.661	Intermediate
2	Mokolo: Ka'ingo	A42F	B/C	S24 03.897 E27 47.230	Intermediate
3	Mokolo: Gorge	A42G	B/C	S23 58.080 E27 43.614	Intermediate
4	Mokolo: Malalatau	A42G	C	S23 46.272 E27 45.315	Intermediate
5	Mokolo: Tambotie floodplain	A42G	D	N/A	-

This information will be utilized to identify the final set of rivers where additional field work needs to be undertaken if estimation and/or extrapolations can't be undertaken using existing EWR site information.

Estimation was used to determine the EWRs at the various hydronodes identified for the Mokolo catchment, using the existing EWR sites from the intermediate Reserve determination study. Table 6 provides the details of the sites that were used for each of the quaternaries to estimate the EWRs at the selected hydronodes for the various tributaries of the Mokolo River. The information

for these hydronodes is available as rule and summary tables to be used during the classification process.

Table 6: Estimation undertaken for the Mokolo catchment

Quaternary catchment	Site nr	River	Coordinates
A42A	1	Sand	-24.65283; 28.231
A42B	2XSA/2XSB	Renosterbosspuit	-24.50804; 27.86574
A42D	9	Frikkie-se-Loop	-24.31397; 27.95724
A42D	10	Sterk	-24.30554; 27.89699
A42E	11	Klein Vaalrivierspruit	-24.21941; 28.05363
A42E	6	Jim-se-Loop	-24.27184; 28.20002
A42E	4	Upper Dwars	-24.26661; 28.21718
A42E	5XSA/5XSB	Lower Dwars	-24.26736; 28.21873
A42F	8	Taaibos	-24 11.128; 27 51.673
A42H	7XSB	Tambotie	-23.81291; 27.94885

The Present Ecological State (PES) as determined during the Reserve studies will be compared to the updated desktop PES categories for all of the catchments if available.

Matlabas River has non-perennial flow hence no sustainable yield from surface water; as such emphasis should be based on groundwater rather than surface water. The results from the Determination of the Groundwater Component of the Reserve study (2011) will provide valuable input, such as the groundwater contribution to EWR information, towards the classification process. Table 7 summarises the groundwater Reserve for Matlabas catchment.

Table 7: Groundwater Reserve summary for Matlabas catchment (2011)

Description	Groundwater Resource Unit (GRU)	Area (Km ²)	Recharge Mm ³	GW to Baseflow Mm ³	BHN Mm ³	Reserve Mm ³	Reserve as % of Recharge
Upper Matlabas	A41-1	1050	25.53	6.33	0.11	6.44	25%
Lower Matlabas	A41-2	3024	29.95	1.16	0.12	1.28	4%
Steenbokpan	A41-3	1940	12.41	0.35	0.07	0.42	3%

3.4.3 Socio-economics

Building on Prime Africa's work on the socio-economic component of the Olifants WRCS, most of the information required for the socio-economic analysis is gathered from sources other than the reports published by DWA. This section provides a detailed list of the information categories generally required in a study of this nature.

Social data comes primarily from the StatsSA 2001 Ward Census Data. While this data may be fairly out-dated, results from the recently conducted 2011 Census are not yet available. Information to be used from this database will include the following:

- Household income;
- Household sanitation;
- Household water services;
- Person by labour employment;
- Person by labour industry; and
- Person by labour occupation.

The underlying data from the DWA (2009) report entitled: "Development of Water Reconciliation Strategies for All Towns in the Central Region: Demographic Scenario Report" will also be utilised.

Water quality data

A large component of the socio-economic study would be to quantify the water quality impacts on the economic sectors directly dependent on water resources in the WMA. The main activities within the Mokolo Catchment are mining, agriculture, light industries, urban development, rural settlements and tourism. These activities will impact on the water quality of receiving water bodies as point and non-point sources of pollution.

In order to estimate the cost of the decline in water quality due to these activities the following data and information is required:

- Physical data: the flow (expressed as MAR) of the river system at EWR sites;
- Physical data: the loading of specifically identified water quality indicators at EWR sites;
- Spatial data: in order to identify specific activities downstream of EWR sites;
- Other data: volumes of effluents and concentrations of water quality indicators in effluents of waste water treatment works within the study area;
- Economic data: using the load model and the marginal cost of abatement model as developed for the Olifants WMA.

