Cover Page

Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10

MANAGEMENT CLASSES OF THE VAAL RIVER CATCHMENT REPORT:

Report number: RDM/WMA8,9,10/00/CON/CLA/0212

September 2012

(FINAL)

REFERENCE

This report is to be referred to in bibliographies as:

Department of Water Affairs, South Africa, September 2012. **Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10: Management Classes of the Vaal River Catchment Report**

Prepared by:

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Report No. RDM/WMA8,9,10/00/CON/CLA/0212

DOCUMENT INDEX

Reports as part of this project (report status as in September 2012):

Index number	RDM Report number	Report title
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1.2	RDM/WMA8,9,10/00/CON/CLA/0211	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
1.3	RDM/WMA8,9,10/00/CON/CLA/0311	Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10, Quantification of the Ecological Water Requirements
1.4	RDM/WMA8,9,10/00/CON/CLA/0411	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
1.5	RDM/WMA8,9,10/00/CON/CLA/0112	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
1.6	**RDM/WMA8,9,10/00/CON/CLA/0212**	**Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10, Management Classes of the Vaal River Catchment Report**

Bold indicates this report.

Title: ***Management Classes of the Vaal River Catchment Report***

Authors: *R Cloete, G Huggins, D Louw, S Koekemoer, W, Mullins, S Swart, P van Rooyen*

Study Name: ***Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10***

DWA Report No: *RDM/WMA8,9,10/00/CON/CLA/0212*

Status of Report: *FINAL*

First Issue: *August 2012*

Second Issue: ***-***

Final Issue: *September 2012*

Consultants: WRP Consulting Engineers (Pty) Ltd in association with DMM Development Consultants CC, Rivers for Africa eFlows Consulting (Pty) Ltd, Conningarth Economists, Koekemoer Aquatic Services and Zitholele Consulting (Pty) Ltd.

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Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10

Management Classes of the Vaal River Catchment Report

Executive Summary

1. PURPOSE OF THE STUDY

*This study entitled "Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10" was commissioned by the Chief Directorate Resource Directed Measures (RDM) of the Department of Water Affairs (DWA) in October 2010. The ultimate purpose of the study is the implementation of the Water Resource Classification System (WRCS) in the above-mentioned three Vaal WMAs according to the 7 step process proposed by the WRCS (**DWAF, 2007**). The WRCS, which is required by the National Water Act (Act 36 of 1998) is a consultative process to classify water resources (Classification Process) to help facilitate a balance between the protection and use of the nation's water resources.*

2. STUDY AREA

*The core of the study area consists of the Upper, Middle and Lower Vaal River Water Management Areas (WMAs), and comprises of the water resource and bulk supply systems of the entire Integrated Vaal River System (IVRS) as shown in **Appendix A.***

3. PURPOSE OF THIS REPORT

The purpose of this report is to present the Management Classes (MCs) and rationale for each IUAs within the Upper, Middle and Lower Vaal Water Management Areas (WMAs) and serves as the primary deliverable for this study.

4. STUDY APROACH WITHIN THE CONTEXT OF THE WRCS

The WRCS Steps have been completed in accordance with the requirements of the study terms of reference as well as the study execution plan presented in the Inception Report. Key elements of the study procedure that lead to the determination of the Management Classes are:

Step 1: *Integrated Units of Analysis (IUAs) for the three Vaal WMAs were finalised and within these areas 115 biophysical nodes were selected. The biophysical nodes included key biophysical nodes or Ecological Water Requirement (EWR) sites and additional biophysical nodes (referred to as desktop biophysical nodes).*

Step 2: *Describing the status quo of the water resources within each of the IUAs in terms of water resource infrastructure and availability, ecological status, socio-economic conditions (including framework for impact assessment), and Goods and Services (communities and their well-being). During this step information on the National Freshwater Ecosystems Priority Areas (NFEPAs) obtained from the CSIR* (**WRC, 2011**) *informed the selection of the biophysical nodes and were used in the definition of Ecological Importance as well as the Ecological Categories (details are presented in each node's evaluation sheet that can be found in the electronic database of the study). The NFEPAs are shown in* ***Figures A-1*** *to* ***A-3*** *of* ***Appendix A*** *and relevant information is summarised in* ***Appendix B****.*

Step 3: *Quantification of EWRs at selected nodes within the Vaal River system. Eighty two desktop biophysical nodes were identified to which existing Resource Directed Measures (RDM) data could be extrapolated.*

Step 4: *Starter scenario definitions were formulated based on the status quo information and the practical functioning of the integrated water resource system. The Ecologically Sustainable Base Configuration (ESBC) Scenario (starter scenario) consisted of the Recommended Ecological Category (REC) at all the EWR sites and desktop biophysical nodes except for EWR 4 and 5 (downstream of Vaal Dam and Vaal Barrage) where the ESBC for EWR 4 and 5 was recommended as the Present Ecological Status (PES).*

Step 5: *During this step the relative changes, and other planning scenarios, were evaluated and measured against the ESBC. The outcome from Step 5 was to inform the selection of scenarios for presentation to stakeholders. The scenarios evaluated are described in* ***DWA (2012****) and the recommendation was made that Scenario D (2020 scenario which includes the Lesotho Highlands Water Project Phase 2 that will be operational and desalination of mine water), together with Scenario A (which implies releases from Balfour Dam for EWR 9 in the Suikerbosrand River) be selected. In addition it was recommended that a revised seasonal release pattern (similar to Scenario E) be implemented from Sterkfontein Dam to maintain the PES in the Wilge River downstream of the Nuwejaarspruit.*

5. APPROACH TO DETERMINING THE MANAGMENT CLASS OF THE IUAs WITHIN THE VAAL RIVER SYSTEM

*The Management Classes that are recommended for consideration by DWA are based on a recommended operational scenario that has been evaluated (****DWA, 2012****) to determine consequences on the ecological state, economy, Goods and Services and system yield. To determine the Management Class and its ESBC, the catchment configuration had to be specified for each IUA. This was undertaken using the guidelines provided below as outlined in* ***DWAF (2007****). Management Classes, according to* ***DWAF (2007)*** *are defined below and the interpretation to broadly define the link between Ecological Categories (ECs) and the Management Class (MC) is also included:*

- ***Class I - Minimally used*** *(configuration of ecological categories minimally altered from its pre-development condition). Mostly B ECs and higher;*

- ***Class II - Moderately used*** *(configuration of ecological categories moderately altered from its pre-development condition). Mostly C ECs;*
- ***Class III - Heavily used*** *(configuration of ecological categories significantly altered from its pre-development condition). Mostly D ECs.*

*According to the guidelines (**DWAF, 2007**), Management Classes only consider the ecological state at the nodes within the IUAs. There are no clear or practical guidelines to incorporate other aspects such as the Goods and Services (G&S), water resource importance, economics and water quality issues other than those considered within the Reserve which may influence the MC of a particular IUA. A qualitative process was used in this study that considers all factors and the reasoning documented in this report was followed to recommend a MC to present to stakeholders. This recommendation could differ from the preliminary recommendation using the ecological guidelines. In cases where this did occur, the reasons/motivations were provided in this document.*

The MCs represented in this report include the stakeholder recommendations with explanations where they differ from the recommended MCs.

It is important to note that the MC is defined by the particular catchment configuration, which in turn is defined by a set of ECs at the biophysical nodes located within the various IUAs. For example, if an IUA is in a Management Class III with 10% of the IUA nodes in an EC of a B, the IUA should always have 10% of nodes in a B EC. It is this specific configuration that will guide planning, decision-making and management. Therefore, two IUAs that are both in a MC III could differ significantly in terms of its configuration and its specific management objectives.

6. CONCLUSIONS AND KEY FINDINGS

*The Management Classes for the Vaal River Catchment are provided in **Table 1**.*

Table 1: Proposed Management Classes of the Vaal River system.

WMA	*Integrated Unit of Analysis*		*Proposed MC*
Upper Vaal	*UA*	*Vaal River upstream of Grootdraai Dam*	*II*
	UB	*Klip River (Free State)*	*II*
	UC1	*Upper Wilge River*	*II*
	UC2	*Wilge River and tributaries*	*II*
	UC3	*Lower Wilge River*	*II*
	UD	*Liebenbergsvlei River*	*III*
	UE	*Waterval River*	*III*
	UF	*Kromspruit and Skulpspruit*	*II*
	UG	*Vaal River from Grootdraai Dam to Vaal Dam*	*II*
	UH	*Suikerbosrand River*	*II*
	UI	*Klip River (Gauteng)*	*III*
	UJ	*Taaibosspruit*	*III*
	UK	*Kromelmboogspruit*	*III*
	UL	*Mooi River*	*III*
	UM	*Vaal River reach from Vaal Dam to C23L*	*III*

WMA	Integrated Unit of Analysis		Proposed MC
Middle Vaal	MA	Renoster River	II
	MB	Vals River	III
	MC	Schoonspruit River	III
	MD1	Upper Sand River	III
	MD2	Lower Sand River	III
	ME1	Upper Vet River	II
	ME2	Lower Vet River	III
	MF	Vaal River from Renoster River confluence to Bloemhof Dam	III
Lower Vaal	LA1	Upper Harts River	II
	LA2	Middle Harts River	II
	LA3	Dry Harts River	III
	LA4	Lower Harts River	II
	LB	Vaal River from downstream of Bloemhof Dam to Douglas Weir	III

*Thirteen IUAs fall within a MC II and thirteen IUAs fall within a MC III. An additional three IUAs fall within a MC III but currently fail (red shading in **Table 1**) as they include areas lower than a D EC or have non-ecological water quality problems. IUA UI (Klip, Blesbokspruit and other rivers) and IUA UL (Mooi River) are both dominated with water quality problems amongst others. IUA UM (Vaal River downstream of the Vaal Barrage) has non-ecological water quality problems that impact on recreation and other activities, with the emphasis of the impact on the Vredefort Dome as a prime tourist venue.*

The results and findings from this study point to the following recommendations:

- *Considering that poor water quality was identified as the primary reason the Present Ecological State (PES) of several Integrated Units of Analysis (IUAs) are "seriously modified [where] the loss of natural habitat, biota and basic ecosystem functions is extensive" - Ecological Category E (**Kleynhans and Louw, 2007**), it is recommended strategies be identified, investigated and implemented to improve these rivers such that the indicated Recommended Ecological Categories (REC) can be achieved. To this end, the Integrated Water Quality Management Strategy, currently being implemented in the Vaal River System, should consider prioritising these catchments for devising management plans to implement appropriate intervention measures that will improve the present ecological state of these rivers.*
- *The regulation of flow in the Wilge River (EWR Site 8) through releases from Sterkfontein Dam should attempt to mimic a seasonal release pattern while limiting the reduction in the firm supply available from the Vaal River System (maintain the assurance of supply). The effect such seasonal release rules will have on the ecology will have to be evaluated through a monitoring programme to be implemented during and after the releases are made. This can typically be coordinated along with the Annual Operating Analysis carried out for the system each year.*
- *Due to the fact that the PES and EI-ES study (**DWA, 2011a**) was not completed prior to the execution of the WRCS, information on any additional nodes from the final assessments of the PES and EI-ES study should be incorporated to define the catchment configuration. It is therefore recommended that information from all available nodes be evaluated during licensing and or other assessments. In cases*

where further nodes are evaluated those should also be added to regularly update the catchment configurations.

- *The analysis and evaluations carried out at the desktop nodes (ecological and hydrological) in this study are of low confidence and it is recommended further detail evaluations be carried out before any remedial measures (such as reduction in allocations) are considered or implemented.*

Designing and implementing appropriate monitoring plans are essential to evaluate the hypotheses made during the EWR assessments. The monitoring result will determine any trends or change in Ecological Categories, and, most importantly, identify possibly non-compliance of the Management Classes.

Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8,9,10

Management Classes of the Vaal River Catchment Report

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ABBREVIATIONS

Acronym	Meaning
AMD	Acid Mine Drainage
DAFF	Department of Agriculture, Forestry and Fisheries
DWA	Department of Water Affairs
DWAF	Department Water Affairs and Forestry
EC	Ecological Category
EI	Environmental Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESBC	Ecologically Sustainable Base Configuration scenario
EWR	Ecological Water Requirements
FS DETEA	Free State Department of Economic Development, Tourism and Environment
FSE	Federation for a Sustainable Environment
G&S	Goods and Services
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
IRR	Issues and Responses Report
IUA	Integrated Unit of Analysis
IWRM	integrated water resource management
IWRS	integrated water resource strategy
LHWP	Lesotho Highlands Water Project
MAR	Mean Annual Runoff
MC	Management Class
MCM	million m^3/annum
MPRDA	Mineral and Petroleum Resources Development Act
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystems Priority Areas
NGO	Non-Governmental Organisation
NWA	National Water Act
NWRCS	National Water Resource Classification System
PES	Present Ecological State
PSC	Project Steering Committee
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RQO	Resource Quality Objective
SALGA	South African Local Government Association
SDC	Source Directed Controls
VRS	Vaal River System
WDCS	Waste Discharge Charge System
WMA	Water Management Area
WRCS	Water Resources Classification System
WULA	Water User License Applications

Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10

Management Classes of the Vaal River Catchment Report

1 INTRODUCTION

1.1 OVERVIEW OF THE STUDY

This report describes the Management Classes for the Vaal River catchment and serves as the primary deliverable for this study that was commissioned in October 2010 by the Chief Directorate: Resource Directed Measures of the Department of Water Affairs (DWA) for the *Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10*.

The Water Resources Classification System (WRCS), which is required by the National Water Act (Act 36 of 1998), provides a set of guidelines and a seven step procedure for determining different classes of water resources (**DWAF, 2007**). The WRCS prescribes a consultative process to classify water resources (Classification Process) to help facilitate a balance between the protection and use of the nation's water resources.

1.2 STUDY APROACH WITHIN THE CONTEXT OF THE WRCS

The WRCS Steps have been completed in accordance with the requirements of the study terms of reference as well as the study execution plan presented in the Inception Report (**DWA, 2011b**). The main emphasis of the study approach was to utilise available information and build from existing and current initiatives undertaken in support of integrated water resource management. Key elements of the study procedure that lead to the determination of the Management Classes are presented in the following paragraphs:

Step 1: Integrated Units of Analysis (IUAs) for the three Vaal WMAs were finalised and within these areas 115 biophysical nodes were selected. The biophysical nodes included key biophysical nodes or Ecological Water Requirement (EWR) sites which represented critical habitat for ecosystem functioning in the Vaal River main stem and major tributaries. Large sections of the catchment were still unaccounted for and additional biophysical nodes (referred to as desktop biophysical nodes) were selected.

Step 2: The main objective was to describe the status quo of the water resources within each of the IUAs in terms of water resource infrastructure and availability, ecological status, socio-economic conditions (including framework for impact assessment), and Goods and Services (communities and their well-being). During this step information on the National Freshwater Ecosystems Priority Areas (NFEPAs) obtained from the CSIR (**WRC, 2011**) informed the selection of the biophysical node and were used in the definition of Ecological

Importance as well as the Ecological Categories (details are presented in each node's evaluation sheet that can be found in the electronic database of the study). The NFEPAs are shown in **Figures A-1** to **A-3** of **Appendix A** and relevant information is summarised in **Appendix B**.

Step 3: The quantification of EWRs at selected nodes within the Vaal River system was carried out in this step. Eighty two desktop biophysical nodes were identified to which existing Resource Directed Measures (RDM) data could be extrapolated.

Step 4: During this step starter scenario definitions were formulated based on the status quo information and the practical functioning of integrated water resource system. The recommended EWRs for the sites determined in the Reserve Study and the low confidence EWRs at the desktop nodes provided a viable and practical Ecologically Sustainable Base Configuration Scenario (ESBC) against which relative changes could be evaluated. The ESBC starter scenario consisted of the Recommended Ecological Category (REC) at all the EWR sites and desktop biophysical nodes except for EWR 4 and 5 (Downstream of Vaal Dam and Vaal Barrage) where the ESBC for EWR 4 and 5 was recommended as the Present Ecological Status (PES).

Step 5: During this step the relative changes, and other planning scenarios, were evaluated and measured against the ESBC. The outcome from Step 5 was to inform the selection of scenarios for presentation to stakeholders.

1.3 PURPOSE OF THE REPORT

The purpose of this report is to present the Management Classes (MCs) and rationale for each IUAs within the Upper, Middle and Lower Vaal Water Management Areas (WMAs).

1.4 LAYOUT OF THE REPORT

Section 2 outlines the approach to determining the Management Classes of the different IUAs within the Vaal River Catchment. **Sections 3 – 5** provide the Management Classes per IUA for the Upper, Middle and Lower Vaal WMA respectively. **Section 6** provides a summary of the findings as well as recommendations while **Section 7** lists the references cited in this report.

2 APPROACH TO DETERMINING THE MANAGMENT CLASS OF THE IUAS WITHIN THE VAAL RIVER SYSTEM

The Management Classes that are recommended for consideration by DWA are based on a recommended operational scenario that has been evaluated (**DWA, 2012**) to determine consequences on the ecological state, economy, Goods and Services and system yield. The scenarios evaluated are described in **DWA** (**2012**) and the recommendation was made that Scenario D (2020 scenario which includes the Lesotho Highlands Water Project Phase 2 that will be operational and desalination of mine water), together with Scenario A (which implies releases from Balfour Dam for EWR 9 in the Suikerbosrand River) be selected. In addition it is recommended that a revised seasonal release pattern (similar to Scenario E) be implemented from Sterkfontein Dam to maintain the PES in the Wilge River downstream of the Nuwejaarspruit. The Management Classes are based on the Ecological Categories (ECs) (at each biophysical node) that are the result of the recommended scenario which define the catchment configuration (see further explanation below).

To determine the Management Class and its ESBC, the catchment configuration had to be specified for each IUA. This was undertaken using the guidelines provided below as outlined in **DWAF** (**2007**). As can be seen from the extract of the National Water Resource Classification System (NWRCS) guidelines (**DWAF, 2007**) below, the guidelines provided in the document are preliminary and has to be developed through application.

Extract from the NWRCS guidelines (DWAF, 2007):

"To ensure consistency, summarising these data into an IUA Class will eventually need to be governed by a set of agreed guidelines. It is recommended that the nature and content of these guidelines be developed through implementation of the WRCS, *as it is important to have a clear understanding of all their implications before finalisation.*

To assist with the development of the guidelines, a preliminary set of guidelines has been developed *and is presented in the table below."*

Table 16.1 "*Preliminary guidelines for the calculation of the IUA Class for a scenario"*

		% EC representation at units represented by biophysical nodes in an IUA				
		≥ A/B	≥ B	≥C	≥ D	< D
Class 1		40	60	80	99	-
Class 2			40	70	95	-
Class 3	**Either**			30	80	-
	Or				100	-

Management Classes, according to **DWAF (2007)** are defined as:

- **Class I - Minimally used** (configuration of ecological categories minimally altered from its pre-development condition);
- **Class II - Moderately used** (configuration of ecological categories moderately altered from its pre-development condition);

- **Class III - Heavily used** (configuration of ecological categories significantly altered from its pre-development condition).

The interpretation to broadly define the link between Ecological Categories (ECs) and the Management Class (MC) is as follows:

- Class I – Mostly B ECs and higher.
- Class II – Mostly C ECs.
- Class III – Mostly D ECs.

The NWRCS guidelines (**DWAF, 2007**) provided above have been used to calculate preliminary MCs of the IUAs within the Vaal River catchment. These guidelines (**DWAF, 2007**) only consider the ecological state at the nodes within the IUAs. However, MCs also consider other aspects such as the Goods and Services (G&S), water resource importance, economics and water quality issues other than those considered within the Reserve. Furthermore, additional information on ecological state of the broader catchment was also incorporated in the recommendations. No clear or practical guideline to incorporate all of these factors was provided in the NWRCS guidelines (**DWAF, 2007**). A qualitative process was used in this study that considers all factors and the reasoning documented in this report was followed to recommend a MC to present to stakeholders. This recommendation could differ from the preliminary recommendation using the ecological guidelines. In cases where this did occur, the reasons/motivations were provided in this document.

The MCs represented in this report includes the stakeholder recommendations with explanations where they differ from the recommended MCs.

It is important to note that the MC is defined by the particular catchment configuration, which in turn is defined by a set of ECs at the biophysical nodes located within the various IUAs. For example, if an IUA is in a Management Class III with 10% of the IUA nodes in an EC of a B, the IUA should always have 10% of nodes in a B EC. It is this specific configuration that will guide planning, decision-making and management. Therefore, two IUAs that are both in a MC III could differ significantly in terms of its configuration and its specific management objectives.

A flow diagram to summarise the process is provided in **Figure 2.1**

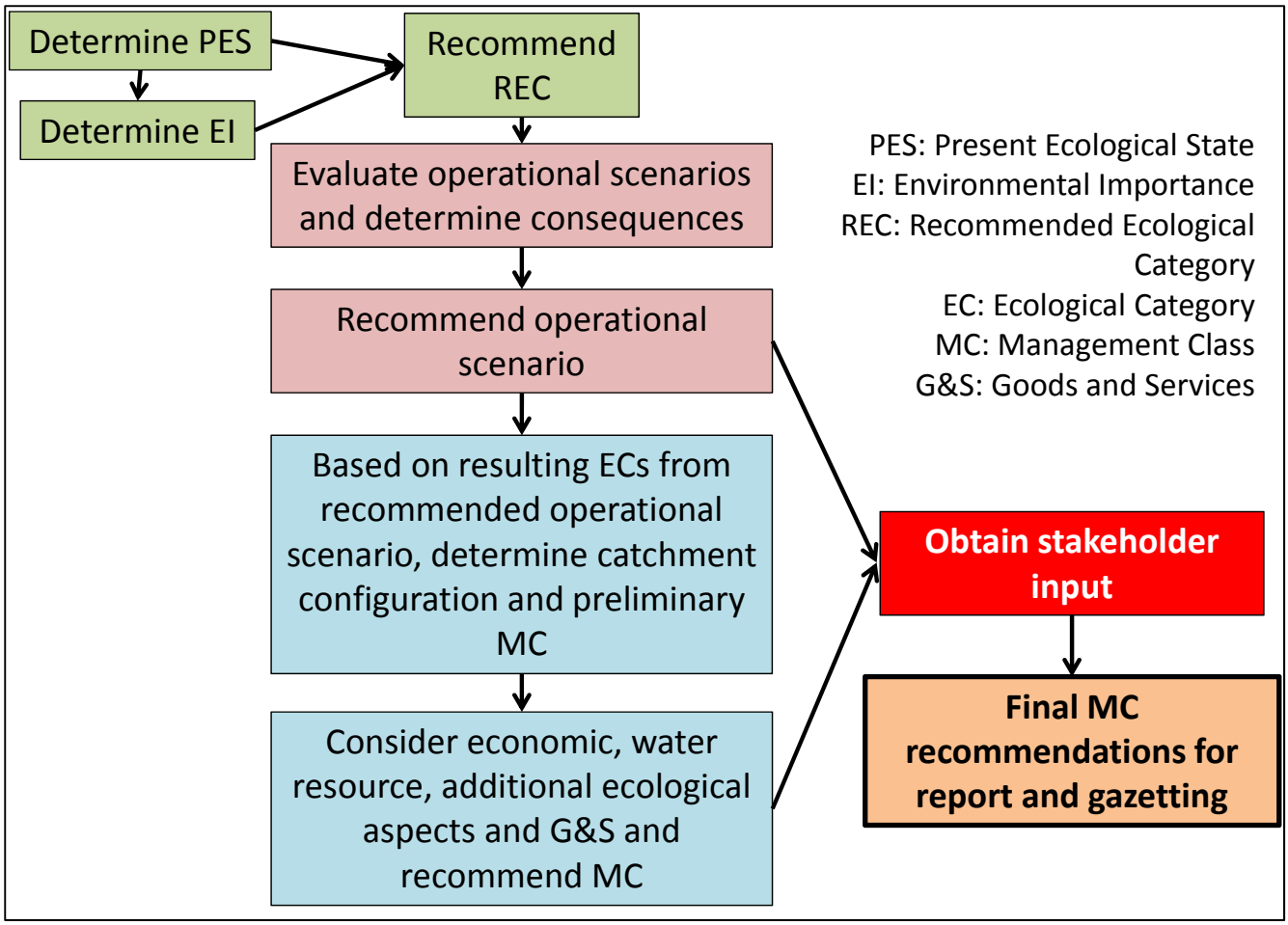


Figure 2.1: Summary of process to determine Management Classes

3 MANAGEMENT CLASSES OF THE UPPER VAAL CATCHMENT

3.1 OVERVIEW

The water resources in the Upper Vaal WMA are essential to sustain the water needs of the Gauteng Province and surrounding areas as the most important economic hub in the country. This includes strategic water users such as Eskom, Sasol and critical mining operations producing coal, precious metals (gold, uranium, etc.), base metals, semi-precious stones and other industrial minerals. The major impact mining on the water resource is the water pumped from the mines to dewater the underground workings mainly of the gold operations. Irrigation is an important activity in the WMA. Large areas of irrigation are located in the tributary catchment of the Vaal River receiving water at varying levels of assurance ranging from relying only of river runoff, some supported by numerous farm dams and others supplied from large storage dams and associated conveyance infrastructure. Land use in the south and east is dominated by cultivated dry land agriculture with the main crops being maize and wheat.