Mining Data

Data will be collected from the Chamber of Mines, The Department of Mineral Resources (DMR), Statistics SA and the Council for Geoscience. Published annual reports of mining companies in the WMA will be sourced. Information on mining will be sourced from various DWA published reports, including:

- Scoping level assessment of how water quality and quantity will be affected by mining method and mining of the shallow Waterberg coal reserves west of the Daarby Fault. 2011. WRC.

A meeting will be held with the Chamber of Mines in order to gather information regarding possible mining expansions and trajectories.

Data Gaps

Data for mining production is aggregated on a National and Provincial level, so it is difficult to make assumptions on a WMA scale. The Council of Geosciences has spatial data that may be of use to the study, but there is a cost associated with the data, which may be prohibitive. A quote is available on request.

Agricultural Data

Output for the agricultural sector will be calculated from several sources:

- Total area of dryland, irrigated and subsistence for each integrated unit of analysis (IUA) will be calculated using the Land Cover Database developed by the CSIR (2001). Although the database is a decade old, it is reliable source of data and has been used as a baseline for several studies;
- Further area estimates will be calculated from the Stats SA Agricultural Census of 2002. Results from the Stats SA Agricultural Census of 2010 will be utilised if completed by Stats SA; and
- Discussions with Department of Agriculture, Forestry and Fisheries (DAFF).

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 conservation 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) and the Water Resources Yield Model (WRYM) for the Mokolo catchment of the DWA, Directorate National Water Resource Planning will be relied upon to determine and ESBC.

3.6 OTHER

Data available from the River Health Programme (RHP), the NFEPA project, WMS, water quality assessments and the updated PES, EI and ES (current study) will be used to populate the models during the specialist workshop to evaluate the ESBC scenarios.

This information will enhance the data collected for the Intermediate Reserve determination study and will assist the specialist to make recommendations on more current data.

4 IDENTIFICATION OF POTENTIAL INFORMATION GAPS

In terms of the information analysis undertaken key information gaps that have been identified for the study relate to three aspects, *viz*:

- The hydrology component;

- The socio-economic component;
- To some extent to the water quality information; and
- Other supporting information

The gaps in information that are present are detailed below.

4.1 Hydrology

Updated hydrology information is required, together with the hydraulic profiles and biotic information and models. The information is obtainable from the Intermediate Reserve Determination study of Mokolo catchment. Geohydrology information is obtainable from the Groundwater Reserve Determination study of the Limpopo WMA.

4.2 Socio-Economic

In terms of the socio-economic information for the Mokolo and Matlabas catchments, social data comes primarily from the Stats SA 2001 Ward Census Data. While this data may be fairly outdated, the next Census took place in 2011 and it is hoped that this data will be available.

- Information to be used from this database will include the following:
- Household income;
- Household sanitation;
- Household water services;
- Person by labour employment;
- Person by labour industry; and
- Person by labour occupation.

4.3 Water quality

- The Department of Water Affairs (DWA) Resource Quality Services (RQS) water quality database will be used as the source of the water quality data for this analysis.
- Some further data sources will be investigated to obtain additional water quality monitoring data such as those of the local municipalities and irrigation boards. This data will be useful in understanding local sub-catchment water quality status and related impacts.
- A challenge posed for the classification study is the determination of the water quality status at more remote sites where no monitoring is currently undertaken.

4.4 Other Supporting information

- Water User sector information
- Infrastructure
- Environmental information
- Resource economics

5 CONCLUSIONS ON INFORMATION APPLICABILITY AND ADEQUACY FOR CLASSIFICATION 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 Mokolo and Matlabas catchments Limpopo WMA required for the implementation of the WRCS, it is evident that considerable data exists for the significant water resources within the Mokolo Catchment Limpopo WMA to enable an evaluation of changes in their ecological condition in response to changes in water related issues.

The Mokolo Catchment Limpopo WMA is well studied, thorough preparations have been made and it can be concluded that adequate, useful information as well as experts, with firsthand knowledge of the system for the implementation of the WRCS in the Mokolo catchment, are available. With regard to Matlabas catchment relatively few studies were conducted, therefore expert knowledge from specialists will be relied upon for the classification of water resources in the catchment.

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