The dams in the WMA, particularly the Vaal Dam are important recreational zones. Bulk water supplier, Rand Water, abstracts water from Vaal Dam and supplies water to a large number of municipalities located in the Upper Vaal and Crocodile West Marico WMAs. Most of the inter-basin transfers into the Vaal River system take place within this WMA. The water quality of tributaries within the Vaal Barrage incremental catchment as well as the main stem of the Vaal downstream of the Vaal Barrage is influenced by mine dewatering/decanting and urban effluent discharges (**DWA, 2011c**).

The Upper Vaal catchment consists of sixteen identified Integrated Units of Analysis (IUA) (**DWA, 2011c**) as illustrated in ***Appendix A***.

3.2 IUA UA: VAAL RIVER UPSTREAM OF GROOTDRAAI DAM

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.1**[1].

Table 3.1: IUA UA: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES[1]	REC[2]	EIS[3]	EI[4]	Gross catchment area (km^2)	Natural MAR (MCM[5]/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR[6]	Demand (MCM/a)	Volume (MCM)	% MAR	
UA.1	8VF5	B/C	B	moderate	high	197	13.27	0	0	0	1.23	9.3	Class II
UA.2	C1VAAL_KVAAL	C	C	moderate	moderate	1073	69.33	1.3	1.88	0.18	5.94	8.57	
UA.3	UV9	C	C	low	low	215	12.03	0	0	0.5	0.26	2.18	
UA.4	C1RIET_AMERS	C	C	low	moderate	746	41.73	0.87	2.08	0.5	0.67	1.59	
UA.5	C1KVAA_UNSPE	C/D	C/D	moderate	low	533	41.66	1.77	4.25	0	0.74	1.78	
UA.6	UV17	C/D	C/D	low	low	1331	66.07	3.16	4.78	0.06	14.02	0.06	
UA.7	C1BLES_UNSPE	C/D	C/D	moderate	low	1084	70.66	0.38	0.54	0.02	2.09	2.96	
UA.8	VC4_C11L	B/C	B/C	moderate	moderate	355	18.62	0.42	2.24	0	0.92	4.95	

[1] Note that the preliminary MC (prelim MC) calculation, provided in Table 3.1, was based on the extract from the NWRCS guidelines (**DWAF, 2007**) provided in Section 2. No other aspects such as the G&S, water resource importance and economics were considered at this stage. These aspects are discussed in this section after which the final MC of the IUA is provided. This approach was followed for all IUAs documented in this report.

New Node name	Original Node Name	PES[1]	REC[2]	EIS[3]	EI[4]	Gross catchment area (km^2)	Natural MAR (MCM[5]/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR[6]	Demand (MCM/a)	Volume (MCM)	% MAR	
UA.9	VC5_C11K	C	C	moderate	moderate	340	18.07	0.13	0.7	0.02	0.35	1.93	
EWR1RE	RE EWR 1 KLEINVAAL	C	C	moderate	moderate	318	26.09	Simulated as part of larger Vaal system.					
EWR1	EWR 1	B/C	B/C (B)	high	high	4984	288.8	Simulated as part of larger Vaal system.					

1: PES: Present Ecological State
2: REC: Recommended Ecological Category
3: EIS: Ecological Importance and Sensitivity
4: EI: Environmental Importance
5: MCM: mill m^3/a
6: MAR: Mean Annual Runoff

IUA description

This IUA is situated in the Upper Vaal above Grootdraai Dam. The dominant land use is agriculture, mining and some small towns (Bethal, Ermelo, Amersfoort and Morgenzon) occur. This area is part of the integrated system of water supply to Eskom Power Stations and the Sasol Secunda Complex and is therefore strategically critical to the county's economy.

Ecological Reserve

There are eleven biophysical nodes in IUA UA of which nine are desktop biophysical nodes and two are EWR sites. The majority of the biophysical nodes are in a C and C/D EC (**DWA, 2012**) with three biophysical nodes in a B/C EC (two desktop nodes and EWR 1). Improvement is required at only one desktop biophysical node, UA.1. This improvement is non-flow related and linked to the improvement of agricultural practices and control and/or removal of alien vegetation. The improvement required at EWR 1 is also non-flow related as it is perceived that there are some water quality problems that impact on the instream biota. Uncertainty exists regarding the exact source (origin) of the water quality issue.

Goods and Services

Recreational fishing is important in certain areas with the emphasis on the river and farm dams while subsistence fishing is limited to farm workers. The area offers a limited set of recreational opportunities associated with the riverine system but some bird watching is important in areas associated with wetlands. Although there are floodplains in the area and they are utilised, it is part of the commercial agricultural utilisation sector rather than direct use for livelihoods (**DWA, 2011c**).

Given that land use is primarily commercial agriculture the function of the river in this regard is of moderate importance. It is mainly agricultural runoff that will be diluted but nutrients do not react particularly well to dilution influences (**DWA, 2011c**).

Economics

This area is part of the integrated system of water supply to most of the Eskom Power Stations and the Sasol Secunda Complex and is, therefore, strategically critical to the country's economy. The area includes the urban centres of Bethal, Ermelo, Amersfoort and Morgenzon. The main contributor to Gross Domestic Product (GDP) in the area is power generation with R24 331.3 million and income to households at R8 872.8 and manufacturing the main contributor to employment opportunities of 8 566. In total the 22 500 direct employment opportunities is supported by water complemented by another 23 000 indirect and induced opportunities.

Conclusions

Usage of Ecological Goods and Services are limited in this area. The area is sparsely populated with some concentration in urban areas. Majority of nodes (73%) are in a C EC or higher (**Table 3.2**). The recommended scenario maintains the REC at all nodes. Maintaining this configuration will not impact on current economic activities and allows in certain areas for further development. The Ecological guideline indicates a MC of II (dominated by C ECs).

Table 3.2: Catchment configuration for IUA UA

Ecological Category	B	B/C	C	C/D	MANAGEMENT CLASS
UA (%)	9	18	45	27	**II**

3.3 IUA UB: KLIP RIVER (FREE STATE)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.3**.

Table 3.3: IUA UB: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UB.1	UV_Uklip	B	B	high	high	88	5.67	0	0	0	0	0	Class II
UB.2	C13C	B/C	B	high	high	837	54	2.05	3.79	0.45	1.46	2.71	
UB.3	C1KLIP_UNSPE1	B/C	B	moderate	high	1090	68.04	2.05	3.01	0.45	1.89	2.77	
UB.4	C13A	C	C	moderate	moderate	595	51.37	1.14	2.22	0.01	0.46	0.9	
UB.5	C1SAND_UNSPE	C	C	moderate	moderate	1139	78.84	1.14	1.45	0.01	0.48	0.61	
UB.6	C13E	B/C	B	moderate	high	603	33.6	0.95	2.83	0	0.73	2.17	
UB.7	C1KLIP_UNSPE2	C/D	C/D	moderate	moderate	4129	248.05	7.52	3.03	0.46	5.03	2.03	
UB.8	C13G	C	C	moderate	moderate	435	20.8	0.69	3.3	1.1	3.79	18.23	
UB.9	C13H	C/D	C/D	moderate	moderate	589	19.22	7.52	39.14	2.66	8.98	46.72	
EWR6	EWR 6	B/C	B/C	moderate	moderate	1583	95.31	Simulated as part of larger Vaal system					

IUA description

This IUA consists of the Klip River with its source and most of the length of the river in the Free State Province. The Klip River catchment contributes a large portion of the incremental runoff to Vaal Dam and is an important tributary of the Vaal River. The area is dominated by agriculture and the flow in the river is influenced by numerous small dams.

Ecological Reserve

There are ten biophysical nodes in IUA UV-B of which nine are desktop biophysical nodes and one an EWR site (EWR 6). Half of the biophysical nodes are in a C and C/D EC and half in a better state than a C EC. Improvement is required at three desktop biophysical nodes (UB.2, UB.3 and UB.6). Of these three nodes, UB.3 and UB.6 require improvement in flow to achieve the REC of a B EC. The area includes Seekoeivlei, a Ramsar wetland, which gives an indication of its ecological importance.

Goods and Services

Recreational fishing is important in certain areas with the emphasis on the river and farm dams while subsistence fishing is limited to farm workers. The area offers an important set of recreational opportunities associated with bird watching, specifically the Seekoeivlei Ramsar wetland. The upper reaches of the IUA offer important recreational opportunities as it is of a pleasing aesthetic nature. Usage is however relatively low. The floodplains that occur are utilised as part of the commercial agricultural utilisation sector rather than direct use for livelihoods (**DWA, 2011c**). Given that land use is primarily commercial agriculture the function of the river in this regard is of moderate importance.

Economics

The area is mainly rural with the urban centres, Vrede and Memel with restricted economic activities. The main contributor to GDP, employment and household income is the manufacturing sector with a GDP of R892.9 million, employment opportunities of 3 526 and a household income of R500.2 million respectively. In total the 2 450 direct employment opportunities is supported by water complemented by another 2 550 indirect and induced opportunities.

The Klip River UIA is the only catchment area where possible economic implications could occur if the REC is implemented. The confidence level of the hydrological and ecological information is however low and further studies need to be undertaken before any intervention is implemented that could impact on the current socio-economic activities in this IUA.

Conclusions

There are very few people residing in this IUA who would be reliant on goods and services for livelihoods and subsistence. Therefore G&S does not play a significant contributing role to the final MC. There is a good representation of different ECs within the IUA and the catchment configuration for IUA B is provided below (**Table 3.4**). The MC II is representative of the IUA but it must be noted that potentially 50% of the IUA is in a B EC and therefore this IUA is a 'high' Class II (compared to, e.g., IUA UA).

The estimated EWR for the B EC at UB 3 and 6 indicate that there could be serious economic impact on agriculture if implemented. However, one must consider that the EWR is based on a desktop estimate only, the hydrological is limited and it is expected the water use for irrigation could be reduced through the DWA initiative to eradicate unlawful abstractions and storage of water. It is therefore recommended that further work is undertaken to better understand the scale of the problem. Increasing the confidence in the EWR however will not be sufficient on its own but will also require more detailed information of the present water resource use.

Table 3.4: Catchment configuration for IUA UB

Ecological Category	B	B/C	C	C/D	MANAGEMENT CLASS
UB (%)	40	10	30	20	**II**

3.4 IUA UC1 (UPPER WILGE RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.5**.

Table 3.5: IUA UC1: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UC1.1	8WF1	B	B	moderate	high	591	69.03	0.32	0.46	0.01	0.44	0.63	Class II
UC1.2	8WF3	C	C	moderate	low	932	81.11	0.73	0.9	0.08	1.89	2.33	
UC1.3	UV25	B	B	moderate	high	364	26.49	0.95	3.6	0	0.24	0.9	
UC1.4	UV28	C	C	moderate	moderate	1831	104.03	3.16	3.04	0.03	3.31	3.18	
UC1.5	UV_Cor	C	C	moderate	moderate	156	7.82	0.15	1.89	0	0.71	9.03	
UC1.6	C82B_N	C	C	moderate	low	812	39.63	2.73	6.88	0	3.03	7.65	
EWR7	EWR 7	A/B	A/B	high	high	170	23.47	Small catchment not simulated in WRPM.					

1: WRPM: Water Resource Planning Model

IUA description

This IUA consists of the Wilge River with a very large wetland in the upper area as well as, amongst others, the Meul and Cornelius River tributaries. The proposed Braamhoek Pump-storage Scheme will result in the construction of a dam in the upper part of quaternary C81A. The Wilge River System is largely unregulated with only small dams for water supply to local users. Water users within this catchment comprise of both urban (Harrismith and Warden) and irrigation user groups. The IUA is dominated by agriculture.

Ecological Reserve

There are seven biophysical nodes in IUA UC1 of which six are desktop biophysical nodes and one an EWR site (EWR 7). Four of the biophysical nodes are in a C EC, two in a B and one, EWR 7, in an A/B EC. None of the nodes require improvement. EWR 7 is the only node that represents the wetland and its A/B EC is representative of the wetland. It is recommended that the development and operation of the proposed Braamhoek pump-storage scheme, which could impact on the wetland, should therefore accommodate and maintain the integrity of the wetland at an EC of A/B.

Goods and Services

Recreational fishing is important in certain areas with the emphasis on the river and farm dams while subsistence fishing is limited to farm workers. The upper reaches of the IUA offer important recreational opportunities as it is of a pleasing aesthetic nature. Usage is however relatively low. The floodplains that occur are utilised as part of the commercial agricultural utilisation sector rather than direct use for livelihoods (**DWA, 2011c**).

Given that land use is primarily commercial agriculture the function of the river in this regard is of moderate importance. It is mainly agricultural runoff that will be diluted but the comment was made that nutrients do not react particularly well to dilution influences of this nature (**DWA, 2011c**).

Economics

As it is impractical to do the socio-economic assessment of the individual integrated units of analyses UV-C1 to UV-C3 separately, it has been included in the Socio-Economic Assessment of the combined UV-C1 to UV-C3: Wilge River.

The area is to a large extent rural in nature and includes the urban centres of Witsieshoek, Harrismith, Kestell

and Phuthaditjhaba. The main contributor to GDP, employment and household income is the manufacturing sector with a GDP of R1 198.7 million, employment opportunities of 4 734 and a household income of R671.5 million respectively. In total the 5 950 direct employment opportunities is supported by water complemented by another 4 300 indirect and induced opportunities. Irrigation agriculture offers the most direct employment opportunities in the area.

Conclusions

Fifty seven percent of the nodes in the IUA are in a C EC with the remaining nodes in a better state. Following the ecological guideline, a MC II is recommended and the catchment configuration for IUA C1 is provided in **Table 3.6**. The recommended scenario does not impact on this area and the MC recommended will maintain the status quo (and therefore the REC).

Table 3.6: Catchment configuration for IUA UC1

Ecological Category	A/B	B	C	MANAGEMENT CLASS
UC1 (%)	14	29	57	**II**

3.5 IUA UC2 (WILGE RIVER AND TRIBUTARIES)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.7**.

Table 3.7: IUA UC2: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UC2.1	8EF4	C/D	C/D	low	moderate	1405	114.76	0.26	0.23	16.04	33.98	29.61	Class II
UC2.2	C81G	C	C	moderate	moderate	435	22.13	0.26	1.19	0	0.02	0.08	
UC2.3	GG	B	B	moderate	high	115	5.85	0	0	0	0	0	
UC2.4	C81J	C	C	low	low	392	12	0.12	1.01	0	0.31	2.6	
UC2.5	C81C	B/C	B/C	moderate	moderate	250	18.41	0.83	4.5	0.01	1.15	6.26	
UC2.6	C8NUWE_CONFL	C	C	low	low	527	39.87	0.97	2.43	0.01	3.9	9.78	
UC2.7	C82D	C	C	low	moderate	572	19.6	4.23	21.56	0	3.21	16.37	
EWR8	EWR 8	C	C	moderate	moderate	7503	474.25	Simulated as part of larger Vaal system.					

IUA description

This IUA is situated in the middle Wilge River and tributaries include Nuwejaarspruit and Nahamadi to Elands Rivers. Golden Gate is also part of this IUA and the land use in the remainder of the IUA can be categorised as commercial and mixed farming. Urban areas of note are Phuthaditjhaba surrounding by communal grazing on tribal land. The Wilge River *via* the Nuwejaarspruit receives the transfer from Sterkfontein Dam (located in C81D). In the upper portion of quaternary C81F water is abstracted from Fika Patso and Metsi Matso dams to supply the Phuthaditjhaba area.

This is an important area with respect to reliance on resources as a part of livelihoods. G&S are particularly important in the upper part of the catchment as this is made up of the areas that were the former homeland of

Qwa-Qwa around the town of Phuthaditjhaba and includes some of the most marginal areas of the country (**DWA, 2011c**).

Ecological Reserve

There are eight biophysical nodes in IUA UC2 of which seven are desktop biophysical nodes and one is an EWR site (EWR 8). The majority of the biophysical nodes (six) are in a C and C/D with only two biophysical nodes in a B and B/C EC. One of these nodes has a HIGH Environmental Importance (EI) as it is situated in Golden Gate National Park, but as it is already within a B category and therefore does not require improvement to achieve the REC.

Goods and Services

G&S is important within the Phuthaditjhaba area to provide part of livelihoods. Recreational fishing is important in certain areas with the emphasis on the river and farm dams while subsistence fishing is important with respect to residents of Phuthaditjhaba. Golden Gate National Park also forms part of this IUA and provides an important recreational resource. Waste water dilution from Phuthaditjhaba is also important (**DWA, 2011c**). Riparian vegetation is an important component of the livelihoods strategies of people in the Phuthaditjhaba area. Resources are however highly utilised and sustainability of utilisation is questionable (**DWA, 2011c**).

Economics

See description of economic characteristics in **Section** 0 - IUA UC1.

Conclusions

The operational scenarios evaluated did not achieve the REC (or in this case, the PES) at EWR 8 due to the unseasonal high base flows associated with the releases from Sterkfontein Dam. EWR 8 is currently in a C EC and all scenarios would result in a D EC. An attempt was made (Scenario E) to optimise releases from Sterkfontein Dam to improve this situation. The situation improved from a D to a D/C EC which still did not achieve the ecological objectives of maintaining a C EC.

During the past ten years releases from Sterkfontein Dam was infrequent (limited) due to higher than average rainfall and runoff in the Vaal River System resulting in the PES at EWR site 8 to be in a C EC. The requirement for releases will increase over time to supply the growing water needs in the system until Phase 2 of Lesotho Highlands Water Project (LHWP) is implemented where after temporary surplus conditions will be experienced for a few years and (during that time) releases can again be reduced. The ecological implications of these long periodic release variations are uncertain and it could be possible that infrequent releases could maintain EWR 8 at a C EC.

The water resource analysis carried out for Scenario E indicated that the long-term sustainable supply (availability) from Vaal River System is reduced by 45 million m^3/annum (determined in terms of a decrease in the historical firm supply or yield). This implication could also be moderated through infrequent releases during periods of higher than average runoff where reduced transfers from the Thukela River are possible.

As most of the nodes (76% is in a C or higher EC) (**Table 3.8**), a Management Class II as indicated by the ecological guideline is supported. It is recommended that monitoring at EWR 8 is essential to determine the consequences of the operating rule at Sterkfontein Dam and to recommend practical mitigation measures if possible.

Table 3.8: Catchment configuration for IUA UC2

Ecological Category	B	B/C	C	C/D	MANAGEMENT CLASS
UC2 (%)	13	13	63	13	**II**

3.6 IUA UC3 (LOWER WILGE RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.9**.

Table 3.9: IUA UC3: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UC3.1	UV31	C	C	moderate	moderate	729	32.9	3.94	11.98	0	0.74	2.26	Class II
UC3.2	VC8_C82G	B/C	B/C	low	moderate	152	6.34	0	0	0	0.01	0.17	
UC3.3	UV35	C	C	moderate	moderate	296	11.08	0	0	0	0.08	0.76	
UC3.4	VC9	C/D	C/D	moderate	low	10633	591.39	50.48	8.54	16.51	22.28	3.77	

IUA description

This IUA is situated in the lower Wilge River which is sparsely populated with scattered mixed farming and some irrigation. The river is infested with alien willows resulting in bank erosion.

Ecological Reserve

There are four biophysical nodes in IUA UC3. Three nodes are in a C EC or higher with one node being in a C/D EC.

Goods and Services

There is negligible livelihood usage but fishing may be important, particularly closer to the area around Frankfort. Other small-scale recreation is probably important upstream of Frankfort. Subsistence fishing is limited to farm workers and some usage from the dams (**DWA, 2011c**).

Given that land use is primarily commercial agriculture the function of the river in this regard is of moderate importance.

Economics

See description of economic characteristics in **Section** 0 - IUA UC1.

Conclusions

No improvement is required and the REC at each node is set to maintain the PES which results in a Management Class II due to most nodes categorised to be at a C or higher. The recommended scenario maintains the REC. The catchment configuration for the IUA is provided in **Table 3.10**.

Table 3.10: Catchment configuration for IUA UC3

Ecological Category	B/C	C	C/D	MANAGEMENT CLASS
UC3 (%)	25	50	25	**II**

3.7 IUA UD (LIEBENBERGSVLEI RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.11**.

Table 3.11: IUA UD: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UD.1	VC15	C	C	moderate	low	375	14.36	0.14	0.95	0	0.31	2.13	Class II
UD.2	C83D	C	C	moderate	moderate	465	12.42	0.11	0.86	0	0.56	4.52	
UD.3	C83E_N	C	C	moderate	moderate	891	23.31	3.15	13.51	0	5.37	23.02	
UD.4	VC16	B/C	B	moderate	high	139	4.74	0.08	1.73	0	0.03	0.61	
UD.5	VC17	B/C	B	moderate	high	76	2.66	0	0	0	0.01	0.34	

IUA description

The area is sparsely populated with scattered mixed farming enterprises the most prominent land form with scattered irrigation along the tributary river reaches. The flow in the Liebenbergsvlei River (including and upstream of C83H) is highly influenced by the transfer from the LHWP. The LHWP water is discharged into the river system upstream of Saulspoort Dam (located in quaternary catchment C83A). There are significant irrigation abstractions along the Liebenbergsvlei River, of which a significant portion is considered to be unlawful (**DWA, 2011c**).

Ecological Reserve

There are five desktop biophysical nodes in IUA UD. All of these nodes except one are situated in tributaries of the Liebenbergsvlei. The resulting MC will therefore not represent the Liebenbergsvlei River downstream of the LHWP transfer. The Liebenbergsvlei River is mostly in a degraded condition of a D EC or even lower. There are at this stage no operational scenarios that can be implemented to improve the situation with regards to the impacts of the transfer. The focus therefore was to identify nodes in the tributaries to ensure that these can function as important refuge areas. Two of the nodes are in a B/C EC condition, both with a HIGH EI and therefore requires improvement to a B EC. This improvement will be related to addressing agricultural practices, i.e. non-flow related aspects. Improving flow is unlikely to achieve the improved condition.

Goods and Services

There is negligible livelihood usage but fishing may be important. Recreational fishing is important in certain areas with the emphasis on the river and farm dams while subsistence fishing is limited to farm workers and some usage from the dams. Some of the higher flows from the transfer may promote other recreational aspects such as canoeing. Although there are floodplains in the area and they are utilised it is part of the commercial agricultural utilisation sector rather than direct use for livelihoods (**DWA, 2011c**).

Given that land use is primarily commercial agriculture the function of the river in this regard is of moderate importance. It is mainly agricultural runoff that will be diluted but the comment was made that nutrients do not react particularly well to dilution influences of this nature (**DWA, 2011c**).

Economics

The area is to a large extent rural and includes the urban centres of Bethlehem and Reitz. The manufacturing sector is the biggest contributor in the area to GDP with R1 063.2 million and to household incomes with R595.6 million. Irrigation agriculture is by far the biggest employment generator in the area with 10 355 employment

opportunities offered. In total the 7 600 direct employment opportunities is supported by water complemented by another 7 000 indirect and induced opportunities.

Conclusions

As indicated above, the nodes situated in tributaries do not reflect the current situation in the Liebenbergsvlei River. Based purely on the nodes, a MC of II would be recommended as all the nodes are a C or higher. However, giving due cognisance of the Liebenbergsvlei PES which is in a D or lower, it is proposed that the MC of a II (**Table 3.11**) be amended to a MC III. The catchment configuration for IUA UD is provided below (**Table 3.12**). This configuration of ECs can accommodate more nodes at D ECs within the recommended Management Class setting.

Table 3.12: Catchment configuration for IUA UD

Ecological Category	B	C	D	MANAGEMENT CLASS
UD (%)	40	60	0	**III**

3.8 IUA UE (WATERVAL RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.13**.

Table 3.13: IUA UE: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (mill m^3/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UE.1	VC6	C	C	low	low	695	59.33	0.39	0.66	0	0.2	0.34	
UE.2	WA1	D	D	low	low	970	80.37	1.64	2.04	0.11	2.55	3.17	
UE.3	VC7	C	C	low	moderate	41	2.12	0	0	0	0	0	**Class III**
UE.4	WA2	D	D	low	low	2278	149.84	0	0	0	0	0	
UE.5	UV WV	D	D	moderate	moderate	2787	177.67	12.51	7.04	0.14	5.75	3.24	

IUA description

The area includes the industrial centres of Secunda (which includes the Sasol complex), Evander, Kinross and Sasolburg and, in the upper reaches of this IUA; most impacts are associated with deteriorated water quality due to primarily mining, industry, urban and sewage runoff. Agriculture occurs in other parts of the IUA and unlawful irrigation water use occurs in this catchment.

Ecological Reserve

This IUA has five nodes, of which three are in the main Waterval River and all has a status of a D EC. The water quality deterioration plays the major role in the EC. The two other nodes are in a C EC. There are no areas of HIGH importance and the REC for all the nodes is set to maintain the PES.

Goods and Services

Aside from the urban nodes the population is sparse and usage in terms of G&S is highly limited. Some recreational fishing and other recreational activities is limited to the lower reaches close to the Vaal River confluence. Some subsistence fishing occurs around the urban areas of Sasolburg.

Economics

The area includes the industrial centres of Secunda, Evander and Kinross. The main contributor to GDP, employment and household income in the area is manufacturing with GDP at R77 610.8 million, employment numbers of 306 501 and a contribution to household income of R43 479.9 million. In total the 156 750 direct employment opportunities is supported by water complemented by another 180 650 indirect and induced opportunities.

Conclusions

A Management Class of a Class III is representative of the IUA. The recommended operational scenario will not impact on the current situation and PES. The catchment configuration for IUA UE is provided in **Table 3.14**.

Table 3.14: Catchment configuration for IUA UE

Ecological Category	C	C/D	MANAGEMENT CLASS
UE (%)	40	60	**III**

3.9 IUA UF (KROM AND KLIP RIVERS FLOWING INTO VAAL DAM)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.15**.

Table 3.15: IUA UF: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UF.1	UV45	C	C	moderate	moderate	546	25.7	1.84	7.17	0	0.98	3.82	**Class III**
UF.2	C8KLIP_VAALD	C	C	moderate	moderate	765	35.59	0.2	0.56	0	0.76	2.14	

IUA description

These two relatively small rivers both flow directly into the Vaal Dam and the land use is mainly commercial agriculture. The IUA is relatively sparsely populated.

Ecological Reserve

Both desktop nodes are in a C EC with moderate EIS and EI and the REC is set to maintain these rivers. The catchment configuration consists therefore a 100% C ECs.

Goods and Services

Some recreational fishing and other recreational activities is limited to the lower reaches close to the Vaal Dam confluence. Subsistence fishing is limited to some farm workers. Overall the G&S does not play a significant contributing role to the final MC (**DWA, 2011c**).

Economics

This IUA includes no significant urban main centres. The main contributor to GDP, employment and household income in the area is irrigation agriculture with total GDP at R14.2 million, total employment numbers of 357 and

a contribution to household incomes of R10.9 million.

Conclusions

There are only two nodes in this river, both falling within a C EC. Additional nodes were not selected as these nodes are likely to be representative of the IUA. The ecological guideline recommends a MC III, but considering that the nodes and the rest of the area is likely to be in a C EC, a MC II is recommended. Furthermore, the water resource importance is low and this IUA does not fall into the description of a MC III as a working class river (dominated by D ECs). The operational scenarios do not impact on these rivers. The catchment configuration for IUA UF is provided in **Table 3.16**.

Table 3.16: Catchment configuration for IUA UF

Ecological Category	C	MANAGEMENT CLASS
UF (%)	100	**II**

3.10 IUA UG (VAAL RIVER BETWEEN GROOTDRAAI AND VAAL DAMS)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.17**.

Table 3.17: IUA UG: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UG.1	8VF3	C	C	low	low	75	3.36	1.45	43.21	0	1.02	30.24	Class III
UG.2	C12A	C	C	moderate	moderate	485	21	0	0	0	0.13	0.62	
UG.3	C12K	C	C	moderate	low	479	22	0.31	1.4	0	0.35	1.57	
UG.4	C12J	C	C	moderate	moderate	344	12.43	0.16	1.3	0	0.21	1.69	
EWR2	EWR 2	C	C	moderate	moderate	7995	457.68	Simulated as part of larger Vaal River system.					
EWR3	EWR 3	C	C	moderate	moderate	15638	852.13	Simulated as part of larger Vaal River system.					

IUA description

The area is mainly rural, includes the urban centres of Standerton and Villiers with substantial agricultural activities. The yield balance of Grootdraai Dam is such that most available yield is used to supply Sasol (Secunda Complex) and Eskom Power Stations.

Ecological Reserve

This IUA consists of six biophysical nodes of which two are EWR sites. All nodes are in a C EC with moderate or low EIS and EI and the REC is set to maintain these rivers. The catchment configuration consists therefore of a 100% C ECs.

Goods and Services

The IUA is sparsely populated. Recreation fishing is important in reaches close to the Vaal Dam confluence. Subsistence fishing is relatively important given the town of Villiers and its population, some of whom rely on fish for part of their diet. Picnic spots in the lower reaches close to the Vaal Dam confluence are of importance.

Floodplain usage is important but this is restricted to commercial utilisation.

Given that land use is primarily commercial agriculture the function of the river in this regard is of moderate importance. It is mainly agricultural runoff that will be diluted but the comment was made that nutrients do not react particularly well to dilution influences of this nature (**DWA, 2011c**).

Economics

The economic base of the area is small with irrigation agriculture being the largest contributor to GDP, employment and household income in the area with GDP at R273.5 million, employment numbers of 3 285 and contribution to household incomes of R172.6 million. In total the 1 900 direct employment opportunities is supported by water complemented by another 2 300 indirect and induced opportunities.

Conclusions

This reach is influenced by the regulating storage of Grootdraai Dam and the associated abstractions that are of key strategic importance to the economy of the country. Even though the economic and water resource importance of this area are high and the flow regime significantly modified, the Vaal River is still within a C EC (two EWR sites). This is likely due to the fact there are some releases made from Grootdraai Dam to support irrigation and that such a large river is resilient to change and the instream biota is robust. The four desktop nodes located in tributaries are representative of the tributaries and all in a C EC. Therefore, even though the Vaal River does comply with the 'workhorse' definition of a MC III, it is proposed that that a MC II be accepted. All nodes should be maintained at a C EC and the recommended scenario maintains this C EC. Selecting a MC III would imply that future development could to degrade areas in this IUA to D ECs with possible negative consequences for the whole of Vaal River downstream of this IUA. This IUA also serves as a dilution source for the deteriorated water quality from the Waterval River and therefore requires the level of protection provided by a MC II Category.

The catchment configuration for IUA UV UG is provided in **Table 3.18**.

Table 3.18: Catchment configuration for IUA UG

Ecological Category	C	MANAGEMENT CLASS
UG (%)	100	**II**

3.11 IUA UH (SUIKERBOSRAND RIVER US OF BLESBOKSPRUIT CONFLUENCE)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.19**.

Table 3.19: IUA UH: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UH.1	C21A	B/C	B	moderate	high	707	28.65	0.22	0.75	0.01	0.86	2.99	Class II
EWR9	EWR 9	C	B/C	high	high	1175	31.31	Simulated as part of larger Vaal system					

IUA description

Balfour Dam, situated on the main stem of the Suikerbosrand River, regulates the flow to some extent and is

used for supplying water to the town of Balfour. There are extensive areas of commercial agriculture as well as urban development including Nigel and Heidelberg. There are many farm dams and abstractions often result in the river flowing at very low levels.

Ecological Reserve

This IUA contains only two biophysical nodes, of which one is an EWR site. Both nodes have HIGH importance and the ecological condition should be improved. Both require an increase in flow as well as non-flow related measures to improve the state of the rivers.

Goods and Services

The Suikerbosrand catchment is sparsely populated and G&S utilisation is negligible. Given that land use is primarily commercial agriculture the function of the river in terms of waste water assimilation and dilution is of some importance.

Economics

The area includes the industrial centres of Nigel and Heidelberg. The main contributor to GDP, employment and household income in the area is manufacturing with GDP at R35 321.5 million, offering employment opportunities of 154 951 and a contribution to household incomes of R26 090.5 million. In total the 96 100 direct employment opportunities is supported by water complemented by another 129 800 indirect and induced opportunities in the area.

Conclusions

It could be argued that since the two nodes that were evaluated are respectively at a B/C and B EC, this IUA should be set at a MC I. However, it must be considered that there are likely other areas (not covered by these two nodes) that are in PES lower than a B/C EC. Furthermore, the B EC is based on the assumption that Balfour Dam can make the required releases (in terms of outlet size), and that it will be agreed to supply the increased flows necessary to achieve the REC. It is therefore more realistic and appropriate to recommend a MC II which is supported by the ecological guidelines. Furthermore, the existing economic activities will not be impacted on by any of the flow scenarios. Only one scenario (operational Scenario A) achieves the REC and it was therefore recommended that for EWR 9, this scenario form part of the final recommended scenario.

The catchment configuration for IUA UV UH is provided in **Table 3.20**.

Table 3.20: Catchment configuration for IUA UH

Ecological Category	B	B/C	MANAGEMENT CLASS
UH (%)	50	50	**II**

3.12 IUA UI (BLESBOKSPRUIT, RIET AND KLIP RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.21**.

Table 3.21: IUA UI: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UI.1	VC11	E	D	low	low	857	36.6	3.87	10.56	1.31	0.19	0.53	Class III
UI.2	VC12	E	D	low	moderate	893	39.21	6.29	16.04	0.19	0.13	0.33	
UI.3	VC13	E	D	low	low	2309	96.98	22.44	23.14	1.6	0.68	0.71	
UI.4	VC14	D/E	D	low	moderate	926	22.1	3.21	14.51	0	0.19	0.85	
EWR10	EWR 10	C/D	C/D	moderate	moderate	3271	86.97	Simulated as part of larger Vaal River system.					
EWR11	EWR 11	D	D	low	low	1098	29.14	Simulated as part of larger Vaal River system.					

IUA description

The IUA is highly urbanized and includes the Rietspruit and Klip rivers in Gauteng as well as the Blesbokspruit River. Urban areas include Johannesburg, Soweto, Boksburg, Brakpan, Benoni, Springs and Sebokeng. The IUA is characterised by water quality related problems due to pollution from gold mining slimes dams, industrial effluent run-off, mine dewatering, run-off from urban areas, leaking sewers, effluent from WWTW, and agricultural return flows.

Ecological Reserve

The IUA is represented by six biophysical nodes of which two are EWR sites. Four out of the six biophysical nodes are currently in an unacceptable state, and under present conditions, the Management Class will fail (**DWAF, 2007**). Improvement is therefore related mainly to the mitigation of the water quality problems, rather than addressing the increased flow.

Goods and Services

There are a broad range of communities present but most are urbanised and dependence on the G&S is likely to be limited. There are a number of poor urban and informal communities that have been observed making use of the fish and living in the vegetation in areas around the river banks. The area offers a relatively limited set of recreational opportunities but the nature of the area means that these are utilised (**DWA, 2011c**).

Economics

The area includes the industrial centres and densely populated area of Johannesburg, Soweto, Boksburg, Brakpan, Benoni, Springs and Sebokeng. The main contributor to GDP, employment opportunities and household income in the area is manufacturing with GDP at R46 599.7 million, employment opportunities of 204 252 and a contribution to household incomes of R37 793.6 million. In total the 102 200 direct employment opportunities is supported by water complemented by another 136 800 indirect and induced opportunities.

Conclusions

It must be noted, that under present conditions, the river does not comply even with the Management Class III criteria. None of the scenarios achieve the REC. The catchment configuration provided in **Table 3.22** is based on the assumption that the REC will be achieved and does not reflect the current situation.

Table 3.22: Catchment configuration for IUA UI

Ecological Category	C/D	D	MANAGEMENT CLASS
UI (%)	17	83	**III**

3.13 IUA UJ (TAAIBOSSPRUIT)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.23**.

Table 3.23: IUA UJ: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UJ.1	C22G	D	D	low	low	831	18.4	0.26	1.42	0	0.19	1.02	**Class III**

IUA description

This catchment contains the Sasolburg industrial complex including coal-mining areas. Extensive agricultural activities occur (dryland and irrigation using pivots), with highly elevated levels of nutrients and salts.

Ecological Reserve

Only one desktop biophysical node represents this IUA and it is in a D EC due to both flow modification and urbanisation as well as water quality related issues. This IUA therefore consists of a catchment configuration of a 100% of a D EC.

Goods and Services

G&S utilisation is likely to be practically non-existent however, waste water dilution and assimilation as a function of the river is of some importance given that land use is primarily commercial agriculture.

Economics

As it is impractical to do a socio-economic assessment of the individual integrated unit of UV-J: Taaibosspruit on its own, it has been included in the socio-economic Assessment of UV-M: Vaal River from Downstream of Vaal Dam to Outlet of C23 and UV-UK: Kromelmboogspruit.

The area includes the manufacturing areas of Vereeniging, Vanderbijl Park, Sasolburg and Parys. The main contributor to GDP, employment opportunities and household income in the area is the manufacturing sector with a GDP of R29 888.0 million, employment opportunities of 131 115 and a contribution to household incomes of R22 077.1 million.

Conclusions

Based on the information above which characterises a workhorse river, a MC III is representative of the IUA. The operational scenarios do not impact on this river, so the MC is set to maintain the status quo. The catchment configuration for IUA UJ is provided in **Table 3.24**.

Table 3.24: Catchment configuration for IUA UJ

Ecological Category	D	MANAGEMENT CLASS
UJ (%)	100	**III**

3.14 IUA UK (KROMELMBOOGSPRUIT)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.25**.

Table 3.25: IUA UK: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UK.1	UV53	C	C	moderate	low	724	14.3	0.59	4.15	0	0.29	2	**Class III**

IUA description

This reach covers the entire Kromelmboogspruit, a tributary of the Vaal River entering the Vaal upstream of Parys and downstream of Vaal Barrage. Catchment development in the area is mostly agricultural, with numerous road crossings and pivots in the lower reaches. There are no significant abstractions or discharges influencing the river flow. Elevated salts, nutrients and toxics are expected.

Ecological Reserve

Only one desktop biophysical node represents this IUA and it is in a C EC due to both flow modification and agriculture. This IUA therefore consists of a catchment configuration of a 100% of a C EC.

Goods and Services

G&S utilisation is likely to be practically non-existent however, waste water dilution and assimilation as a function of the river is of some importance given that land use is primarily commercial agriculture.

Economics

See **Section 3.13** - Economics.

Conclusions

The upper section of the Kromelmboogspruit is probably in a worse condition than a C EC which confirms the Management Class III. The operational scenarios do not impact on this river, so the MC is set to maintain the status quo. The catchment configuration for IUA UK is provided in **Table 3.26**.

Table 3.26: Catchment configuration for IUA UK

Ecological Category	C	MANAGEMENT CLASS
UK (%)	100	**III**

3.15 IUA UL (MOOI RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.27**.

Table 3.27: IUA UL: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
UL.1	C23F	C/D	C/D	low	low	1324	37.69	0.5	1.33	0	0.44	1.16	
UL.2	**VC19**	**E**	**D**	**low**	**low**	**1360**	**25.96**	**2.25**	**8.67**	**23.81**	**0.25**	**0.96**	
UL.3	**M2**	**E**	**D**	**low**	**low**	**890**	**20.26**	**0**	**0**	**0**	**0**	**0**	**Class III**
UL.4	VC20	D	D	low	low	5535	132.21	Simulated as part of larger Vaal system.					
EWR2RE	RE_EWR 2 MOOI	D	D	low	low	1324	37.69						

IUA description

The area includes the mining areas of Westonaria, Carletonville and Potchefstroom. This IUA is characterised by water quality problems originating from physical disturbance and changes to the river especially the channel, urban runoff, sewage and mining. The IUA includes the Mooi River of which the major tributary Wonderfonteinspruit is adversely impacted by uranium-laden effluent originating from mining, industrial and urban runoff. In the upper reaches of the Mooi River, commercial farming is also an important land use and the Boskop and Klerkskraal Dams supply water to the irrigation schemes. Loopspruit, another tributary of the Mooi River in the lower reaches of the IUA receives significant mine dewatering upstream of Klipdrift Dam.

Ecological Reserve

Two out of the five biophysical nodes representing this IUA are currently in an unacceptable state, and under present conditions, the Management Class will fail (**DWAF, 2007**). It is likely that evenly spread nodes in this IUA will result in a higher percentage of nodes in a PES below a D EC. Improvement is therefore related mainly to the mitigation of the water quality problems, rather than addressing additional flow issues.

Goods and Services

Given the industrial nature as well as the water quality issues there are few opportunities for communities to make use of G&S. As such any utilisation is negligible.

Economics

The area includes the mining areas of Westonaria, Carletonville and Potchefstroom. The main contributor to GDP, employment opportunities and household income in the area is the mining industry with GDP at R7 814.7 million, employment opportunities of 32 946 and a contribution to household incomes of R3 573.1 million. The area also has a strong manufacturing sector. In total the 23 700 direct employment opportunities is supported by water complemented by another 32 200 indirect and induced opportunities.

Conclusions

Under present conditions, the river does not comply even with the Management Class III criteria and fails. None of the operational scenarios evaluated, address these problems which are mostly water quality based and physical disturbance to the channel. The catchment configuration provided in **Table 3.28** is based on the unlikely assumption that these problems can be addressed and the REC achieved.

Table 3.28: Catchment configuration for IUA UL

Ecological Category	C/D	D	MANAGEMENT CLASS
UL (%)	20	80	**III**

3.16 IUA UM (VAAL RIVER DOWNSTREAM OF VAAL DAM TO THE OUTLET OF C23J)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 3.29**.

Table 3.29: IUA UM: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
EWR4	EWR 4	C	B/C	high	high	38638	1977.26	Simulated as part of larger Vaal system.					**Class III**
EWR5	EWR 5	C/D	C	high	high	49739	2288.01	Simulated as part of larger Vaal system.					

IUA description

The area includes the urban areas of Vereeniging, Vanderbijl Park, Sasolburg and Parys. In the reach between Vaal Dam and the Vaal Barrage the three main tributaries (Suikerbosrand, Klip and Rietspruit rivers) discharge into the Vaal Barrage, each conveying significant volumes of treated waste water and mine discharge water. Management of the flow entering this reach is from Vaal Dam and is influenced by the water users in and downstream of the Vaal Barrage, the urban return flows and mine dewatering discharges as well as the releases form Vaal Dam to maintain the TDS concentration at 600 mg/l (**DWA, 2011c**). Downstream of the Vaal Barrage the flow is influence by return flows from mine dewatering and treated urban wastewater entering this reach and upstream of the Vaal Barrage as well as a flow dilution operating rule applied to Vaal Dam releases. The Vredefort Dome World Heritage Site is situated in this reach.

Ecological Reserve

Two EWR sites were defined in this IUA, one with a C EC and the other a C/D EC state, both with a HIGH EI providing motivation that the REC should be an improvement of the PES. However, the assessment of this scenario as part of the Reserve study indicated that the implications of this improvement have significant impacts on the economy. The operational scenario accepted for the purpose of defining the Reserve was therefore to maintain the PES. The scenarios evaluated during this study still do not achieve the REC and for that reason the PES was used in the catchment configuration for this IUA.

Goods and Services

G&S utilisation is likely to be practically non-existent on the tributaries but of high importance in the main Vaal River stem. Recreational fishing is highly important and it includes some of the prime yellow fish and carp fishing areas in the country while subsistence fishing is relatively important. Other recreational usage is of high importance including boating, canoeing and utilisation of the area as an aesthetic resource. The river is also a key feature in the Vredefort Dome World Heritage Site.

Economics

See **Section 3.13** - Economics.

Other

The in-stream water quality often does not comply with recreational acceptable standards in areas such as Parys. This means that even though the Ecological Status is still above a D EC, other human related water quality aspects might be unacceptable. Considering the importance of the Vredefort Dome, these should be improved to acceptable standards. It should be noted that many of these issues relate to inadequacy of municipalities to manage sewage in accordance with current discharge licences/permits.

Conclusions

This stretch of river complies with the characterisation of a working class river with the presence of the Vaal Barrage, Lethabo Weir, the manmade contributions from all the sewage and mine return flows as well as the significant regulating storage provided by Vaal Dam. Severe localised and upstream water quality issues exist. The G&S in terms of recreation, as well as economic issues linked to the tourism potential (especially in the Vredefort Dome) has been severely compromised by the water quality situation. Taking into account the importance of this river within the context of the above (as well as ecological aspects); it is crucial that improvements in water quality are recommended. It is uncertain how this must be encapsulated within the Management Class. The catchment configuration for IUA UM is provided in **Table 3.30**. This catchment configuration however is based on the assumption that water quality issues that compromise recreational and other activities must be addressed. Currently therefore, this MC is not achieved and fails.

Table 3.30: Catchment configuration for IUA UM

Ecological Category	C	C/D	MANAGEMENT CLASS
UM (%)	50	50	**III**

4 MANAGEMENT CLASSES OF THE MIDDLE VAAL CATCHMENT

4.1 OVERVIEW

The Middle Vaal WMA is located downstream of the confluence of the Vaal and the Rietspruit Rivers and upstream of Bloemhof Dam. It extends to the Schoonspruit River in the north and the Vet River in the south, and covers a total catchment area of 52 563 km^2. The Middle Vaal WMA incorporates portions of the Free State and North-West Provinces and is, therefore, important to the regional economies of these provinces. Major rivers in the Middle Vaal WMA include the Schoonspruit, Renoster, Vals, Vet and Vaal rivers (**DWA, 2011c**).

Primary sector activities such as mining and agriculture accounted for approximately 55% of the areas total GDP in 1997 (**DWAF, 2004**). Mine dewatering and the discharge into the river systems have a negative impact on water quality within this WMA. Settlement patterns within the Middle Vaal WMA are dispersed and extensive dryland agricultural practices take place throughout this WMA. Major towns and urban areas in the Middle Vaal WMA include Klerksdorp, Kroonstad, Welkom and Virginia (**DWA, 2011c**).

The Middle Vaal catchment consists of nine identified IUAs (**DWA, 2011c**) as illustrated in ***Appendix A*** and discussed in the following sections.

4.2 IUA MA (RENOSTER RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.1**.

Table 4.1: IUA MA: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
MA.1	VC24	C	C	moderate	moderate	613	18.46	2.23	12.05	0	4.94	26.76	Class III
MA.2	VC25	B/C	B/C	moderate	moderate	881	25.55	2.6	10.17	0	5.32	20.84	
MA.3	VC26	C	C	moderate	moderate	81	2.11	0	0	0	0.33	15.83	
MA.4	R 1	C	C	low	low	2413	63.86	4.31	6.76	0.45	39.87	62.43	
MA.5	VC27	C/D	C/D	low	low	422	7.86	0.75	9.53	0	2.92	37.2	
MA.6	R 2	C	C	low	low	4092	93.14	7.9	8.48	1.11	56.49	60.65	
MA.7	VC29	C	C	low	moderate	1152	17.94	0.91	5.04	5.28	13.67	76.2	
MA.8	VC30	C	C	low	low	5868	120.92	9.67	7.99	8.78	82.78	68.46	

IUA description

This area includes the Renosterspruit with large areas of dryland and some irrigated commercial agriculture as well as abstractions for Voorspoed diamond mine. The main impacts are therefore abstraction and other non-flow related agricultural activities. The IUA is regulated by Koppies Dam, and all available yield is fully utilized. Tributaries include the Doringspruit, Rietspruit and Heuningsspruit. Towns situated in the IUA are Koppies and Edenville among others. Towns serve largely as agricultural service nodes but there are also a number of high value small holdings.

Ecological Reserve

The IUA consists of eight desktop biophysical nodes and the PES varies from a C/D (one node) to a B/C EC

(one node) with all the other nodes being in a C EC. There are no nodes with a HIGH importance therefore the REC in all cases reflects the maintenance of the PES. The IUA is mostly in a C EC as reflected by 75% of assessed nodes.

Goods and Services

The area offers a limited set of recreational opportunities associated with the riverine system but given the relative paucity of alternative recreational zones the riverine areas may play some role particularly in the lower reaches of the Renoster River. Waste water dilution and assimilation is of moderate importance given that land use is primarily commercial agriculture. Overall the use of G&S is likely to be low.

Economics

The unit covers a rural area with the only two urban centres being the small town of Koppies and Edenville. The main contributor to GDP, employment opportunities and household income in the area is the Voorspoed Mine representing a GDP of R665.1 million offering employment opportunities of 2 182 and making a contribution to household incomes of R290 million. In total the 4271 618 direct employment opportunities is supported by water complemented by another 3 430 indirect and induced opportunities.

Conclusions

A cursory overview of the IUA has indicated that a C EC or higher is representative of the area not covered by nodes. A decision was therefore made that a Management Class II is a more appropriate representation in this IUA than the MC III recommended by the ecological guideline. The recommended scenario does not impact on the river and the PES (REC) is therefore maintained. The catchment configuration for IUA MA is provided in **Table 4.2**.

Table 4.2: Catchment configuration for IUA MA

Ecological Category	B/C	C	C/D	MANAGEMENT CLASS
MA (%)	13	75	13	**II**

4.3 IUA MB (VALS RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.3**.

Table 4.3: IUA MB: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
MB.1	VC31	C	C	low	low	860	31.24	0.65	2.08	0	2.92	9.36	Class III
MB.2	VC33	C	C	low	moderate	349	8.2	1.24	15.06	0	1.54	18.83	
MB.3	VC35	C	C	low	low	4898	131.7	10.27	7.79	12.57	37.54	28.5	
EWR14	EWR 14	C/D	C/D	moderate	moderate	5930	145.79	Simulated as part of larger Vaal system					

IUA description

Dryland commercial agriculture and some limited irrigation occur in the Vals River. A sparse population is

characteristic of most of the area. Tributaries are the Elandspruit, Renosterspruit and Skikspruit. These are also associated with dryland agriculture. The major town is Kroonstad which receives water from several small storage dams as well as the Viljoenskroon supplied with water from the Renosterspruit River (IUA MA).

Ecological Reserve

The IUA consists of three desktop biophysical nodes and one EWR site. River reaches in close proximity to larger towns e.g. Kroonstad and Viljoenskroon will be impacted by anthropogenic activities and it is expected that these areas will generally have an EC of a D or lower due to water quality related impacts and abstractions.

Goods and Services

The area offers a limited set of recreational opportunities but given the relative paucity of alternative recreational zones the riverine areas may play some role particularly in the lower reaches of the Vals River. Overall the usage of G&S is likely to be low.

Economics

The area hosts both mining and manufacturing sectors with Kroonstad and Viljoenskroon as urban centres. The main contributor to GDP, employment opportunities and household income in the area is the manufacturing sector with a GDP of R1 827.1 million, employment opportunities of 10 040 and a contribution to household incomes of R1 257.9 million. The area also has a competing mining sector. In total the 9 980 direct employment opportunities is supported by water complemented by another 10 700 indirect and induced opportunities.

Conclusions

A MC III is representative of the Vals River as it is assumed that there will be many reaches in at least a D EC. The recommended scenario does not impact on the river and the PES (REC) is therefore maintained. The catchment configuration for IUA MB is provided in **Table 4.4**.

Table 4.4: Catchment configuration for IUA MB

Ecological Category	C	C/D	MANAGEMENT CLASS
MB (%)	75	25	**III**

4.4 IUA MC (SCHOONSPRUIT)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.5**.

Table 4.5: IUA MC: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
MC.1	S1	C	C	low	low	1350	60.6	0	0	0	0	0	Class III
MC.2	VC21	C	C	low	moderate	2020	19.5	0.11	0.58	0	3.99	20.45	
MC.3	S3	C/D	C/D	low	low	2694	105.52	0	0	0	0	0	
MC.4	S4	C/D	C/D	low	low	3503	117.31	0	0	0	0	0	
MC.5	**VC22**	**D/E**	**D**	**low**	**low**	**839**	**26.19**	**0.23**	**0.88**	**0**	**3.63**	**13.86**	
MC.6	VC23	D	D	low	low	499	5.24	0	0	0	2.7	51.45	

IUA description

Land use is predominately mining, dryland and limited irrigated agriculture and urbanization. Important towns include Ventersdorp, Klerksdorp, Stilfontein, and parts of the outskirts of Orkney. Tributaries include Taaibosspruit, Koekemoerspruit and Jagspruit. The Schoonspruit dolomitic eye represents an important resource in the upper part of the catchment, providing water for irrigation agriculture and Ventersdorp as well as base flow in the river. There are also substantial irrigation abstractions through boreholes from the dolomitic compartments feeding the eye. Major impacts include mining and agricultural return flows, flow regulation for irrigation use, and water quality related problems due to urbanization, mining and agriculture.

Ecological Reserve

The IUA consists of six biophysical nodes of which three nodes are EWR sites, situated in the Schoonspruit. The PES varies from C to a C/D in the Schoonspruit while the Koekemoerspruit and Jagspruit are in a D to D/E EC. To improve the Koekemoerspruit to a D (the required REC) would require water quality improvements as well as improvement in agricultural practices.

Goods and Services

Waste water dilution and assimilation is of moderate importance given that land use includes commercial agriculture and mining. Overall the usage of G&S is likely to be low.

Economics

The area is a predominantly mining area, with the urban centres of Ventersdorp, Klerksdorp, Stilfontein and a section of Orkney. The main contributor to GDP, employment opportunities and household income in the area is therefore the mining industry with a GDP of R9 757.6 million, employment opportunities of 59 276 and a contribution to household incomes of R4 254.9 million. In total the 33 800 direct employment opportunities is supported by water complemented by another 31 400 indirect and induced opportunities.

Conclusions

Based on the LOW EI of all the nodes and the high occurrence of urbanization and related water quality problems a MC III was confirmed. Improvement is required to address the D/E at the MC.5 node and other areas below a D EC. This will require actions by mines to address water quality as well as improvement in agricultural practices. The catchment configuration is based on the assumption that this improvement will take place and is provided in **Table 4.6**.

Table 4.6: Catchment configuration for IUA MC

Ecological Category	C	C/D	D	MANAGEMENT CLASS
MC (%)	33	33	33	**III**

4.5 IUA MD1 (UPPER SAND RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.7**.

Table 4.7: IUA MD1: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
MD1.1	VC40	C	C	low	low	2215	66.4	0.85	1.28	0	9.5	14.31	Class III

IUA description

Dryland agricultural activities are the main land use in this IUA. The main flow-related impacts in the upper reaches are abstraction for irrigation while the lower reaches are impacted by water quality impacts relating to Senekal.

Ecological Reserve

This IUA consist of only one desktop biophysical node, MD1.1 which is in a C EC. The rest of the area was evaluated using Google Earth and it was found that most of the areas are potentially in a D EC.

Goods and Services

Some parts of the upper catchment have a marked aesthetic appeal and provide for recreational opportunities. The Allemanskraal Dam also offers recreational opportunities. Recreational fishing may be of some importance in certain areas with the emphasis on the river and farm dams.

Economics

For practical economic purposes units MV-D1 (Upper Sand River) and MV-D2 (Lower Sand River) was grouped together in the socio-economic assessment as one economic sector. As the two units are similar, it will not affect the assessment and only differ in that it represents the area above the Allemanskraal Dam and the area below.

This area is also predominantly a mining area with Welkom and Virginia being the main urban centres. The main contributor to GDP, employment opportunities and household income in the area is therefore the mining industry with a GDP of R2 576.1 million, employment opportunities of 15 650 and a contribution to household incomes of R1 123.3 million. In total the 10 000 direct employment opportunities is supported by water complemented by another 20 000 indirect and induced opportunities.

Conclusions

The ecological guideline indicated that this should be MC III irrespective of the 100% C EC. However, as the C EC was found not to be representative of the larger area and ECs lower than C could occur, the MC III was accepted. The recommended scenario does not impact on the river and the PES (REC) is therefore maintained. The catchment configuration for IUA MD1 can therefore include additional nodes at ECs lower than C if that is currently the case. The catchment configuration based on one node is provided in **Table 4.8**.

Table 4.8: Catchment configuration for IUA MD1

Ecological Category	C	MANAGEMENT CLASS
MD1 (%)	100	**III**

4.6 IUA MD2 (LOWER SAND RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.9**.

Table 4.9: IUA MD2: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
MD2.1	V1	C	C	moderate	low	3974	104.16	4.02	3.86	0.75	72.44	69.54	Class III
MD2.2	VC42	C	C	moderate	low	734	19.26	0.78	4.07	0	2.33	12.08	
MD2.3	VC46	C	C	moderate	low	7555	180.27	5.34	2.96	3.95	47.81	26.52	

IUA description

This IUA includes the lower Sand River and the Klipspruit, Koolspruit, Maselspruit, Erasmusspruit, and the Sloopspruit. Towns include Ventersburg, Henneman, and Virginia. Allemanskraal Dam regulates the flow in the Sand River supporting irrigation agriculture and serves as a source of water for Virginia. Most of the impacts associated in this reach are due to agricultural activities, abstraction, urbanisation and mining (node MD 2.3). Water quality in the area is worst near Welkom and Virginia where mining impacts occur.

Ecological Reserve

The IUA consist of three desktop biophysical nodes which all are in a C EC. To determine whether the EC is representative of the whole IUA, four additional nodes were evaluated and found to be within a D EC due to a large number farm dams and erosion.

Goods and Services

Recreational fishing is of some importance in certain areas with the emphasis on the river and farm dams while limited subsistence fishing will occur among poorer communities. The area offers some of recreational opportunities associated with the riverine areas but these are limited and mostly used as a result of the paucity of other options. Given that land use is primarily commercial agriculture waste water dilution and assimilation is of moderate importance.

Economics

See above Section 4.5 – Economics.

Conclusions

With the desktop biophysical nodes in a D EC as well as the assumption that the PES around Welkom and Virginia is likely to be a D EC or lower, confirms that the Management Class for this IUA to be MC III. The recommended scenario does not impact on the river and the PES (REC) is therefore maintained. The catchment configuration for IUA MD2 is provided in **Table 4.10**.

Table 4.10: Catchment configuration for IUA MD2

Ecological Category	C	MANAGEMENT CLASS
MV D2 (%)	100	**III**

4.7 IUA ME1 (UPPER VET RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.11**.

Table 4.11: IUA ME1: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
ME1.1	VC49	C	C	low	moderate	2113	72.01	1.2	1.66	0.18	15.57	21.62	Class III
ME1.2	VC52	C	C	low	low	2083	81.86	1.53	1.87	1.95	17.5	21.38	
ME1.3	VC51	B/C	B/C	low	moderate	159	3.87	0	0	0	0.86	22.22	

IUA description

This is the upper portion of the Vet River but also includes the Lengana River, Leeuspruit River, Vaalbankspruit, Klein Vet River and Soutspruit. The only town of any significance is Winburg. Some mining activities also occur in the IUA. Land use is mainly agriculture and the most significant impacts are flow modification due to farm dams and erosion.

Ecological Reserve

The three desktop biophysical nodes are in a C and B/C EC. Three additional nodes, excluded from the EWR assessment, were evaluated and the EC of these nodes are also likely to be in a C EC (farm dams and erosion).

Goods and Services

Recreational fishing is of some importance in certain areas with the emphasis on the river and farm dams while subsistence fishing is limited to farm workers. The area offers some recreational opportunities associated with the riverine areas mostly in the upper regions.

Economics

The area above the Erfenis Dam has both mining and manufacturing sectors with Winburg as the urban centre. The main contributor to GDP and employment opportunities in the area is the mining industry with a GDP of R1 691.7 million and employment opportunities of 10 277. The manufacturing sector, however, contributes the most to household incomes, namely R1 064.7 million. In total the 9 650 direct employment opportunities is supported by water complemented by another 10 350 indirect and induced opportunities.

Conclusions

Considering the ecology as well as the fact that there are no major urban development or large dams and regulatory infrastructure in the area, a MC II rather than a MC III are recommended for the IUA. This was further supported by an overview of the IUA which confirmed that a C EC will most likely occur in the areas not covered

by the biophysical nodes as well as the finding that the recommended scenario does not require changes to the current operation of the river. The REC is therefore to maintain the PES. The catchment configuration for IUA ME1 is provided in **Table 4.12**.

Table 4.12: Catchment configuration for IUA ME1

Ecological Category	B/C	C	MANAGEMENT CLASS
MV E1 (%)	33	67	**II**

4.8 IUA ME2 (LOWER VET RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.13**.

Table 4.13: IUA ME2: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
ME2.1	V2	C	C	low	moderate	5551	190.94	3.33	1.74	3.95	44.09	23.09	Class III
EWR15	EWR 15	C/D	C/D	moderate	moderate	16040	413.55	Simulated as part of larger Vaal system.					

IUA description

This reach is the Vet River downstream of Erfenis Dam and also includes the Taaibosspruit and the Bloemhof Dam. The major urban settlement is Hopetown but, as with the upper Vet portion of the catchment, the population is sparse. Irrigation agriculture dominates, with erosion evident in the reach. Major impacts within the IUA include flow modification due to Erfenis Dam, alien vegetation and presence of agricultural lands.

Ecological Reserve

One desktop biophysical node and one EWR site was assessed. Additional areas within tributaries were also investigated and will most probably be in a C - D EC mainly due to the presence of instream dams and the occurrence of erosion throughout the catchment.

Goods and Services

Recreational fishing is of some importance in certain areas with the emphasis on the river and farm dams as well as the areas upstream of the Bloemhof Dam. The area offers some recreational opportunities as well as those associated with the points of inflow into Bloemhof dam.

Economics

This area below the Erfenis Dam is mainly a farming area with Bultfontein and Hoopstad being the only towns. The main contributor to GDP, employment opportunities and household income in the area is therefore the manufacturing sector with a GDP of R1 268.5 million, employment opportunities of 6 971 and a contribution to household incomes of R873.3 million. In total the 6 150 direct employment opportunities is supported by water complemented by another 6 750 indirect and induced opportunities.

Conclusions

A MC III is considered to be representative of the IUA if one considers the level of development and flow regulation from Erfenis Dam. The recommended scenario does not require changes to the operation of the river and therefore no economy consequences occur since the REC is to maintain the PES. The catchment configuration for IUA UJ is provided in **Table 4.14**.

Table 4.14: Catchment configuration for IUA ME2

Ecological Category	C	C/D	MANAGEMENT CLASS
ME2 (%)	50	50	**III**

4.9 IUA MF (VAAL RIVER FROM RENOSTER TO BLOEMHOF DAM)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 4.15**.

Table 4.15: IUA MF: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
MF.1	VC56	C	C	low	moderate	864	4.75	0					Class III
EWR12	EWR 12	D	D	moderate	moderate	62305	2546.42	Simulated as part of larger Vaal system.					
EWR13	EWR 13	C/D	C/D	moderate	moderate	70809	2714.89	Simulated as part of larger Vaal system.					

IUA description

The IUA is characterised by mining and irrigation as well as some dryland agriculture.

Ecological Reserve

The IUA comprises one desktop biophysical node and two EWR sites. Major impacts include flow modification (increased flow due to releases from Vaal Barrage and Vaal Dam) and water quality impacts of mining and treated wastewater from urban areas. This IUA falls well within the “workhorse” river definition of a MC III.

Goods and Services

Recreational fishing is highly important and some of the prime yellow fish and carp fishing areas in the country occur here. Subsistence fishing is relatively important but possibly limited to the poorer sectors of the urban areas associated with Orkney and some farm workers. Other recreational usage is of moderate importance but not as notable as the areas of the Vaal River upstream of this reach.

Economics

This area is mainly a manufacturing and mining area. The main contributor to GDP, employment opportunities and household income in the area is therefore the manufacturing sector with a GDP of R979.5 million, employment opportunities of 5 383 and a contribution to household incomes of R674.3 million. In total the 4 650 direct employment opportunities is supported by water complemented by another 5 000 indirect and induced opportunities.

Conclusions

The MC III is representative of the reach. The recommended scenario does not impact on the operation of the river or on the economy since the REC is to maintain the PES. The catchment configuration for IUA MF is provided in **Table 4.16**.

Table 4.16: Catchment configuration for IUA MF

Ecological Category	C	C/D	D	MANAGEMENT CLASS
MV F (%)	33	33	33	**III**

5 MANAGEMENT CLASSES OF THE LOWER VAAL CATCHMENT

5.1 OVERVIEW

The Lower Vaal WMA is located downstream of Bloemhof Dam and upstream of Douglas Weir. It extends to the headwaters of the Harts, Molopo and Kuruman River in the north and the Vaal River Downstream of Bloemhof in the south. It covers a catchment area of 51,543 km^2 and lies in the North West and Northern Cape Provinces, with the south-eastern corner in the Free State, and borders on Botswana in the north, as well as on the Crocodile (West) and Marico, Middle Vaal, Upper Orange and Lower Orange water management areas (**DWA, 2011c**).

Agriculture is the primary economic activity in the Lower Vaal WMA. Water is supplied from the Vaal River main stem via the Vaal-Harts Weir to the Taung and Vaalharts Irrigation schemes under which 6 000ha and 32000ha of irrigated land are cultivated, respectively. Commonly produced crops include a mix of high and low value crops such as maize, wheat, lucerne, table grapes, citrus and peaches. **DWAF (2004)** noted that approximately 80% of the water released from the Upper Vaal WMA is used for irrigation purposes and that only irrigation return flows and flood flows reach the confluence with the Orange River. The Middle and Lower Vaal WMAs also have an important role to play in the context of the provincial economies (**DWA, 2011c**).

The Lower Vaal catchment consists of five identified IUAs (**DWA, 2011c**) as illustrated in ***Appendix A*** and discussed in the following sections.

5.2 IUA LA1 (UPPER HARTS RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 5.1**.

Table 5.1: IUA LA1: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
LA1.1	VC55	C	C	low	low	3145	17.06	0.05	0.3	0	2.99	17.52	Class III
LA1.2	VC61	C	C	low	moderate	1554	12.18	1.16	9.54	0	1.55	12.76	

IUA description

The IUA includes the Upper Harts and Klein Harts systems. Sannieshof is the only urban area of any importance in the area. Most of the impacts are associated with agricultural activities (which includes dryland agriculture and livestock farming) and abstraction due to limited centre pivot irrigation.

Ecological Reserve

Two desktop biophysical nodes were assessed and both nodes fall within a C EC. The Environmental Importance (EI) is LOW and MODERATE and the REC is therefore set to maintain the PES. Impacts are mostly due to farming activities. Baberspan, a Ramsar site occurs in this IUA and is important for recreation in terms of bird watching. Additional areas were also evaluated and it was found that the C EC is representative of the larger area.

Goods and Services

The population density is low and overall the usage of G&S is likely to be low.

Economics

For practical economic assessment the individual integrated units of analyses of LV-A1: Upper Harts River, LV-A2: Middle Harts River, LV-A3: Dry Harts River and LV-A4: Lower Harts River was grouped together in the Socio-economic Assessment as one economic sector. As the four units are similar it will not affect the assessment.

The area hosts the mining, manufacturing and irrigation agriculture sectors. The main urban centres are Schweizer-Reneke, Taung and Hartswater. The main contributor to GDP and employment opportunities is the mining sector with a GDP of R3 478.8 million and employment opportunities of 21 133. The manufacturing sector is the main contributor to household income, namely R2 144.2 million. In total the 20 800 direct employment opportunities is supported by water complemented by another 21 900 indirect and induced opportunities.

Conclusions

Considering that a C EC is representative of the larger IUA, the Management Class III as recommended by the guideline was changed to a MC II. The recommended scenario does not impact on the river and economy and the PES (REC) is therefore maintained. The catchment configuration for IUA LA1 is provided in **Table 5.2**.

Table 5.2: Catchment configuration for IUA LA1

Ecological Category	C	MANAGEMENT CLASS
MV LA1 (%)	100	**II**

5.3 IUA LA2 (MIDDLE HARTS RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 5.3**.

Table 5.3: IUA LA2: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
LA2.1	VC57	C	C	low	moderate	9109	45.33	0	0	1.02	NA	NA	Class III

IUA description

This IUA includes the middle Harts River upstream of Wentzel Dam. Land use is primarily dryland agriculture and urban areas include Schweizer-Reneke and Delareyville.

Ecological Reserve

One desktop biophysical node falls within a C EC and is representative of the IUA.

Goods and Services

The population density is low and overall the usage of G&S is likely to be low.

Economics

See above **Section 5.2** – Economics.

Conclusions

It is recommended that the Management Class of III be adjusted to II due to the suspected dominance of a C EC in the wider area. The recommended scenario does not impact on the river and the PES (REC) is therefore maintained. The catchment configuration for IUA LA2 is provided in **Table 5.4**.

Table 5.4: Catchment configuration for IUA LA2

Ecological Category	C	MANAGEMENT CLASS
MV LA2 (%)	100	**II**

5.4 IUA LA3 (DRY HARTS RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 5.3**.

Table 5.5: IUA LA3: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
LA3.1	VC58	D	D	low	low	10205	48.7	0.87	1.78	0.37	1.38	2.83	Class III

IUA description

This IUA represents the dry Harts River system. Vryburg is the only urban area of any importance in the area. Population density is low to very sparse. No regulation storage is present in this catchment and the flow is largely natural. The whole reach is characterised by extensive erosion (overgrazing). The upper reaches consist of settlements, e.g. Leshobo and Matlapaneng.

Ecological Reserve

One desktop biophysical node represents the IUA and is in a D EC.

Goods and Services

Goods and Services usage is limited in this area.

Economics

See above Section 5.2 – Economics.

Conclusions

An overview of the IUA has indicated that this state is representative of the IUA and the Management Class was confirmed. The recommended scenario does not impact on the river and economy and the PES (REC) is

therefore maintained. The catchment configuration for IUA LA3 is provided in **Table 5.6**.

Table 5.6: Catchment configuration for IUA LA3

Ecological Category	D	MANAGEMENT CLASS
MV LA3 (%)	100	**III**

5.5 IUA LA4 (LOWER HARTS RIVER)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 5.7**.

Table 5.7: IUA LA4: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
LA4.2	VC59	A/B	A/B	moderate	high	1167	3.29	0	0	0	NA	NA	Class I
EWR17	EWR 17	D	D	moderate	moderate	31029	147.85	Simulated as part of larger Vaal system.					

IUA description

The upper portions of the area are largely influenced by the Vaalharts Irrigation scheme which generates a significant base flow in the river due to irrigation return flows. The lower portion of the IUA, downstream of Spitskop Dam, is influenced by releases for irrigation abstracted along the river reach with little flow reaching the Vaal River. Dryland commercial agriculture is the most significant land use. The major towns are Hartswater and Pampierstad in the upper portion of the IUA, while the population of the lower portion of the area is negligible (**DWA, 2011c**). The irrigation return flows from Vaalharts Irrigation Scheme (increased base flows) in the upper reaches as well as the effect of Spitskop Dam (reduction in moderate flow events) in the lower reaches are the biggest impacts within the IUA.

Ecological Reserve

One desktop biophysical node and one EWR site was assessed. EWR 17 is in a D EC mainly due to flow modification (Spitskop Dam) as well as deteriorated water quality. LA4.2 is situated in a tributary and has an EC of an A/B with agriculture being the main impact on the node mainly due to non flow-related activities. It was observed that the main river is in a much more degraded state than the ephemeral tributaries.

Goods and Services

Recreational fishing is limited, while subsistence fishing is limited throughout the IUA, but is of some importance to the residents of Pampierstad.

Economics

See above Section 5.2 - Economics.

Conclusions

It is assumed that a range of Ecological Categories will occur in this IUA, and to cater for this, and the fact that the main stem is in a D EC, a MC II will better represent this IUA than the MC I which the ecological guideline

recommends. The recommended scenario does not impact on the operation of the river and the economy due to the REC being set to maintain the PES. The catchment configuration for IUA LA4 is provided in **Table 5.8**.

Table 5.8: Catchment configuration for IUA LA4

Ecological Category	A/B	D	MANAGEMENT CLASS
LA4 (%)	50	50	**II**

5.6 IUA LB (VAAL RIVER DOWNSTREAM OF BLOEMHOEF DAM TO ORANGE CONFLUENCE)

A summary table of EcoClassification and water availability at the biophysical nodes is provided in **Table 5.9**.

Table 5.9: IUA LB: Summary of EcoClassification and water availability at the biophysical nodes

New Node name	Original Node Name	PES	REC	EIS	EI	Gross catchment area (km^2)	Natural MAR (MCM/a)	Irrigation		Other	Storage		Prelim MC
								Demand (MCM/a)	% MAR	Demand (MCM/a)	Volume (MCM)	% MAR	
LB.1	VC60	A/B	A/B	moderate	high	4743	11.62	0.32	2.78	0	NA	NA	Class II
EWR16	EWR 16	D	D	moderate	moderate	108474	3303.1	Simulated as part of larger Vaal system.					
EWR18	EWR 18	C	C	moderate	moderate	157685	3407.79	Simulated as part of larger Vaal system.					
Douglas EWR	IFR1	C/D	C	moderate*	moderate	194479	3759	Simulated as part of larger Vaal system.					

* The REC is based on the high instream EIS.

IUA description

The IUA includes the Vaal River downstream of Bloemhof Dam which serves as a conveyance conduit to supply water for irrigation and urban use in the lower reaches of the Vaal River (Kimberley, Christiana, Warrenton, Windsorton, Barkly West and Delportshoop). The Douglas Irrigation Scheme is supplied from the Douglas Weir and, in addition to the runoff entering Douglas Weir from the upstream incremental catchments, water is transferred (pumped) from the Orange River into the weir. The IUA has significant irrigation agriculture along the banks of the river and the river operating rule entails that no water from the Vaal River reaches the Orange River. Outside of riparian the zone the most prominent land use is dryland commercial agriculture with very sparse populations.

Ecological Reserve

Four nodes were assessed of which one is a desktop biophysical node (LB.1) and the others are EWR sites. As with the previous IUA, node LB.1 is an outlier situated on a tributary with limited development, hence the A/B EC (see **Table 5.9**). The river stretch downstream of Douglas Weir is a very important migration corridor between the Vaal and Orange Rivers and therefore this area is of high Ecological (instream) Importance. Currently there are often zero flows in this river stretch. The key indicator species that would be potentially impacted by a change in flow regime would be *Labeobarbus kimberleyensis* (BKIM) which is a Red Data species. The recommendation was put forward to improve the PES of a C/D to a C EC which could be attained by setting revised flows based on revised hydrology which was an improvement on the current zero flow durations.

The D, C/D and C ECs of the three EWR sites are representative of the implication of flow regulation and irrigation return flows in the main Vaal River.

Goods and Services

Recreational fishing is of importance while subsistence fishing, although limited, may play some role for residents of from the pooper parts of the towns named above. Return flow dilution and assimilation as a function of the river is of some importance given that land use is primarily commercial agriculture particularly given the intensity of use.

Economics

The economic activity in the IUA consists of mining, manufacturing and irrigation agriculture sectors. The main urban centres are Bloemhof and Jan Kempdorp. The main contributor to GDP and household income is the manufacturing sector contributing R2 815.1 and R1 938.1 million respectively. The agricultural sector contributes the most to employment opportunities, namely 22 076. In total the 24 600 direct employment opportunities is supported by water complemented by another 28 350 indirect and induced opportunities.

The economic cost of providing the flow to achieve the recommended ecological category at the Douglas EWR site was estimated to be between R511 million and R569 million and is as a result of the reduction in the available water in the Vaal River System (**DWA, 2012**).

Conclusions

The ecological guideline indicates a MC II which is mostly due to the one A/B node. Taking the socio economic importance of the main Vaal River into account and noting that tributaries do not represent important water resources, a Management Class of III ("workhorse" river) is more applicable and representative of the main Vaal River. It must be noted that the catchment configuration does not include the REC of the C EC for the Douglas EWR site. This is due to the low confidence in the EWR estimates (assessed 12 years ago) as well as the economic impact if a C EWR had to be achieved (see above section). However, the most important improvement required is to decrease the periods of zero flows and therefore improve the connectivity between the Orange and Vaal Rivers. If in future the situation changes and this becomes a possibility, a serious effort should be made to implement these mitigation measures.

The catchment configuration for IUA LB is provided in **Table 5.10**.

Table 5.10: Catchment configuration for IUA LB

Ecological Category	A/B	C	C/D	D	MANAGEMENT CLASS
UC2 (%)	25	25	25	25	**III**

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The Management Classes for the Vaal River Catchment are provided in **Table 6.1**.

Table 6.1: Proposed Management Classes of the Vaal River system.

WMA	Integrated Unit of Analysis		Proposed MC
Upper Vaal	UA	Vaal River upstream of Grootdraai Dam	II
	UB	Klip River (Free State)	II
	UC1	Upper Wilge River	II
	UC2	Wilge River and tributaries	II
	UC3	Lower Wilge River	II
	UD	Liebenbergsvlei River	III
	UE	Waterval River	III
	UF	Kromspruit and Skulpspruit	II
	UG	Vaal River from Grootdraai Dam to Vaal Dam	II
	UH	Suikerbosrand River	II
	UI	Klip River (Gauteng)	III
	UJ	Taaibosspruit	III
	UK	Kromelmboogspruit	III
	UL	Mooi River	III
	UM	Vaal River reach from Vaal Dam to C23L	III
Middle Vaal	MA	Renoster River	II
	MB	Vals River	III
	MC	Schoonspruit River	III
	MD1	Upper Sand River	III
	MD2	Lower Sand River	III
	ME1	Upper Vet River	II
	ME2	Lower Vet River	III
	MF	Vaal River from Renoster River confluence to Bloemhof Dam	III
Lower Vaal	LA1	Upper Harts River	II
	LA2	Middle Harts River	II
	LA3	Dry Harts River	III
	LA4	Lower Harts River	II
	LB	Vaal River from downstream of Bloemhof Dam to Douglas Weir	III

Thirteen IUAs fall within a MC II and thirteen IUAs fall within a MC III. An additional three IUAS fall within a MC III but currently fail (red shading in **Table 6.1**) as they include areas lower than a D EC or have non-ecological water quality problems. IUA UI (Klip, Blesbokspruit and other rivers) and IUA UL (Mooi River) are both dominated with water quality problems amongst others. IUA UM (Vaal River downstream of the Vaal Barrage) has non-ecological water quality problems that impact on recreation and other activities, with the emphasis of the impact on the Vredefort Dome as a prime tourist venue.

6.2 RECOMMENDATIONS

The results and findings from this study points to the following recommendations:

- Considering that poor water quality was identified as the primary reason the Present Ecological State (PES) of several Integrated Units of Analysis (IUAs) are "*seriously modified [where] the loss of natural habitat, biota and basic ecosystem functions is extensive*" - Ecological Category E (**Kleynhans and Louw, 2007**), it is recommended that strategies be identified, investigated and implemented to improve these rivers such that the indicated Recommended Ecological Categories (REC) can be achieved. To this end, the Integrated Water Quality Management Strategy, currently being implemented in the Vaal River System, should consider prioritising these catchments for devising management plans to implement appropriate intervention measures that will improve the present ecological state of these rivers.
- The regulation of flow in the Wilge River (EWR Site 8) through releases from Sterkfontein Dam should attempt to mimic a seasonal release pattern while limiting the reduction in the firm supply available from the Vaal River System (maintain the assurance of supply). The effect such seasonal release rules will have on the ecology will have to be evaluated through a monitoring programme to be implemented during and after the releases are made. This can typically be coordinated along with the Annual Operating Analysis carried out for the system each year.
- Due to the fact that the PES and EI-ES study (**DWA, 2011a**) was not completed prior to the execution of the WRCS, information on any additional nodes from the final assessments of the PES and EI-ES study should be incorporated to define the catchment configuration. It is therefore recommended that information from all available nodes be evaluated during licensing and or other assessments. In cases where further nodes are evaluated those should also be added to regularly update the catchment configurations.
- The analysis and evaluations carried out at desktop nodes (ecological and hydrological) are usually of low confidence. It is recommended further detail evaluations be carried out before any remedial measures (such as reduction in allocations) are considered or implemented.
- Designing and implementing appropriate monitoring plans are essential to evaluate the hypotheses made during the EWR assessments. The monitoring result will determine any trends or change in Ecological Categories and, most importantly, identify possibly non-compliance of the Management Classes.

7 REFERENCES

WRC, 2011 Technical report for the National Freshwater Ecosystem Priority Areas Project. WRC report No. 1801/2/11. JL Nel, KM Murray, AM Maherry, CP Petersen, DJ Roux, A Driver, L Hill, H van Deventer, N Funke, ER Swartz, LB Smith-Adao, N Mbona,L Downsborough & S Nienaber. 2011.

DWAF, 2004 Department of Water Affairs and Forestry, South Africa, Middle Vaal Water Management Area: Internal Strategic Perspective, 2004. Prepared by PDNA, WRP Consulting Engineers (Pty) Ltd, WMB and Kwezi-V3 on behalf of the Directorate: National Water Resource Planning. DWAF Report No P WMA 09/000/00/0304).

DWAF, 2007 Department Water Affairs and Forestry. Chief Directorate: Resource Directed Measures. Development of the Water Resource Classification System (WRCS) Volume 1 Overview and 7-step classification procedure. October 2006.

DWA, 2011a Determination of the Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) of Sub-Quaternary river reaches in South Africa. RQS & RDM.

DWA, 2001b Department of Water Affairs, South Africa, March 2011. 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. *Prepared by:* WRP Consulting Engineers (Pty) Ltd in association with DMM Development Consultants CC, Rivers for Africa eFlows Consulting (Pty) Ltd, Conningarth Economists, Koekemoer Aquatic Services and Zitholele Consulting (Pty) Ltd. Report No. RDM/WMA8,9,10/00/CON/CLA/0211.

DWA, 2011c Department of Water Affairs, South Africa, March 2011. 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. *Prepared by:* WRP Consulting Engineers (Pty) Ltd in association with DMM Development Consultants CC, Rivers for Africa eFlows Consulting (Pty) Ltd, Conningarth Economists, Koekemoer Aquatic Services and Zitholele Consulting (Pty) Ltd. Report No. RDM/WMA8,9,10/00/CON/CLA/0211.

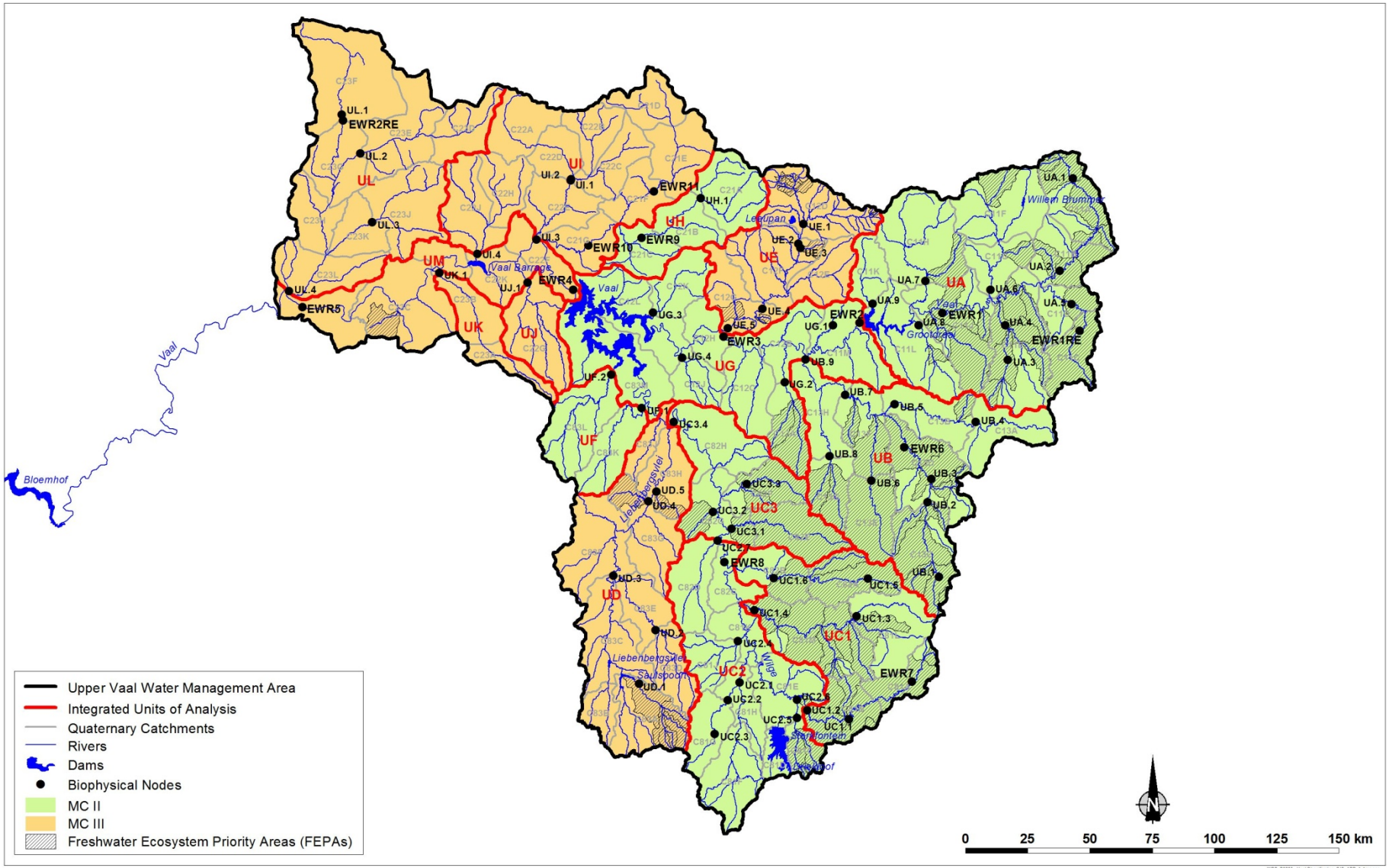
DWA, 2012 Department of Water Affairs, South Africa, June 2012. Classification of Significant Water Resources (River, Wetlands, Groundwater and Lakes) in the Upper, Middle and Lower Vaal Water Management Areas (WMA) 8, 9, 10: Scenario Evaluation Report. *Prepared by:* WRP Consulting Engineers (Pty) Ltd in association with DMM Development Consultants CC, Rivers for Africa eFlows

Consulting (Pty) Ltd, Conningarth Economists, Koekemoer Aquatic Services and Zitholele Consulting (Pty) Ltd. Report No. RDM/WMA8,9,10/00/CON/CLA/0112.

Kleynhans, C.J. and Louw, M.D. 2007 — Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT329-08.

Appendix A:

Catchment Maps of the Integrated Units of Analysis and MCs



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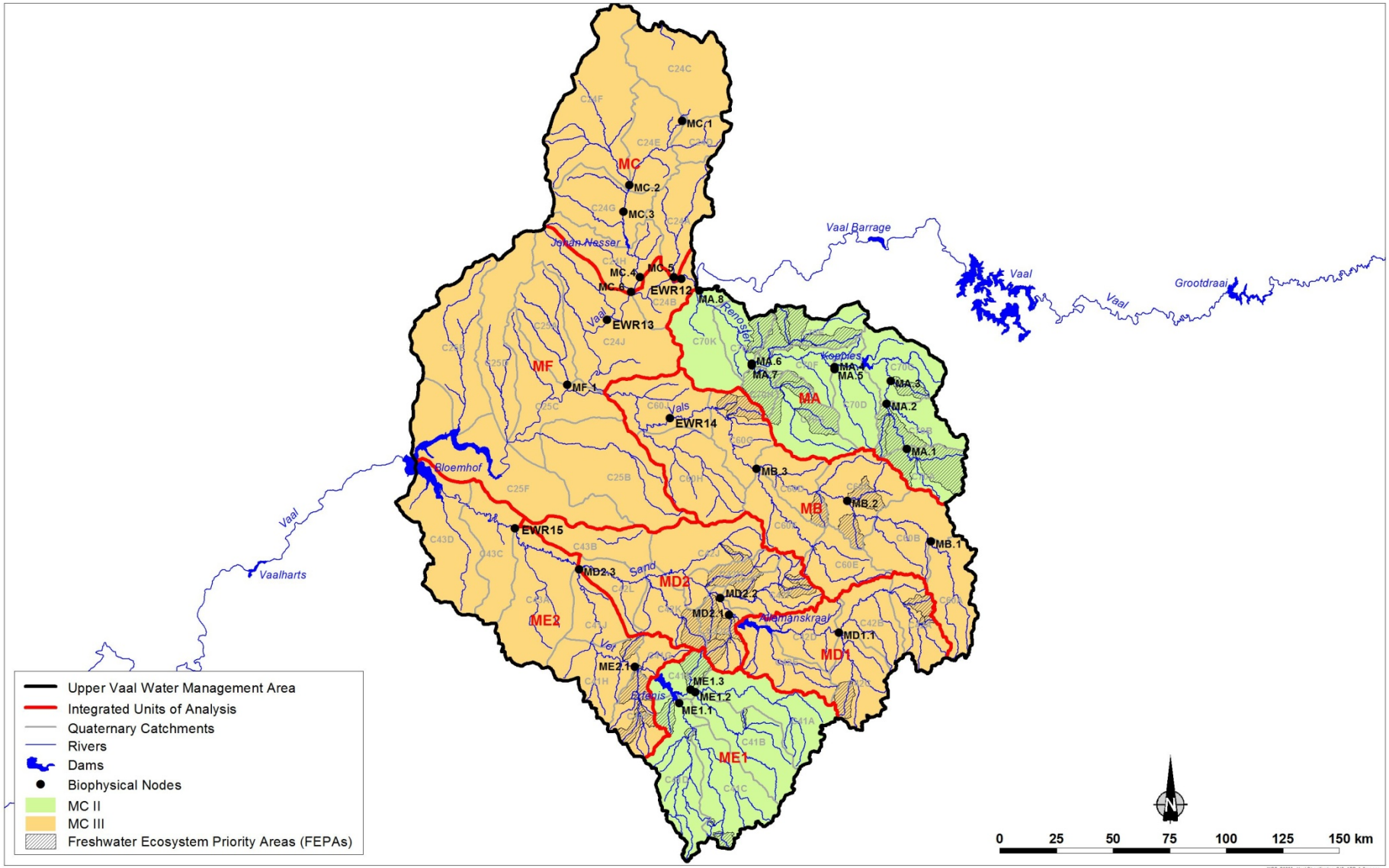
Conningarth Economists

CLASSIFICATION OF SIGNIFICANT WATER RESOURCES (RIVER, WETLANDS, GROUNDWATER AND LAKES) IN THE UPPER, MIDDLE AND LOWER VAAL WATER MANAGEMENT AREAS (WMA) 8, 9, 10

Upper Vaal: Proposed Management Classes

A-1



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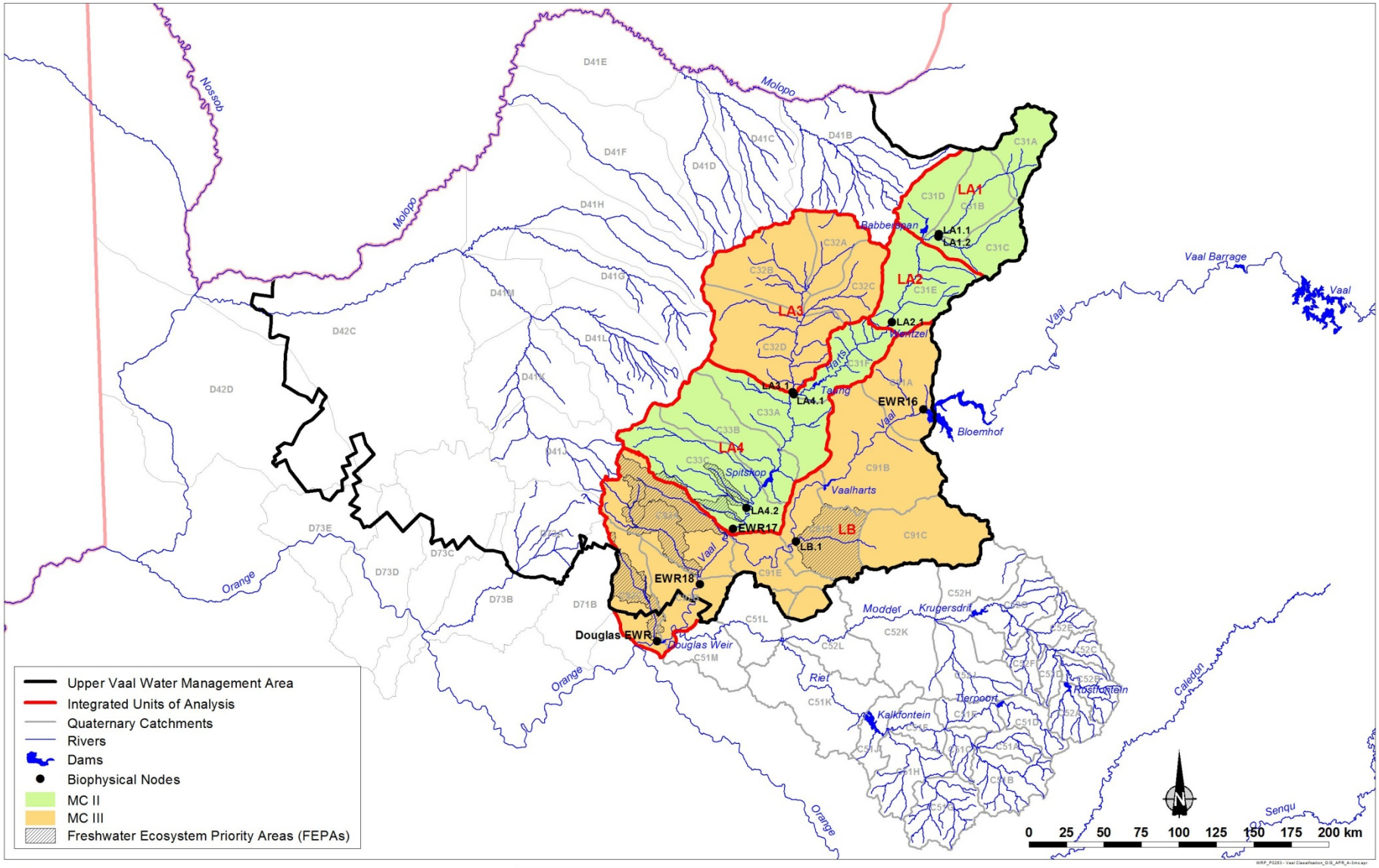
CLASSIFICATION OF SIGNIFICANT WATER RESOURCES (RIVER, WETLANDS, GROUNDWATER AND LAKES) IN THE UPPER, MIDDLE AND LOWER VAAL WATER MANAGEMENT AREAS (WMA) 8, 9, 10

Middle Vaal: Proposed Management Classes

A-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

Lower Vaal: Proposed Management Classes

A-3

Appendix B:

Summarised information on NFEPAs

The National Freshwater Ecosystem Priority Areas (NFEPAs) project is a multi-partner project between the CSIR, South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks).

The purpose of the information provided in this appendix is to summarise the approach adopted for the assessment of the NFEPAs and to describe the incorporation of the NFEPAs in the classification of significant water resources in the three Vaal Water Management Areas (WMAs).

FEPAs were selected for Sub Quaternary river reaches (referred to as SQ or SQs) using a range of criteria and a combination of factors played a role. At the stage when the status quo was assessed for the Vaal WMAs the specific reason for any SQ to be allocated a river (or wetland) FEPA state was not readily available and this is still presently the case. What is however clear, is that the base criteria of the River FEPA is the following: "Rivers had to be in a good condition (A or B ecological category); to be chosen as FEPAs" (**WRC, 2011**).

Furthermore, the method used to determine the present state was described as follows (**WRC, 2011**): "Combines data on present ecological state of rivers (Kleynhans 2000) and available present ecological state updates, river health data, reserve determination data, expert knowledge and natural land cover data."

This means that any current methods and SQ specific assessments used to assess the Present Ecological State (PES) in the Classification Study would be of higher confidence than the above assessment (study which determined the NFEPAs). In essence, any of the identified NFEPAs which are not in a B or A Ecological Category do not warrant the FEPA status.

NFEPAs were evaluated in this study to determine whether they represent A or B Ecological Categories that would indicate that biophysical nodes would be required to represent the NFEPAs. At the stage of the evaluation (2010) the NFEPA reports were not yet available and the study team was advised to only consider River NFEPAs. All the mapped NFEPAs were subsequently tabled and reasoning provided regarding the direct role it played in the EcoClassification (i.e. influencing the Recommended Ecological Category -REC) and indirectly in the determination of the Management Class (MC). It must be noted that based on the criteria of all these NFEPAs having to be in a B or A Ecological Category, more than 90% of them would have fallen away. However, for the purposes of this study all of the approximately 150 river FEPAs were evaluated to ensure that no important information that could be used in support of the REC was excluded.

The table below indicate the incorporation of river FEPAs per IUA. The descriptions of the columns included in the table are as follows:

- **FEPA**: Number of the FEPA in the order as it appears in the table.
- **SQ reach**: The SQ reach name/number which is the DWA code that has to be used.
- **Quat**: Provides the quaternary catchment/s in which the SQ reach is situated.
- **MC**: Allocated Management Class.
- **PES**: Present Ecological State determined during this study and the Comprehensive Reserve study.
- **Representative node (New and Original Node Name)**: Provides the original node names used during the Reserve study and initially during the WRCS as well as the more user friendly names finally used for stakeholder presentation.

- **Included as a desktop biophysical node (Yes/No)**: This indicates whether the FEPA is represented by a desktop biophysical node within the IUA.
- **Role in MC determination**: A short explanation is provided to indicate whether the FEPA was confirmed and is warranted based on the revised PES. The role it played in the REC and therefore in the catchment configuration of the IUA is also provided.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
UA								
1	C11A-01457	C11A	II		Represented by UA.1	Represented by 8VF5	Y	See comment below.
2	C11A-01460	C11A		B/C	UA.1	8VF5	Y	The Environmental Importance (EI) was HIGH with a PES of a B/C and an improved REC of a B. Possible reasons for FEPA (based on study team evaluation) were the presence of oxbows, cranes and floodplains.
3	C11A-01460	C11A		C - B	Represented by UA.1	Represented by 8VF5	Y	See comment above.
4	C11A-01678	C11A		C - B	Represented by UA.2	Represented by C1VAAL-KVAAL	Y	A small tributary with no water resource use, therefore not included as a separate biophysical node.
5	C11A-01518	C11A		C - B	Represented by UA.2	Represented by C1VAAL-KVAAL	N	
6	C11B-01693	C11B		C - B	Represented by UA.2	Represented by C1VAAL-KVAAL	N	
7	C11B-01770	C11B		C	UA.2	C1VAAL_KVAAL	Y	Possible reasons for FEPA (based on study team evaluation) are the presence of oxbows, cranes and floodplains. The PES was a C and due to the MODERATE EI the REC was set to maintain the PES. The impacts were mostly non-flow related and improvement of flow would not achieve the aim of FEPA which would be to improve the present state.
8	C11C-01846	C11C		C	EWR1RE	RE EWR 1 KLEINVAAL	Y	Possible reasons for FEPA (based on study team evaluation) are the presence of oxbows, cranes and floodplains). The PES was a C and due to the MODERATE EI the REC was set to maintain the PES. The impacts were mostly non-flow related and improvement of flow would not achieve the aim of FEPA which would be to improve the present state.
9	C11C-01846	C11D		C/D	UA.5	C1KVAA-UNSPE	Y	The PES is a C/D and EI was MODERATE. Although in the same SQ reach as EWR1RE the FEPA was not confirmed for the river stretch represented by this SQ as it is located downstream of the transfer and would be in a F EC. It was therefore assumed that EWR1RE, located upstream of the transfer was representative of the FEPA. Due to the PES which for FEPA either has to be in an A or B, or if a C it should be improved to a B, the aims for FEPA cannot be achieved.
10	C11E-01822	C11E			Represented by EWR 1	Represented by EWR1	Y	See EWR 1 (FEPA 19)
11	C11E-02117	C11E			Represented by UA.3	Represented by UV9	Y	See below.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
12	C11E-01985	C11E		C	UA.3	UV9	Y	The whole reach and upstream reaches are dominated by dryland agriculture with some irrigation. Many small farm dams and one large dam present in the reach. This reach includes Amersfoort town. No obvious reason for FEPA and as the PES was a C and EIS was LOW no improvement was recommended.
13	C11E-02005	C11E					N	This reach was evaluated and originally represented by VC1 which was excluded from the final biophysical nodes. The land use of the whole reach consists of dryland agriculture and irrigation. There are many small dams at the source of the river. There was no obvious reason for the FEPA which would require an improvement. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node.
14	C11E-01941	C11E			Represented by UA.4	Represented by C1RIET_AMERS	Y	
15	C11E-01895	C11E		C	UA.4	C1RIET_AMERS	Y	The land use of the whole reach consisted of dryland agriculture. There was only one farm dam noted in this reach. Many oxbows are present within the reach. Based on instream biota, there was no reason for FEPA. The reach has water quality problems and is infested by alien willow trees. The node was however included in the study but the aims of FEPA (improvement) will not be achieved due to the LOW EI.
16	C11F-01491	C11F		≤C			N	This reach was evaluated and originally represented by VC2 which was excluded from the final biophysical nodes. The land use of the whole reach consisted of dryland agriculture. There are many small dams at the source, in tributaries and further downstream. Therefore, there was no obvious reason for the FEPA which would require an improvement. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node. Furthermore, the PES of potentially lower than a C indicates that this SQ should not be a FEPA. UV6 lies at the end of the main river and did play an indirect role in representing the FEPA.
17	C11G-01723	C11G		≤C			N	There was no obvious reason for the FEPA which would require an improvement as the river is in a C or likely lower PES. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node. Furthermore, the PES of potentially lower than a C indicates that this SQ should not be a FEPA. UV6 lies at the end of the main river and did play an indirect role in representing the FEPA.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
18	C11J-01920	C11J		≤C			N	There was no obvious reason for the FEPA which would require an improvement as the river is in a C or likely lower PES. Due to the limitation of number of nodes that could be included in the study this FEPA is not represented by a biophysical node. Furthermore, the PES of potentially lower than a C indicates that this SQ should not be a FEPA. EWR1 is situated in the main Vaal River just downstream of the FEPA and indirectly caters for the FEPA.
19	C11J-01838	C11J		B/C	EWR1	EWR 1	Y	EWR 1 has a PES of a B/C with a HIGH EI and therefore a REC of a B EC. This therefore supports the aims of FEPA. It must be noted however that improvement could only be achieved by addressing possible water quality problems identified at the site.
20	C11J-01969	C11J		≤C			N	There was no obvious reason for the FEPA which would require an improvement. There are large scale developments in the catchment. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node. Furthermore, the PES of potentially lower than a C indicates that this SQ should not be a FEPA.
21	C11J-01931	C11J		≤C			N	There was no obvious reason for the FEPA which would require an improvement. There are large scale developments in the catchment. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node. Furthermore, the PES of potentially lower than a C indicates that this SQ should not be a FEPA.
22	C11L-02031	C11L		B/C	Represented by UA.8	Represented by VC4	Y	The PES is a B/C and the EI was MODERATE. The FEPA was unconfirmed, however the PES was in a reasonable state and as there was no other node representing this quaternary catchment it was maintained as a biophysical node. Due to the MODERATE EI, the aims of FEPA (improvement) would not be achieved.
UB								
23	C13C-02550	C13C	II	B	UB.1	UV_Uklip	Y	The EI was HIGH with a PES of a B and the REC was set to maintain the PES. The FEPA was confirmed with possible reasons being the downstream wetland and the PES of a B.
24	C13C-02549	C13C					Y	Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node. However the upstream section of the river is represented by UB.2 and the downstream section is represented by UB.1.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
25	C13C-02459	C13C					Y	Represented by UB.1 upstream and UB.2 downstream of the FEPA.
26	C13C-02421	C13C					Y	Represented by UB.1 upstream and UB.2 downstream of the FEPA.
27	C13C-02420	C13C					Y	Represented by UB.2 downstream of the FEPA.
28	C13C-02416	C13C		B/C	UB.2	C13C	Y	The EI was HIGH with a PES of a B/C and the REC was set to improve the PES to a B EC. This would require non-flow related measures. The FEPA was confirmed with possible reasons being the presence of the Seekoeivlei RAMSAR wetland and the PES of a B/C
29	C13C-02413	C13C					Y	Represented by UB.2 upstream of the FEPA.
30	C13D-02335	C13D			Represented by UB.3	Represented by C1KLIP_UNSPE1	Y	Represented by UB.3 downstream of the FEPA.
31	C13D-02371	C13D			Represented by UB.3	Represented by C1KLIP_UNSPE1	Y	Represented by UB.3 downstream of the FEPA.
32	C13D-02284	C13D		B/C	UB.3	C1KLIP_UNSPE1	Y	The EI was MODERATE with a PES of a B/C and the REC was set to maintain the PES. The site was confirmed as a FEPA with the possible reasons being the presence of a wetland and a perceived PES of a B. Due to the moderate importance the aims of FEPA (improvement to a B) would not be achieved.
33	C13D-02226	C13D		B/C	EWR6	EWR 6	Y	Although EWR 6 represented a FEPA the reasoning for the FEPA was unclear except for a perceived PES of a B. Due to the MODERATE EI the REC was set to maintain the B/C PES and the aims of FEPA (improvement to a B) would not be achieved.
34	C13B-02161	C13B					N	There was no obvious reason for the FEPA. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node.
35	C13B-02228	C13E		B/C	UB.6	C13E	Y	The PES is a B/C and the EI is MODERATE. There was no reason why this SQ should be a FEPA apart from a perceived state of a B. The point was included in the study as it was originally selected based on a reasonable spread of hydro nodes. The REC was set to maintain the PES.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
36	C13F-02190	C13F		≤C			N	The FEPA was not confirmed as the PES category is highly likely to be lower than a C. The river reach has many dams with a large dam at the confluence basically isolating the tributary from the rest of the river system.
37	C13H-02156, C13G-02339, C13G-02340	C13G		C	UB.8	C13G	Y	UB.8 represents the two immediate upstream FEPAs C13G-02339 and C13G-02340. There was no obvious reason for the FEPA. An improvement to a B is not warranted due to the moderate EIS.
UC1								
38	C81A-02757	C81A			Represented by EWR7	Represented by EWR 7	N	
39	C81A-02790	C81A		A/B	EWR7	EWR 7	Y	The PES is a A/B and the EI was HIGH. The FEPA was confirmed possibly due to the presence of a wetland. The REC was set to maintain the PES of a A/B.
40	C81B-02856	C81B					N	Represented by UC1.1 upstream and UC1.2 downstream of the FEPA.
41					UC1.2	8WF3	Y	The FEPA was unconfirmed as wetland features were very limited. *Barbus anoplus* was given as a motivation but this is a common fish species. Due to the moderate importance the aims of FEPA (improvement) would not be achieved and the REC was set to maintain the PES.
42	C81L-02646	C81L	II		Represented by UC1.4	Represented by UV 28	Y	
43	C81M-02657	C81M						
44	C81M-02673	C81M						
45	C81M-02626	C81M						
46	C81M-02819	C81M						
47	C81M-02820	C81M						
48	C81M-02803	C81M						
49	C81M-02808	C81M						

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
50	C81M-02687	C81M						
51	C81M-02619	C81M						
52	C81M-02696	C81M						
53	C81M-02609	C81M		C	UC1.4	UV28	Y	The FEPA was unconfirmed as there were no obvious reasons (e.g. no wetland features or important fish species). Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES. It must be noted that this point represents many FEPAs but due to the limitation of number of nodes, they could not be all considered individually.
54	C82A-02542	C82A		C	UC1.5	UVCor	Y	The FEPA was unconfirmed as *Barbus anoplus* was given as a motivation but this is a common fish species. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.
55	C82A-02523	C82A					N	The FEPA was unconfirmed as *Barbus anoplus* was given as a motivation but this is a common fish species. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node.
56	C82B-02540	C82B		C	UC1.6	C82B	Y	The FEPA was unconfirmed as there were no obvious reasons for the FEPA. The REC was set to maintain the PES. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved.
UC2								
57	C81C-02978, C81C-03037, C81C-03034	C81C	II	C	UC2.5	C81C	N	UC2.5 represents the two immediate upstream FEPAs C81C-03037 and C81C-03034. There was no obvious reason for the FEPA. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved.
UC3								
58	C82E-02418	C82E C82G	II	C	UC3.1	UV31	Y	There was no obvious reason for the FEPA apart from highly disturbed oxbows and other wetland features. The REC was set to maintain the PES. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved.
59	C82G-02415	C82G		B/C	UC3.2	VC8	Y	There was no obvious reason for the FEPA. The REC was set to maintain the PES. Due to the MODERATE EI the aims of FEPA (improvement) would not be achieved.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
60	C82F-02326	C82F		C	UC3.3	UV35	Y	There was no obvious reason for the FEPA. The REC was set to maintain the PES of a C EC. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved.
UD								
61	C83A-03035	C83A	III		Represented by UD.1	Represented by VC15	Y	
62	C83A-03027	C83A						
63	C83A-02984	C83A						
64	C83A-02977	C83A						
65	C83A-02960	C83A						
66	C83A-02949	C83A						
67	C83A-02863	C83A	III	C	UD.1	VC15	Y	The FEPA was unconfirmed as *Barbus anoplus* was given as a motivation but this is a common fish species; there were some wetland components. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES. It must be noted that this point represents many FEPAs but due to the limitation of number of nodes, they could not all be considered separately.
68	C83G-02364	C83G		B/C	UD.4	VC16	Y	The FEPA was unconfirmed as no important fish were provided and there are limited wetland features in the reach. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.
69	C83H-02395	C83H		B/C	UD.5	VC 17	Y	The FEPA was unconfirmed as no important fish were provided and there are limited wetland features in the reach. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved and the REC is set to maintain the PES.
UE								
70	C12D-01522	C12D	III		Represented by UE.1	Represented by VC6	Y	

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
71	C12D-01532	C12D						
72	C12D-01524	C12D						
73	C12D-01521	C12D						
74	C12D-01493	C12D						
75	C12D-01498	C12D						
76	C12D-01538	C12D						
77	C12D-01560	C12D						
78	C12D-01565	C12D						
79	C12D-01535	C12D						
80	C12D-01547	C12D						
81	C12D-01628	C12D						
82	C12D-01640	C12D						
83	C12D-01608	C12D						
84	C12D-01642	C12D						
85	C12D-01576	C12D		C	UE.1	VC6	Y	There was no obvious reason for the FEPA. UE.1 also represents the upstream FEPAs. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES. It must be noted that this point represents many FEPAs but due to the limitation of number of nodes, they could not all be considered.
86	C12F-01728	C12F		C	UE.3	VC7	Y	There was no obvious reason for the FEPA as there are many instream dams especially in the tributaries. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
87	C12G-01903	C12G					N	The FEPA was unconfirmed. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node.
88	C12G-01939	C12G					N	The FEPA was unconfirmed. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node.
89	C12G-01959	C12G					N	The FEPA was unconfirmed. Due to the limitation of number of nodes that could be included in the study this FEPA was not represented by a biophysical node.
UG								
90	C12A-02195	C12A	II		Represented by UG.2	Represented C12A	Y	
91	C12A-02184	C12A			Represented by UG.2	Represented C12A	Y	
92	C12B-02028	C12B		C	UG.2	C12A	Y	The FEPA was unconfirmed as *Barbus anoplus* was given as a motivation but is a common fish species; there are some wetland components. Due to the MODERATE EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES. It must be noted that this point represents two FEPAs but due to the limitation of number of nodes, they could not all be considered.
UM								
93	C23C-01913	C23C	II	≤C			N	The FEPA was unconfirmed. The river is impacted by irrigation and instream dams. Originally VC10 represented the FEPA, but due to the limitation of number of nodes that could be included in the study and the fact that this should not be a FEPA due to present state, the node was excluded.
MA								
94	C70A-02393	C70A	II		Represented by MA.1	Represented by VC24	Y	
95	C70B-02323	C70A C70B		C	MA.1	VC24	Y	There was no obvious reason for the FEPA. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.
96	C70B-02324	C70B			Represented by MA.2	Represented by VC25	Y	

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
97	C70B-02297	C70B		B/C	MA.2	VC 25	Y	There was no obvious reason for the FEPA. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.
98	C70C-02233	C70C		C	MA.3	VC26	Y	There was no obvious reason for the FEPA. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.
99	C70E-02088	C70E			Represented by MA.6	Represented by R2	Y	No obvious reason for FEPA. The river system is non-perennial. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES of a C.
100	C70E-02024	C70E					Y	
101	C70E-02023	C70E					Y	
102	C70E-02061	C70E					Y	
103	C70G-02293	C70E			Represented by MA7	Represented by VC29	Y	
104	C70G-02238	C70E					Y	
105	C70H-02208	C70H		C	MA.7	VC29	Y	No obvious reason for FEPA. The river system is non-perennial. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the C PES. It must be noted that this point represents two FEPAs but due to the limitation of number of nodes, they could not all be considered.
106	C70J-02039	C70J					N	This is a short dry tributary. Due to the limitation of number of nodes, this point could not be considered.
MB								
107	C60C-02564	C60C	III				N	No obvious reason for FEPA, as the river is badly degraded and will be in a PES lower than a C. Erosion is problematic, large instream dam present at source, various other instream dams and those wetland features that are visible are highly degraded. This tributary therefore did not warrant a node.
108	C60C-02471	C60C		C	MB.2	VC33	Y	No obvious reason for FEPA. FEPA indicated a PES of an A/B (compared to the actual PES of a C) and this FEPA is therefore not valid. The node was maintained however and the REC set to maintain the PES.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
109	C60D-02507	C60D		C		VC34	N	Was originally assessed as node VC34, but excluded as final biophysical node. No obvious reason for FEPA. FEPA indicated a PES of a A/B (compared to the actual PES of a C) and this FEPA is therefore not valid. No node was placed here due to the similarities with VC33.
110	C60G-02286	C60G				VC36	N	Was originally assessed as node VC36, but excluded as final biophysical node. FEPA identified wetland features that are actually mostly dams and back-up zones from dams and as the FEPA would be lower than an A or B, the FEPA is therefore not valid. A node representing this SQ was excluded.
111	C60G-02280	C60G					N	FEPA identified wetland features that are actually mostly dams and back-up zones from dams. There were no obvious reasons for FEPA and therefore a node representing this SQ was not included.
MD1								
112	C42A-02796	C42A	III	D		VC38	N	Was originally assessed as node VC38, but excluded as final biophysical node. Alien vegetation present in the channel. Extensive overgrazing and serious erosion. Due to the present state of potentially a D EC it would seem that the FEPA was not warranted. Therefore a node representing this SQ was not included.
113	C42C-03107	C42C		D		VC39	N	Was originally assessed as node VC39, but excluded as final biophysical node. Due to the present state of potentially a D it would seem that the FEPA was not warranted. Therefore a node representing this SQ was not included.
MD2								
114	C42F-02724	C42F	III	D			N	The system has wetland features but is extensively degraded due to the lack of water resource use importance. Due to the present state of potentially a D it would seem that the FEPA was not warranted. Therefore a node representing this SQ was not included.
115	C42F-02756	C42F		D			N	The system has wetland features but is extensively degraded due to the lack of water resource use importance. Due to the present state of potentially a D it would seem that the FEPA was not warranted. Therefore a node representing this SQ was not included.
116	C42F_02762	C42F		C	MD2.2	VC 42	Y	Moderate EIS. REC set to maintain PES so aims of FEPA (improvement to a B) is not warranted.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
117	C42G-02956	C42G				Represented by VC42	Y	
118	C42G-02947	C42G				Represented by VC42	Y	
119	C42G-02881	C42G				VC41	N	This node was not included in the final selection of biophysical nodes due to the many instream dams in the upper reaches as well as erosion. FEPA indicates the river condition as A/B which means the NFEPA is not warranted.
120	C42G-02802	C42G				VC43	N	This node was not included in the final selection of biophysical nodes due to some disturbance and the fact that this node would have only represented one tributary with no water resource importance. FEPA indicates the river condition as A/B which means the FEPA is not warranted.
121	C42H-02659	C42H				VC44	N	This node was not included in the final selection of biophysical nodes due to extensive disturbance and the fact that this node would have only represented one tributary with no water resource importance. FEPA indicates the river condition as A/B which means the FEPA is not warranted.
122	C42J-02628	C42J				VC45	N	This node was not included in the final selection of biophysical nodes due to extensive disturbance and the fact that this node would have only represented one tributary with no water resource importance. FEPA indicates the river condition as A/B which means the FEPA is not warranted.
123	C42K-02857	C42K					N	This node was not included in the final selection of biophysical nodes due to extensive disturbance and the fact that this node would have only represented one tributary with no water resource importance. FEPA indicates the river condition as A/B which means the FEPA is not warranted.
ME1								
124	C41C-03799	C41C	II			Represented by VC 47	N	
125	C41C-03793	C41C			D or lower	Represented by VC 47	N	
126	C41C-03686	C41C				VC47	N	The reach is impacted by an excessive number of dams in the tributaries and a FEPA is not warranted
127	C41B-03227	C41B					N	Due to the lack of water resource use importance as well as the limitations of the number of nodes that could be addressed, this node was excluded.

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
128	C41E-02989	C41E		B/C	ME1.3	VC51	Y	The FEPA was not confirmed as FEPA indicated the river condition as A/B. Due to the LOW EI the aims of FEPA (improvement to a B) would not be achieved and the REC was set to maintain the PES.
129	C41D-03299	C41D		D		VC48	N	River extremely eroded in upstream SQs. The downstream Vet River has a very similar section which is less disturbed, so it was felt that VC49 in the main Vet River was a more appropriate node. FEPA indicated the river condition as A/B which means the FEPA was not warranted.
130	C41D-03184	C41D				VC50	N	This SQ reach is very disturbed and eroded and therefore the FEPA was not warranted as it indicated a river condition of an A or B. Therefore the node was excluded from the final selection of biophysical nodes.
ME2								
131	C41F-03179	C41F	III			Represented by VC53	N	
132	C41F-03198	C41F				Represented by VC53	N	
133	C41F-03190	C41F				Represented by VC53	N	
134	C41F-03078	C41F		≤D		VC53	N	This reach is highly disturbed including areas with dam on dam, extensive erosion and alien vegetation. Due to this high disturbance the FEPA was not warranted.
135	C41H-02948	C41H				VC54	N	Small ephemeral river with no water resource use. This node was excluded from the final biophysical node selection.
LB								
136	C91D-02838	C91C C91D	III	A/B	LB.1	VC60	Y	Uncertainty why reach is a FEPA, but A/B PES supports the FEPA.
137	C92A-02593	C92A		≤C			N	FEPA unconfirmed. River is ephemeral with overgrazing and erosion being the main impacts. Due to the lack of water resource use importance and the fact that due to the PES the FEPA was probably not warranted, no node was selected.
138	C92A-02664	C92A		≤C			N	FEPA unconfirmed. River is ephemeral with overgrazing and erosion being the main impacts. Due to the lack of water resource use importance and the fact that

FEPA	SQ reach	Quat	MC	PES	Representative node		Included as a desktop biophysical node? (Yes/No)	Role in MC determination
					New Node Name	Original Node name		
139	C92A-02837	C92A		≤C			N	due to the PES the FEPA was probably not warranted, no node was selected.
140	C92A-02823	C92A		≤C			N	
141	C92C-02921	C92C					N	FEPA unconfirmed. Most of the channel of the river is not visible as the river is dry. Due to the lack of water resource use importance the node was excluded from the final selection of biophysical nodes.
142	C92C-03216	C92C					N	
143	C92C-03354	C92C					N	
LA4								
144	C33C-02746	C33C	II	A/B	LA4.2	VC59	Y	Uncertainty why reach is a FEPA ,but A/B PES supports the FEPA.
145	C33C-02623	C33C			Represented by LA4.2	VC 59	Y	Channel is hardly visible and river is ephemeral. Very similar to LA4.2 and due to the lack of water resource importance and constraints regarding the number of nodes, this node was excluded.
146	C33C-02794	C33C			Represented by LA4.2	VC 59	Y	Channel is hardly visible and river is ephemeral. Very similar to LA4.2 and due to the lack of water resource importance and constraints regarding the number of nodes, this node was excluded.

Appendix C:

Issues and Responses report

This Issues and Responses Report (IRR) captures the issues raised by stakeholders during the classification study of significant water resources in the Vaal Water Management Areas (WMAs) in order to facilitate an appropriate balance between the use of water resources and the protection thereof. This study has been commissioned by the Department of Water Affairs (DWA).

As part of the announcement process, an advertisement was placed in various national newspapers and a Project Steering Committee (PSC) meeting was held on 22 February 2011 in Pretoria. A second PSC meeting was held on 10 November 2011, the third PSC meeting was held on 17 May 2012 and a fourth PSC meeting took place on 4 September 2012. Two stakeholder meetings took place on 23 (Pretoria) and 24 (Kimberley) July 2012 as instructed by Step 6 of the Seven-Step Water Resources Classification System process.

Information on the main stakeholder engagements held during the 24 month study is summarised in **Table C-1**.

Table C-1 :Summarised information on stakeholder engagements

Meeting	Date	Venue	Total present	Organisations represented
Project Steering Committee (PSC) 1	22 Feb 2011	G18, DWA, Pretoria	37	Department of Water Affairs; Department of Agriculture, Forestry and Fisheries; Department of Environmental Affairs; Department of Mineral Resources; Mpumalanga Department of Economic Development, Environment and Tourism; North West Department of Agriculture, Conservation, Environment and Tourism; Gauteng Department of Agriculture and Rural Development; City of Tshwane Metropolitan Municipality; Johannesburg Water; Ekurhuleni Municipality; Emfuleni Municipality; Gert Sibande District Municipality; Fezile Dabi District Municipality; Sedibeng District Municipality; BirdLife South Africa; South African Biodiversity Institute; Agricultural Development, Obaro; Agri SA; Transvaal Agricultural Union; National Water Forum; Free State Agriculture; Chamber of Mines; Sasol; Federation for a Sustainable Environment; Gauteng Water Forum; Sedibeng Water, Midvaal Water Company, Rand Water, TCTA, Eskom, Water Research Commission.
PSC 2	10 Nov 2011	G18, DWA, Pretoria	28	
PSC 3	17 May 2012	G18, DWA, Pretoria	20	
PSC 4	4 Sept 2012	G18, DWA, Pretoria	29	
Stakeholder meeting Pretoria	23 July 2012	G18, DWA, Pretoria	34	
Stakeholder meeting Kimberley	24 July 2012	Flamingo Casino	24	
Meeting with Department of Agriculture, Forestry and Fisheries (DAFF)	12 Mar 2012	Pretoria	6	DWA officials; study team and DAFF officials.
Meeting with Chamber of Mines	7 Apr 2011	Johannesburg	12	DWA officials; study team; Chamber of Mines and various mining companies.

All written and oral submissions received from stakeholders have been summarised in the IRR report and are included in the table below.

	Comments, questions and Issues	Commentator(s)	Response(s)
	Source: Meeting 1 of Project Steering Committee (PSC) at the DWA: 22 February 2011.		
1	Will water quality also play a role in the classification of water resources?	Ms Marina Kruger (Midvaal Water)	Mr Pieter van Rooyen (WRP - Study Leader) said it definitely plays a role. Recent studies such as the Integrated Water Quality Management Plan Study for the Vaal River System will be integrated into this study. Water quality specialists such as Dr Patsy Scherman are also part of the study team.
2	Will groundwater resources be taken into consideration?	Ms Stephinah Mudau (Chamber of Mines)	Mr Van Rooyen said there are three significant dolomite resources that contribute to base flows in the Vaal WMAs that will be investigated. They are: • Suikerbosrand in the Upper Vaal; • Schoonspruit in the Middle Vaal; and • The upper Harts River catchment in the Lower Vaal.
3	The DWA has always followed the boundaries of WMAs when doing studies. Groundwater resources, however, do not stay within WMA boundaries and overlap with neighbouring WMAs.	Ms Ndileka Mohapi (DWA)	Mr Van Rooyen said the study team is aware of groundwater resources going across WMA boundaries and this will be taken into consideration during the study.
4	Will acid mine drainage (AMD) be investigated as part of this study?	Ms Mariette Liefferink (Federation for a Sustainable Environment - FSE)	Mr Van Rooyen said the consequences of AMD will be reflected in scenarios that will be developed at the end of this study. Various processes such as desalination will be investigated to see how the three Vaal WMAs could be affected.
5	In terms of the Task Team's recommendations to the Inter-ministerial Committee on AMD, neutralisation is recommended as the preferred option for the treatment of AMD and not desalination. This recommendation is anomalous to the recommendations of the Directorate: National Water Resource Planning (NWRP) of the DWA. Neutralisation will exacerbate the situation within the Vaal River System with its already high salt load. The Directorate: NWRP of the DWA found that the desalination of AMD has been identified as the first option to limit the salinity of the Vaal River System. It was found that: • The additional salinity as a result of AMD creates water security risks. • In order to comply with the regulatory limit of 600 mg/l sulphates, good quality water has to be released from the Vaal Dam in order to ensure that the water below the Vaal Barrage is fit for use, that is, by means of dilution. • The projected demand for increased releases from the Vaal Dam of expensive Lesotho water will increase the stress upon the water supply. • Water supply shortages will be experienced by 2014. • The additional volume of water that has to be released as a result of the salinity associated with AMD will result in a considerable reduction of water supply to the Upper Vaal so much so that the total capacity of Phase 2 of the Lesotho Highlands Water Project will be cancelled. • It necessitates that the Tugela supplementary scheme will have to be advanced. • It will have significant cost implications. • It will result in the loss of water to the Orange River System and poorer quality water discharges from the Vaal River System to the Orange River system, with associated costs for downstream water users. • Desalination of AMD has been identified as the first option to limit the salinity of the Vaal River System. • A total of 275 million litres of mine water will have to be treated. The capital	Ms Mariette Liefferink (FSE)	Mr Seef Rademeyer (DWA) said the DWA has implemented the Integrated Water Quality Management Strategy for the Vaal River System to improve the water quality. Desalination is the preferred option. A huge effort is needed to get rid of the salts, which is a serious problem in the whole Vaal River System and not just in the mining sector.

	Comments, questions and Issues	Commentator(s)	Response(s)
	expenditure is anticipated to be R3.4 billion and the operational expenditure will be R6.78 per m^3.		
6	Will the Modder and the Riet Rivers be part of the study?	Mr Willem Grobler (DWA - Free State)	Mr Van Rooyen said these two rivers will not be studied, because the Riet-Modder catchment falls within the Upper Orange WMA. The outflows of the Riet River, which confluences with the Vaal River just upstream of the Douglas Weir will, however, are included in the study.
7	Why is the area that includes the Vredefort Dome, a World Heritage Site, only a secondary IUA?	Dr Jack Armour (Free State Agriculture)	Mr Van Rooyen said the study is being done on significant water resources and not based on other criteria. Smaller tributaries of significant water resources will not be assessed due to time and budgetary constraints. However, one of the IUAs does include the Vredefort Dome.
8	How will the study team decide on sub-divisions and what will happen to the smaller areas in the study area.	Ms Mandy Driver (SANBI)	Mr Van Rooyen said the resolution of the availability data (hydrology and detail land use information etc.) is at a large scale and that refining it is outside of the scope of work of this study. He noted that in other catchments in the country, high resolution models (data) have been established; however such studies have not been carried out for the Vaal River System. Smaller scale areas of importance will be dealt with in a qualitative manner. The team will formulate an approach for evaluating the smaller scale catchments.
9	The SANBI has information available in the study area that could be useful to the study team.	Ms Mandy Driver (SANBI)	Ms Delana Louw (Rivers for Africa) said this information will assist the study team.
10	Will the study area be divided into biophysical units?	Mr Sadimo Manamela (DWA)	Ms Louw said previous Reserve studies used Management Resource Units, which included biophysical units. The current study will be much broader.
11	Will the DWA as the licensing authority that regulates Water User License Applications (WULA), be guided by Resource Quality Objectives (RQOs), because the Vaal WMAs resource is already overburdened. Will the classification system be used in the licensing process, because the various DWA directorates do not always work together?	Ms Mariette Liefferink (FSE)	Mr Pienaar Harrison (DWA) said the setting of a MC will be one of the instruments available to the DWA in the licensing process. He agreed that the DWA is striving to work in an integrated fashion.
12	Most pollution in the three Vaal WMAs occurs in the Upper Vaal WMA, at the top of the system which does not bode well for the downstream users. Will the setting of MCs assist the DWA to enforce the 'polluter pays' principle, because the upstream polluters are destroying the economic livelihood of the people downstream.	Ms Mariette Liefferink (FSE)	Mr Pienaar said the water pricing strategy of the DWA has been designed with the 'polluter pays' principle in mind. The big problem in the three Vaal WMAs is that some areas have a 60% unemployment and people, and their municipalities, are too poor for this principle to be enforced. Ms Shane Naidoo (DWA) said the 'polluter pays' principle is based on someone exceeding the RQOs that are linked to the MC of a specific water resource. The entire Vaal catchment will be looked at to prevent the water users in the upper region taking away from users in the lower areas of the Vaal.
13	The DWA must go down to the level of the municipalities for the classification system to work. The South Africa Local Government Association (SALGA) can be used to communicate with municipalities in the three Vaal WMAs. He is not interested in the ecological data and status of a water resource. He sees that as a given, because he trusts the data of the DWA. The DWA should rather try and influence the water use of municipalities and educate them as to how their use of water resources affects the rest of the Vaal River System.	Mr Sorrius Manele (Sedibeng District Municipality)	Mr Pienaar said prevention is better than cure and the DWA is working with municipalities with programmes such as water conservation and water demand management to reduce water use. The DWA must, however, also allow water for economic growth.
14	A structure will be needed to manage the different MCs and to ensure people comply with the set classes.	Mr Sorrius Manele (Sedibeng District Municipality)	Ms Naidoo indicated that a management plan will be developed that supports the achievement or maintenance of the MC which is intended to come into effect once it has been set by the Minister. The MC can be reviewed within an appropriate review period.

	Comments, questions and Issues	Commentator(s)	Response(s)
15	There are absent municipalities who should have attended this meeting. Voluntary structures such as this PSC should actually be made compulsory by the National Water Act.	Mr Sorrius Manele (Sedibeng District Municipality)	Mr Pienaar said the National Water Act is currently being reviewed and maybe the review team should be looking at the role of a compulsory PSC in all DWA projects and studies.
16	The classification of water resources is very complex and it remains largely untested, because it is very new in South Africa. The business sector wants to see a robust and defendable classification system.	Mr Martin Ginster (Sasol)	Mr Pienaar said the DWA will try and simplify the classification process in future.
17	He welcomed this study. He said a clear distinction must be made between the role of the PSC, which guides the process – and that of a stakeholder representing a specific sector. He said there is a need for a formal stakeholder process and something like the Issues and Responses Report can then be used as a register of comments to assist the process.	Mr Martin Ginster (Sasol)	Noted.
18	Do we understand the long-term implications (20 to 30 years from now) of the classification process? A specific class will determine what will happen in future with a specific water resource. How easy will it be to change the MC of a water resource? The classification process should be dynamic and not be bound by a set of MCs.	Mr Marc de Fontaine (Rand Water)	Mr Pienaar said the DWA will continually be looking at improving the classification process. The review period of 60 days as critical for stakeholders to voice their concerns regarding a specific decision made by the Minister.
19	How will pollution be dealt with in a specific MC?	Ms Stephinah Mudau (Chamber of Mines)	Mr Pienaar explained the management plan for a specific water resource will have guidelines to prevent pollution.
20	How often will a MC be reviewed?	Ms Mandy Driver (SANBI)	Ms Naidoo said it will be written into the management plan for a specific MC and should be reviewed every four to five years.
21	Will a MC also need an Environmental Impact Assessment (EIA)?	Mr Sorrius Manele (Sedibeng District Municipality)	No, but any future development will, as per environmental legislation, need an EIA. Mr Pienaar said Government must be careful of a cumbersome decision-making process and the classification process will be done without the need to follow it up with an EIA. The various processes should become more streamlined and one process should inform another.
22	We have formulated scenarios that could be of use to the study team.	Dr Armour (Free State Agriculture)	Noted.
23	What is the DWA is currently doing in the Upper Vaal WMA, because no study has yet been done to see if there is enough water in that area.	Mr Jan Potgieter (Department of Agriculture, Forestry and Fisheries - DAFF)	Mr Rademeyer said the DWA has an integrated water resource strategy (IWRS) in place for the whole Vaal River System with a Steering Committee to oversee it. This strategy is currently being implemented and will provide answers to many questions regarding water use in the Vaal River System. There has been an irrigation strategy since the 1970's for the Upper Vaal WMA. A cap was placed on irrigation water use for industry and urban areas are increasing and supported by expensive transfers. A large quantity of water is, however, being used unlawfully for irrigation. In order to ensure enough water for lawful users, the unlawful use has to be removed and it is vital that 15% of water in the urban area has to be saved through water conservation and water demand management. Ms Mohapi said due to this unlawful use, some of the water users downstream are not receiving the water they are entitled to. There is not an abundance of water in the three Vaal WMAs.
24	A verification and validation process is being undertaken to determine the exact water use in the Vaal River System. It has already been finalised in the Upper Vaal WMA and it proved that some irrigation farmers are using water unlawfully. The study is currently focusing on the Middle and Lower Vaal WMAs.	Mr Seef Rademeyer (DWA)	Noted.
25	Is AMD seen as a resource or a liability with regards to South Africa's water	Ms Mariette Liefferink	Mr Rademeyer said it is seen as a resource in all planning scenarios of the DWA.

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	resources?	(FSE)	The dilution of the water in the Vaal River is not seen as a long-term solution by the DWA who is looking at a water re-use strategy that is much more sustainable.
26	Who will carry the cost of cleaning up the AMD and will the 'polluter pays' principle be used.	Ms Mariette Liefferink (FSE)	Mr Rademeyer said a governmental committee has done a submission to the Cabinet with recommendations regarding AMD.
27	Non-Governmental Organisations (NGOs) make significant financial sacrifices to attend meetings such as this PSC, because no compensation is paid out for time, travel or accommodation.	Ms Mariette Liefferink (FSE)	Mr Pienaar thanked the NGOs for their contributions and said their inputs are valued by the DWA.
	Source: Meeting between the DWA and the Chamber of Mines on 7 April 2011.		
28	How are MCs going to be determined? How will the water use authorisation process be incorporated? Will new and future developments be taken into account?	Ms Stephinah Mudau (Chamber of Mines)	A Water Quality Strategy is in place and the MCs will inform that strategy. Source Directed Controls (SDC) will inform users of how to dispose of discharges and what the standards or conditions of these discharges will be. Future development will be taken into account, because a MC cannot be reviewed constantly. It will be reviewed every 4 to 5 years.
29	Will a MC take into account what was previously decided regarding water resources as the control scheme at the Witbank Dam?	Mr Lucas Nengovhela (Optimum Coal)	Yes, this is a key aspect which will be taken into account.
30	When is the project ending? Will efforts from other Departments such as the Mineral Resources be incorporated in the classification process? What is the goal of the classification?	Mr Cecil Khoza (Harmony Gold)	The project will end late in 2012. The Department will review a MC after 4 to 5 years. In the National Water Resources Strategy there will be a reference to other strategies. The objectives of other Departments need to talk to the DWA objectives, especially from a biodiversity point of view.
31	Wetlands and Pans – What will happen to water use licences applied for before classification?	Ms Carol Dixon (Anglo American)	The Reserve requirements are looked at for the area applied for in order to protect the Reserve. So, ecological requirements will be met, but cumulated impacts will be looked at by the MC.
32	There should be a balance between protection of the environment and socio-economic elements. What will happen to companies without a water use license?	Ms Melani Naidoo-Vermaak (Harmony Gold)	There will be a phased process to clear up the backlog of license applications.
33	What do you do when stakeholders disagree on the specific MC for a water resource?	Mr Reginald Mabalane (Chamber of Mines)	The best option is to make stakeholders understand the process and the implications of each class.
34	Is there an opportunity for the Chamber of Mines to understand the baseline of the study?	Mr Gavin Anderson (De Beers)	The Inception Report will be in place for public use to understand the baseline of the study.
	Source: Waterval Forum meeting in Secunda on 19 May 2011.		
35	Which water quality data are you going to use in this classification project?	Mr Simon Mporetji (Rand Water	The recently completed Reserve study had a water quality component that will be used as well as a wide variety of studies already completed on the three Vaal WMAs.
36	When was the project started?	Ms Nicole Houghton (Harmony EGM)	The project started in October 2010.
37	When is the next PSC meeting?	Ms Jackie Jay (Water Resource Planning, DWA)	The next PSC meeting will be around October 2011.
38	Where will we get classification information?	Mr Jaco Linde (Sasol, Synfuels)	Classification information is available on the DWA website – www.dwa.gov.za
	Source: Schoon/Koekemoerspruit CMF meeting on 27 June 2011.		

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39	Who decided the proposed IUAs at the Upper Harts, Middle Harts, Lower Harts and Dry Harts rivers without consulting the farmers?	Mr Piet Theron (Farmer's Union)	The IUAs were decided by team of specialists guided by the WRCS guideline wherein the current socio-economic status of the catchment is described.
	Source: Klip River (Upper Vaal WMA) Forum meeting, ERWAT offices on 02 August 2011.		
40	When was the first newspaper advert published regarding this project?	Mr Andrew Barker (Development consultant)	During March 2011.
41	Why are we hearing about classification for the first time now and why was it not discussed before?	Mr Andrew Barker (Development consultant)	It was announced at the last Forum meeting that the DWA: Classification Directorate will make a presentation on 2 August 2011. A presentation was also done at the Waterval Forum on the 19 May 2011.
42	How are we expected to participate, as a forum or on a personal capacity?	Mr Andrew Barker (Development consultant)	Both approaches would be welcomed.
43	In my area the newspaper adverts do not reach all the intended stakeholders efficiently. How about Forum website and e-mails.	Mr Andrew Barker (Development consultant)	Noted.
	Source: Stakeholder Consultation Workshop on 16 August 2011 in Vryburg.		
44	Who are the stakeholders in this project? Is it only municipalities?	Mr Oscar Sabelo (Emfuleni Local Municipality)	No, the PSC is comprised of stakeholders from National, provincial, local government, community based organization, NGOs and private sectors.
45	Which process was followed to identify stakeholders?	Mr Oscar Sabelo (Emfuleni Local Municipality)	The stakeholders were identified by DWA in collaboration with PSP and stakeholders within study area. The project was announced in local paper wherein Interested and Affected parties were invited to register their contacts.
46	When is the project ending?	Mr Daster Wiseman Sibiya (Rand Water)	September 2012.
47	What is going to happen after the project is complete?	Mr Daxter Nhubunga (Rand Water)	The MC will be binding in all institutions when excising power under National Water Act. There will be monitoring programme in place, for example, there is another project after classification project, which will set RQOs in particular catchment/WMA. The project will inform the determination of the allocatable portion of a water resource for use.
48	When this project ends in September 2012, what are you going to do about previous and/or current projects in a particular Water Management Area?	Mr John Fourie (Ezulwini Mine)	The department is not going to redo any project happened in the absence of classification regulations. For example, before promulgation of regulations determination of Reserve was preliminary but after the regulation Reserve will be superseded by classification processes. As mentioned during presentation, classification process is not running in isolation it falls within the broader in Integrated Water Resource Management (IWRM) process.
49	At what stage of the project will you allow new stakeholders?	Mr Abe Abrahams (DWA)	We update our stakeholder database regularly and if there are stakeholder who are interested in the project; I can send them registration form.
50	The Molopo river is dry throughout the year, how are you going to implement a classification?	Mr V Maurice (DAFF)	The Issue was raised in one of our meeting and the response was that even if the river is not flowing, it is still a water course, which fulfils other functions.
	Source: Meeting 2 of Project Steering Committee at the DWA on 10 November 2011.		
51	Civil society must be given the opportunity to collaborate in the study and be part of the process from the beginning. Civil society must also have access to all information from a very early stage in the process and not simply shown the final result. Ms Liefferink referred to the Water Research Commission guidelines for participation in IWRM and pointed out that the classification process ought to be more than a consultative process. It is intended to be at the level of collaboration. Stakeholders need access to the financial and predictive models and the information	Ms Mariette Liefferink (FSE)	Ms Naidoo said this meeting is the very first step in discussing the various scenarios. No decision has yet been taken and all will have an opportunity to contribute. The reason why we have this meeting today is to consult with stakeholders.

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	that were used to populate them. The setting of the water quality requirements for the Vaal River (including the Olifants River) is going to have impacts on the receiving environment, economy of the catchment and human activity for decades to come. This access includes the sources of the information and key assumptions, the reliability of the information, degree of confidence in the assumptions and information, time frames used as well as discount rates, inflation costs, depreciation costs, sensitivity analysis and details of the different scenarios.		
52	Is the DWA currently releasing water from Sterkfontein to Vaal Dam?	Mr Martin Ginster (Sasol)	Mr Pieter van Rooyen said his presentation shows the maximum release scenario for the Vaal River System (VRS) to ensure that water is not lost in the Tugela. The VRS has not been in a situation like this for five years.
53	Mr Ginster commented that the Liebenbergsvlei is under constant pressure due to the Lesotho Highlands Water Project (LHWP) transfers.	Mr Martin Ginster (Sasol)	Noted.
54	Does the water sent from the Sterkfontein Dam to Bloemhof Dam go via the Vaal Dam as well?	Mr Jan Potgieter (DAFF)	Ms Susan Swart (Study Team) said there is no other route and water releases impact on the whole main stem of the Vaal River downstream of Vaal Dam.
55	There is a large geographical gap between Ecological Water Requirement (EWR) site 4 and 5. Is it not possible to add more EWR sites?	Mr Martin Ginster (Sasol)	Mr Pieter van Rooyen said there are also desktop nodes in such areas to assist the study.
56	Is the Taung Dam part of the study and can something be done to the flooding in that area.	Mr Benedict Itholeng (Gauteng Department of Agriculture and Rural Development - GDARD)	Mr Pieter van Rooyen said it forms part of the study, but this study does not address flooding, because it is a short-term event. The Taung Dam cannot control the flooding, but people developing below the flood line are also part of the problem.
57	Does the study look at wetlands as well, because the VRS is losing many wetlands to development?	Mr Benedict Itholeng (GDARD)	Mr Pieter van Rooyen said all water resources are being investigated, including wetlands. A holistic approach is followed. So far, the study has picked up that some water resources have been severely impacted such as the Mooi River tributary.
58	Does the socio-economic study look at the cost benefit analysis during the lifetime of the operations or activity or does it look at the lifetime of the impacts. Negative externalities (i.e. deflected costs that are imposed on stakeholders other than the company itself) associated with mining, e.g. are often delayed, and accumulate for decades after mineral extraction. By the time environmental and socioeconomic consequences become noticeable, the mines have typically closed or become insolvent and thus cannot be compelled anymore to contribute to remediation, either financially or through other actions.	Ms Mariette Liefferink (FSE)	Mr Dawie Mullins (Study Team) said he agrees that the lifetime of impacts must be included in the cost benefit analysis, because in most case externalities are ignored. The study has, as far as what was possible, included externalities. It is, however, sometimes difficult to do that. Economic studies cannot just look at the financial side of projects.
59	The economic figure for the irrigation sector is very low, because the Vaal River System has the biggest irrigation area in the country.	Mr Jan Potgieter (DAFF)	Mr Mullins said it does seem very low, but he is prepared to discuss it with Mr Potgieter outside this meeting. Agriculture needs large volumes of water to produce food. We will look at our data again. Normally we do not calculate the impact of dry land, but in this study it has been included in the economic assessment.
60	Has climate change been considered? Changes in water quantity and quality due to climate change are expected to affect water and food availability, stability, access and utilisation. The quality and quantity of groundwater resources will be exacerbated by climate change.	Ms Mariette Liefferink (FSE)	Ms Tovho Nyamande (DWA) said it was not taken into account for this study. She emphasised that the first step is to define the required protection and then monitor long term implications such as climate change.
61	Have the lifelong impacts of gold mines in the VRS been taken into consideration for the socio-economic study with particular reference to AMD.	Ms Mariette Liefferink (FSE)	Mr Pieter van Rooyen said AMD is definitely part of the operating scenarios and has been identified as a management option. Mr Johan van Rooyen (DWA) said the AMD problem is currently being addressed by the DWA through another forum. This study must classify water resources and not make judgements about the future of mining. Mitigation

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			measures must be investigated to prevent problems downstream.
62	According the Department of Mineral Resources' Draft Regional Mine Closure Strategy for the East Rand Goldfield (2008), the Merrivale Bird Sanctuary in the Blesbokspruit is under serious threat due to AMD from the gold mines in the area.	Ms Mariette Liefferink (FSE))	Ms Louw said the Blesbokspruit will be in the lowest ecological category due to all the impacts, but the negative impacts of AMD on the Merrivale Bird Sanctuary will be taken into account.
63	Were data from the Water Research Commission and the Department of Mineral Resources have been used in this study.	Ms Mariette Liefferink (FSE)	Ms Louw said all information that was readily available has been used in this study.
64	The biggest impact on the VRS is infrastructural problems at waste water treatment plants and raw sewage that is pumped into the rivers.	Mr Benedict Itholeng (GDARD)	Noted.
65	Do Goods and Services place more emphasis on livelihoods and if the ecosystem was investigated as well.	Mr John Dini (SANBI)	Ms Louw said although the emphasis was on livelihoods, all aspects were investigated.
66	Were any toxicity studies undertaken in order to quantify the chronic effects such as mutagenicity, teratogenicity and estrogenicity.	Ms Mariette Liefferink (FSE)	Dr Patsy Scherman (Study team) said the standard toxicity studies were done during the reserve determination study and this information was used for the classification study.
67	Do sediment loads have an influence on this study and the VRS?	Mr Jan Potgieter (DAFF)	Ms Louw said too much sediment, normally the result of over grazing, is difficult to control, but has been investigated. Dr Scherman said it also played in role in the water quality studies.
68	Have the impacts of the high sulphate loads of untreated AMD and of neutralised AMD upon the VRS been assessed. The impacts of the proposed treatment of AMD by means of neutralisation, and not desalination, must be taken into account in the various scenarios and strategies in the VRS. The sulphate concentrations of AMD after neutralisation will be reduced from 4 700mg/l (West Rand Basin) to 3 000mg/l. The World Health Organisations standard for sulphates in drinking water is 200mg/l; the DWA's standard for sulphates in drinking water is 600mg/l; for irrigation the standard is 150mg/l; for watering of cattle, the standard is 1 000mg/l, and for the environment the standard is 100mg/l. In substantiation, reference is made to the TCTA's document entitled: "The Impact of Acid Mine Drainage in the Witwatersrand on the Mining Industry in Mpumalanga, Free State, Limpopo, North West and Northern Cape Provinces."	Ms Mariette Liefferink (FSE)	Mr Pieter van Rooyen said feasibility studies are currently being done to find solutions to the AMD problem. The current management strategy indicates desalination will be in place from 2014 and neutralisation will be used until desalination becomes an option as the long term solution. The feasibility study will identify the most appropriate long term solutions. Ms Naidoo said the various studies in the VRS work closely together.
69	The study places a lot of emphasis on the ecology. The study should also take the needs of the downstream users into consideration, because their water use must also be protected. The Resource Water Quality Objectives defined in the Integrated Water Quality Management Plan should also be presented for the nodes where applicable.	Mr Jurgo van Wyk (DWA)	Dr Scherman said the next step in the classification process will take this into consideration.
70	How can PSC members access the studies and reports used by the study team?	Mr Benedict Itholeng (GDARD)	Ms Naidoo said he must send a request through to Mr Andre Joubert (Study team) or Ms Nyamande. Most of the information has been summarised in the Status Quo Report and it also lists all the resources used for this study.
71	The Olifants WMA needs an additional 159 million m^3 of water per year just for its current needs. Augmentation from the VRS is one of the options mentioned. How do the various water systems in South Africa interact with each other and how can this be taken forward?	Mr John Dini (SANBI)	Mr Seef Rademeyer (DWA) said there is a close link between the two systems. Augmentation is only an option in the long term. Short term solutions such as water conservation and demand management must be used in the Olifants in the short term to make extra water available.
72	The way forward revolves around the finalisation of the scenarios. Three types of scenarios will be considered: • ESBC scenario; • Water planning needs scenario; and • RDM scenario (based on protection).	Ms Tovho Nyamande (DWA)	The scenario implications will be evaluated and discussed at the next PSC meeting.

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	Source: Meeting 3 of the Project Steering Committee held at the DWA in Pretoria on 17 May 2012		
73	Is there a public participation process being followed in this study?	Mr Matome Makwela (Chamber of Mines)	Ms Nyamande said this is indeed being done. All catchment management forums in the Vaal River System have been visited to do presentations. Newsletters have also been sent out to stakeholders on a large database. This PSC meeting is also part of the public participation process. Ms Mariette Liefferink (FSE) said care should be taken when talking to local communities, because sometimes the presentations are too technical for people to understand.
74	Will additional energy be needed for Scenario E to transfer water from Woodstock Dam to the Sterkfontein Dam?	Mr Martin Ginster (Sasol)	Mr Van Rooyen said no additional energy will be needed. The same quantity of water will be pumped, the flow will just be managed differently to simulate a more seasonal flow distribution. The current rule is that if the Vaal Dam is low or Sterkfontein is too full, then water will be released. The downside of this scenario is that around 45 million cubic metres per annum of the firm water supply will be reduced due to spillage and evaporation losses. Due to this reduction more water need to be transferred into the VRS which will result in additional costs, because augmentation will have to take place earlier than planned which will result in additional capital costs. Mr William Mullins (Study Team) said it will either be an additional cost for augmentation or a reduction in water use equivalent to 16 000 hectares under irrigation.
75	Will the reduction mentioned in Point 74 have an impact on the irrigation farmers in the Vaalharts?	Ms Sanet de Klerk (Obaro)	Mr Van Rooyen said there will not be an impact on the irrigation sector alone. Should there be a reduction in water then the load will be equally carried by all users and not just the Vaalharts farmers. The economy of the VRS is the heart of the South African economy and it must grow. The principle is that the system will always be augmented. The economic team will be investigating the cost of bringing augmentation forward.
76	Does the study have sufficient data on irrigation in the VRS?	Ms Sanet de Klerk (Obaro)	Mr Van Rooyen said the study is using the data sourced by Schoeman and Vennote during the validation and verification process which has the most reliable figure of hectares under irrigation and associated water use in the whole VRS.
77	The validation and verification data are dated 2009. Could the situation in the VRS have deteriorated since then?	Mr Nic Opperman (Agri SA)	Mr Van Rooyen said there could have been both positive and negative changes since 2009. Ms Naidoo said the Schoeman and Vennote study results will be incorporated into the Reconciliation Strategy study once it has been completed.
78	The Klip River in Gauteng could have been in a far better state had the relevant national departments and local municipalities worked together to avoid over-exploiting this water source.	Mr Benedict Itholeng (GDARD)	Ms Naidoo said municipalities will have to play a key role in managing MCs. There must be cooperation between national and local government to ensure efficient management of our water resources. The resource quality objectives (RQOs) will define in what state a specific water resource must be in and if someone contravenes this, then they will be prosecuted. The municipalities must abide by the MCs and cannot issue building approvals that will contravene a MC.
79	Will RQOs be set for a specific resource?	Ms Calvinia Shomolekae (DWA)	Mr Sadimo Manamela (DWA) said each significant water resource will have its own set of RQOs.
80	What will the relationship be between the provincial conservation plans and RQOs?	Mr Benedict Itholeng (GDARD)	Ms Naidoo said the RQOs will feed into the conservation plans of the provinces.
81	How long it will take for a MC to be implemented.	Ms Calvinia Shomolekae	Ms Naidoo said the Minister will issue a date of implementation but the MC will

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		(DWA)	also need a management plan or a catchment management strategy for implementation thereof.
82	Mr Joubert said public meetings to fulfil Step 6 of the WRCS process will be held in Pretoria (23 July 2012) and in Kimberley (24 July 2012). Mr Joubert said information will be sent to all municipalities and their libraries in the Vaal area. Ideally meetings should have been held at most towns in the study area but it will not be possible due to budgetary constraints.		Mr Ginster suggested care should be taken to develop presentations and documentation so that people will be able to understand the study, but the scientific side of the study should also be explained and not ignored. Ms Naidoo said they will also talk to the DWA's Chief Directorate Communication Services and Stakeholder Engagement colleagues for advice. Ms Liefferink said she is concerned that there are only two meetings. The poorer communities which are the most vulnerable will be ignored. How will they be able to attend? The DWA is mandated to disseminate information to all people. It is not the job of civil society to distribute information on behalf of government.
83	Can the comments emailed by her colleague Dr Koos Pretorius to Mr Joubert regarding the Olifants Study be added to this set of minutes?	Ms Mariette Liefferink (FSE)	Ms Naidoo and Ms Nyamande said this will not be a problem but the information will first be studied to see if it reflects what was discussed here today. Ms Joubert asked Ms Liefferink to edit the comments to reflect the Vaal study, because they are very specific to the Olifants study before emailing it to him.
84	Dr Martine Visser on behalf of the FSE would like to review the socio-economic study.	Ms Mariette Liefferink (FSE)	Ms Naidoo said Dr Visser can contact the study team for the relevant information.
	Source: Stakeholder meeting held at the DWA in Pretoria on 23 July 2012		
85	How does the study define 'sustainable'? Does this definition look at the three pillars – environment, economic and social?	Ms Mariette Liefferink (FSE)	Ms Nyamande explained that the study strives to strike a balance between these three pillars without giving preference to one of the three.
86	Why is the National Nuclear regulator not on the stakeholder database?	Ms Keamogetse Mampe (National Nuclear Regulator)	Ms Ndileka Mohapi (DWA) said some organisations could have been left out of the database. She asked all present to send the names of organisations or persons who should be added to the database for this study.
87	Eskom has water data that could be of value to the study team.	Mr Minolen Reddy (Eskom)	Ms Nyamande thanked him and said Eskom has been part of this process since the first PSC meeting.
88	How were stakeholders informed of this study?	Mr Minolen Reddy (Eskom)	Ms Nyamande explained that the PSC members report back to their organisations after meetings and newsletters have been sent out to stakeholders in the study area. Additional to that the DWA has a stakeholder engagement plan to reach all stakeholders in communities around the river.
89	Does the integrated approach include all water resources? Does this include groundwater and has it been included in all your modelling?	Mr Minolen Reddy (Eskom)	Yes, all significant water resources form part of the study and groundwater has been included.
90	What data were used for the water resource planning model? Is this data based on reality or are assumptions being made?	Ms Ann Naidoo (Sasol)	Mr Van Rooyen said the model uses hydrological databases that were developed through hydrological studies by the DWA. The hydrology and models are derived through calibration against actual recorded data to ensure reliability. Actual water use data from users such as Rand Water, Sasol and Eskom are used in the planning scenarios. A model is then built based on reality, but a model is not always a perfect reflection of the real world and need to be continuously revised and updated. This water resource planning model has been used for years by the DWA and is updated regularly with the latest available data.
91	Have heavy metals other than uranium been taken into consideration during this study. Has the sediment also been studied, because heavy metals are absorbed by the sediment?	Ms Mariette Liefferink (FSE)	Dr Scherman explained that this study used data obtained during the Vaal River System Reserve Study where a toxicology testing was done. A whole range of heavy metals other than uranium were discovered in the sediment. Under various pH levels these can be released from the sediment.
92	Were the effect of the more than 1000 sinkholes and the existing tailings dams in the study area taken into consideration for the water quality part of this study? These	Ms Mariette Liefferink (FSE)	Dr Scherman said the information used for the water quality assessment comes from various DWA studies done during the last few years. The comprehensive

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	tailings dams produce both air and water pollution.		data used by the water quality planning directorate of the DWA is the most recent data available and includes all factors that can impact on water quality.
93	Was the unlawful water use by mining companies taken into consideration?	Ms Mariette Liefferink (FSE)	Ms Mohapi said the DWA has other processes looking at matters such as unlawful water use. It falls outside this study but that does not mean it is ignored and data from other studies are included in the classification process.
94	Did the study investigate the effects of AMD?	Ms Mariette Liefferink (FSE)	Dr Scherman explained that the objectives of classification are broad. Other studies such as the reconciliation strategy investigated AMD. In this classification study AMD was investigated as part of the water quality studies. The DWA currently has specific studies focusing solely on AMD.
95	Were water quality of both ground and surface water investigated?	Mr Minolen Reddy (Eskom)	Dr Sherman explained the importance of both surface water and groundwater in the Vaal WMAs and that both were included in this study. Mr Van Rooyen said Rand Water is an important user of groundwater through boreholes. The big dolomite areas in the Vaal River System such as the Schoonspruit Eye were investigated during this study. General modelling that included all significant water resources for the whole Vaal River System was done.
96	Was a reference site used for the water quality studies?	Ms Ann Naidoo (Sasol)	Dr Scherman said it is almost impossible to find a reference site for water quality on the Vaal River System. A reference site must be set up where a river is still in its natural state, which is not possible for this system. The Reserve Study used an un-impacted site high up in the Upper Vaal as a reference site.
97	What nutrient exceedance is referred to in the presentation? Does it exceed a legal allowable level?	Ms Ann Naidoo (Sasol)	Dr Scherman said that nutrient exceedance refers to the difference between the points used by the Integrated Water Quality Management Plan compared with the EWR sites of this Classification study.
98	Ms Liefferink commented that the Merrievale bird sanctuary is a RAMSAR site but it is not listed in the presentation as part of the study.	Ms Mariette Liefferink (FSE)	Ms Louw said the Blesbokspruit area was investigated, which includes this sanctuary.
99	Why is the ecological category (EC) of a water resource only moved from a D to a C or a C to a B. Why can it not be moved from a D to a B or a C to an A?	Ms Mariette Liefferink (FSE)	Ms Louw said it will not be practical by setting an unreachable EC. An EC should be obtainable and realistic and not impossible.
100	Why are some of the scenarios even considered when it can be seen that it will be impossible to achieve.	Ms Mariette Liefferink (FSE)	Ms Louw said all scenarios had to be investigated to if they are practical or not.
101	Why is there such a focus on rivers with an EC below a D.	Ms Marina Kruger (Midvaal Water Company)	Ms Louw explained that significant water resources under an EC D must be improved, because below a D means it is not sustainable and needs a major improvement.
102	The mining contribution to the GDP is not the true costs, because true costs will only manifest after mine closure.	Ms Mariette Liefferink (FSE)	Mr Van Rooyen said the study assume mitigation activities will also contribute to GDP, because mitigation is also an economic activity. Ms Shane Naidoo said the GDP data used by the DWA and for this study is sourced from the South African Revenue Service.
103	Scenario B looks the best option. When will Phase 2 of the LHWP be completed.	Ms Mariette Liefferink (FSE)	Mr Van Rooyen said the target date is 2020.
104	Will there be sufficient water in the VRS to dilute AMD before Phase 2 becomes operational. Will there not be severe water restrictions in the Upper Vaal or a reduction of water quality in the Lower Vaal?	Ms Mariette Liefferink (FSE)	Mr Van Rooyen explained that a feasibility study is currently being done and that study are considering options, timelines and implications including risk of restrictions. Mr Peter Pike (DWA) added that the LHWP can only add water to the VRS by 2020 and other intervention options will have to be used to stretch the VRS water resources until 2020. The management of all the water resources in SA allows for restrictions due to drought. Should drought happen, then there will be certain restrictions. This has

	Comments, questions and Issues	Commentator(s)	Response(s)
			been planned.
105	The feasibility study investigating the treatment of AMD will only be finished by February 2013. Then funding will first have to be sourced before construction can begin on the infrastructure to clean up AMD which could take until 2019. From 2014 there could be too little water for dilution in the VRS.	Ms Mariette Liefferink (FSE)	Mr Van Rooyen said the System is in a fortunate position that the Bloemhof Dam is not full and the level is actually dropping. This means losses (spills) from the system will be low when releases are made for dilution over the short term from Vaal Dam. According to the current target planning scenario we should have enough water in the VRS until 2020.
106	The real problem is the water quality and in future there will not be enough quantity to effectively dilute the water to counter AMD. Sulphates are currently being reduced from 4000 to 3000 mg/l in the short term while in other areas it will reduce from 5200 to 3000 mg/l. A total of 800 tons of salts are entering the Vaal River System daily and there will not be enough water to dilute all of this.	Ms Mariette Liefferink (FSE)	Mr Pike commented that the VRS is a complex system and short term solutions are being used to counter water quality problems. Mr Pike responded that planning is being done to best address this with the water we have. Ms Calvinia Shomolekae (DWA) added that the DWA is investigating various interventions such as specific plants that can remove some of the sulphates from the system.
107	Will the removal of alien vegetation along the rivers have an impact on the System?	Mr Jan Potgieter (DAFF)	Ms Louw said the removal of alien vegetation will make a huge difference, but the upkeep is vital after removal and the affected areas should be visited annually to keep them clean of alien vegetation. Such a removal of alien vegetation could improve the ecological category of a specific resource when managed properly.
108	The study sounds a little biased towards ecology. Where are the social aspects in the scenarios?	Stakeholder	Mr Van Rooyen explained that the social and economic aspects were included in the Goods and Services. Examples of this are the Vredefort Dome and the various wetlands that were taken into consideration. The scenarios do not, however, affect social aspects negatively.
109	When are you planning of having all resource quality objectives (RQOs) in place?	Stakeholder	Mr Sadimo Manamela (DWA) said consultants have been appointed and the contracts will be signed soon. Work should start and will run for 12 months.
110	Why is the Tugela Water Project used in the economic evaluation of the EWR site downstream of the Douglas Barrage and not pumping from the Orange? Water is being pumped from the Orange to the Vaal at Douglas.	Mr Jan Potgieter (DAFF)	Mr Van Rooyen explained that the Orange does not have excess water. The current augmentation plans for the VRS after Phase 2 of the LHWP, will be to use water from the Tugela System and therefore the economic implication was determined based on the earlier expenditure of capital of the Thukela Water Project.
111	The FSE propose new scenario called the “Polluter Pays Principle”. It basically means that the mines, agriculture, local government and anybody who pollutes the water resources, must pay for cleaning up their waste to improve the quality of water received by downstream users. It should not be the responsibility of national government or the public. Ms Liefferink said she will send a detailed written comment regarding this to Mr Andre Joubert which is outlined below: The National Water Act (NWA), the National Environmental Management Act (NEMA) and the Mineral and Petroleum Resources Development Act (MPRDA) have mechanisms to enforce the Polluter Pays Principle: 1. In terms of the NWA, the companies can be held jointly and severally responsible. 2. The NEMA makes provision for the recovery of costs prior to the cost being incurred as well as any person who had benefitted. In terms of the NEMA apportionment must take place. 3. In terms of the MPRDA the liability of directors are jointly and severally. The Minister of Mineral Resources can however sell any assets needed for the remediation by means of an application to the High Court. The Minister may also direct the Regional manager to use the funds in the financial provision fund for	Ms Mariette Liefferink (FSE)	Noted. The Department of Water Affairs is in the process of implementing the Waste Discharge Charge System which will apply the “Polluter Pays Principle: as a measure to achieve the required protection defined by the Management Classes. This implementation is a separate process which will (along with the Integrated Water Quality Management Strategy) provide the mechanisms for giving effect to the requirements embedded in the Management Classes as well as allow the appropriate use of the water resources.

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	remediation purposes.		
112	Is it possible to work out a cost per kilolitre water to give people a better understanding of the costs involved?	Mr Carl Woodhouse (Eskom)	Mr Van Rooyen explained that such a sum will be too simplistic and does not give a true reflection of actual cost. Water resource experts use a term called Unit Reference Value that compares different options with each other. It looks at rand per cubic metre but many other factors are also included to work out this cost.
	Source: Stakeholder meeting held in Kimberley on 24 July 2012		
113	The irrigation boards such as Koedoeskop and Hartswater in the Vaal River System were not aware of the classification process.	Ms Sanet de Klerk (Obaro)	Ms Mohapi requested that contact details of such organisations be sent to Andre Joubert who will add it to the database of the study. We must all share the responsibility of notifying uninformed parties. Ms Nyamande said the DWA will launch a stakeholder engagement plan to reach key stakeholders and the communities in the study area through workshops and further meetings. The study has been presented at various water forums in the Vaal during the past year and a half and this process will be continued.
114	Does the recent Present Ecological Study (PES) form part of the classification process.	Mr Leon Barkhuizen (Free State Department of Economic Development, Tourism and Environment – FS DETEA)	Various studies done by the DWA such as this PES study and the National River Health Programme, etc. are being used as sources of information for this study.
115	Will the results of the recent study done on the yellow fish also be used in the Classification Study?	Mr Matt Bond (Kimberley North Farmers Association)	Yes, this data have been included in the ecological data of the Reserve Determination Study, one of the main sources of information for the Classification Study.
116	What is the DWA doing to address water quality issues in the Vaal?	Mr Peter Ramollo (Northern Cape Department Environment and Nature Conservation)	Mr Jurgo van Wyk said the DWA is busy with various actions to improve water quality in the VRS. This includes the licensing of big water users, diffuse impacts of salts and nutrients. Water quality in the VRS is being managed and long term projections are in place to keep the river sustainable. AMD is a dilemma, but the DWA is attending to this problem with both short and long term interventions to solve these salinity issues.
117	Is an IUA just one Ecological Category (EC)?	Mr Leon Barkhuizen (FS DETEA)	Ms Louw explained that there are various monitoring points (nodes) in an IUA and each one could have a different EC.
118	Who will take the responsibility to improve the EC for a specific water resource if it is too low?	Mr Leon Barkhuizen (FS DETEA)	Ms Louw said this will be the responsibility of the DWA. Ms Shane Naidoo (DWA) explained that such an action will be part of a management plan for a specific area.
119	Subsistence farming is becoming more and more important and should be included in Goods and Services. More and more people in the VRS are becoming more dependent on fishing as a source of food and income.	Mr Leon Barkhuizen (FS DETEA)	Ms Louw answered that this has been included in the Goods and Services study. She added that yellow fish is very robust and can adapt to changing conditions inside a system.
120	Some IUAs have very low ECs. What is the reason for this?	Mr Piet van Niekerk (Vaalharts Distrik Landbou Unie)	Ms Louw said the alien vegetation and farming activities along the banks of water resources is the reason for bringing the EC down. In some cases it bring the EC down to an E.
121	The DWA must force mines, municipalities to pay for water pollution, because it has a major impact on the water quality downstream. Who is going to pay for this damage?	Mr Piet van Niekerk (Vaalharts Distrik Landbou Unie)	Mr Pieter Viljoen (DWA) explained that this classification process will set various limits for the different Management Classes. How the current water quality will be improved is not to be decided by this study. The DWA is busy developing a Waste Discharge Charge System (WDCS) which will take care of water polluters. This is all forms part of the Integrated Water Quality Management Plan for the three Vaal WMAs. Income made from WDCS will be used to clean up water resources.

	Comments, questions and Issues	Commentator(s)	Response(s)
			Ms Mohapi commented that the DWA has a whole host of actions that will all contribute to the improvement of water resources. Studies to determine the RQOs in the three Vaal WMAs will also assist to improve water quality on the Vaal River. The DWA is also improving its regulatory arm.
122	Did the floods during the past few years improve the water quality in the VRS?	Mr Matt Bond (Kimberley North Farmers Association)	Mr Viljoen said it only improved in the short term, because the sediment transported by such a flood also creates additional water quality problems.
123	I am concerned about decreasing water quality. Farmers must put in more lime and gypsum due to the high salt content of the soil. Farmers are also losing lucrative contracts to farm with fresh produce due to high *E.coli* bacteria counts in the water. Something must be done to improve water quality.	Ms Sanet de Klerk (Obaro)	Mr Viljoen said the DWA is not waiting for the Classification Study to be finalised before actions are implemented to address water quality issues. There are parallel processes taking place to counter these problems. If there are serious issues, contact the nearest DWA regional office and the problems will be investigated. Salinity is a big problem and AMD, for example, is currently being tackled, because this is where most of the salt comes from. Mr Van Wyk said part of the challenge is to coordinate all the DWA projects. This is being done by Study and Strategy Steering Committees to manage the various projects.
124	What are the correct channels of communication with the study team and the DWA?	Mr Matt Bond (Kimberley North Farmers Association)	All the relevant contact information can be found in any of the study newsletters and emails can be sent should you want to comment or need further information.
125	Will it be possible to release water from the Sterkfontein Dam, because this dam is used by Eskom for a pumped storage scheme?	Mr Leon Barkhuizen (FS DETEA)	Mr Van Rooyen explained that the hydro power function will not be affected and has been taken into consideration when the scenarios were developed.
	Source: Email on 20 August 2012		
126	Just concerned about the low "score" of the Mooi River – was the evaluation done as to the quality at C2H085?	Prof Les Stoch	Ms Louw explained that the Mooi River suffers from various problems, most which will be difficult to address. Quality problems (in terms of physico-chemical variables) are an issue, both from tributaries such as the Wonderfonteinspruit and the Mooi River itself. Furthermore, there are major physical disturbances to the river. A large section of the river which was originally a wetland is not being bulldozed and structurally modified for peat mining and other activities. All these changes have resulted in the Mooi River having a low Environmental importance and the recommendations are that where the river is still functioning ecologically in a D state, it should be maintained. This translates to a Management Class III. There will also be areas in a better state such as the upper Mooi above most of the dams. Areas such as in the tributaries which are in a state below a D, such as the Wonderfonteinspruit, should receive attention to improve it to at least a D state. FYI, the reference to D, C and E are in terms of Ecological Categories, A to D with A being near natural, and D being seriously modified – however all these Ecological Categories are deemed to provide some level of resource sustainability. The E and F categories are critically modified area, are deemed to be unsustainable and should be improved.
	Source: Meeting 4 of the Project Steering Committee held at the DWA in Pretoria on 4 September 2012		
127	The absence of water management institutions in the Vaal WMAs is a cause for concern. It is difficult to communicate and interact without a Catchment Management Agency in place. We must think of something else to engage directly with stakeholders. In other areas most farmers belong to a water users association but	Mr Nic Opperman (Agri SA)	Mr Seef Rademeyer (DWA) replied that there are active catchment forums in the Upper Vaal that represent water users. A problem might be that only junior DWA officials attend these meetings.

	Comments, questions and Issues	Commentator(s)	Response(s)
	this is not the case in the Vaal River System.		
128	How can one-on-one meetings be arranged between the DWA and the agricultural sector? Many irrigation boards have not heard of this process and the national bodies of agricultural unions must also be informed.	Ms Sanet de Klerk (Obaro)	Mr Daan du Plessis (TAU, Mpumalanga) suggested that the African Farmers Association must also be added to the data base.
129	What intervention measures can be used to improve the water quality in the Klip River and Blesbokspruit.	Mr Benedict Itholeng (Gauteng Department of Agriculture and Rural Development	Ms Naidoo offered that she or Ms Nyamande can be contacted to set up one-on-one meetings.
130	No mining is currently taking place in the areas with AMD problems, because it is a legacy of the past from mines that have closed down long ago. There must be a differentiation between current mining operations and the legacy of mining in the past. It is also not just AMD, because there are other pollutants as well.	Ms Stephinah Mudau (Chamber of Mines)	Mr van Rooyen replied that Scenario D takes AMD into consideration. Ms Louw added that the current state of the Integrated Units of Analysis (IUAs) is acceptable, except the IUAs in highlighted in red in the presentation. The areas where AMD is a serious issue are in the red areas which must first be addressed to obtain the required management Class (MC).
131	What influence does the DWA head office have over regional offices, because in Mpumalanga mining licenses are still being handed out although the water resources are overextended?	Mr Daan du Plessis (TAU SA)	Mr Keet admitted that this is one of the shortcomings of government, because of poor interaction between the Department of Mineral Resources (DMR), that controls mining licenses and the DWA that controls water licenses. This is currently being discussed at ministerial level to prevent mining licenses from being handed out without interaction with the DWA that must first investigate the water availability. The DWA has recently stopped one mine and insisted a long term plan regarding AMD must be prepared to the satisfaction of the department before the license will be considered.
132	Why is the Lower Wilge River a proposed MC II but Liebenbergsvlei River is a proposed MC III but it flows into the Lower Wilge.	Mr Jan Potgieter (Department of Agriculture, Forestry and Fisheries)	Ms Louw explained that the Liebenbergsvlei only flows into the Lower Wilge about a kilometre from the Vaal Dam, so there is a very small impact that does not affect the proposed MC of the Lower Wilge.
133	Will the information from previous studies be used in the Reserve Quality Objectives (RQOs) study?	Mr Martin Ginster (Sasol)	Ms Naidoo replied that all available information, including the information gathered during the Classification Study on the Vaal River System will be used for the RQO study. One of the ROQs will, for example relate to the yellow fish, because it has been flagged before and again in the classification study.
134	Some of the RQOs have already been set during a previous study.	Mr Seef Rademeyer (DWA)	Ms Naidoo agreed and added that the results of that preliminary study will be used and updated, where necessary. The same methodology will be used as during the preliminary study. Should there be major changes, then it will be discussed with the previous study team
135	Would it be possible to highlight the major issues such as sewage leakages that this study has encountered, specifically in the two Gauteng metros? The working relations between the Department of Environmental Affairs (DEA), DMR and the DWA are not good. Maybe these highlighted water quality issues could improve the working relations between these three departments.	Mr Benedict Itholeng (Gauteng Department of Agriculture and Rural Development)	Ms Naidoo explained that this study is only focusing on classifying significant water resources. A water quality management plan is currently being developed by the DWA that will manage water quality in the Vaal River System (VRS). This is one of the interventions from the VRS Reconciliation Strategy.

	Comments, questions and Issues	Commentator(s)	Response(s)
136	Water users at Barrage were issued with directives before they can discharge effluent into the Vaal, but not to other water users downstream.	Mr Matome Makwela (Chamber of Mines)	Ms Naidoo answered that the water quality management plan will investigate these types of problems.
137	This process (study) is almost completed, but the DWA will be continuing with the Stakeholder Engagement Plan and the Issues and Responses Report will be regularly updated and available on the website. Thank you to everybody for their engagement during this study and asked stakeholders who feel that their concerns have not been addressed to contact her or Ms Nyamande.	Ms Shane Naidoo (DWA)	Noted.

Appendix D:

Members of Project Steering Committee

Last Name	First Name	Company
Aaron	Nontsikelelo	Lejweleputswa District Municipality
Abrahams	Abe	Department of Water Affairs (DWA)
Ah Shene Verdoorn	Carolyn	Birdlife South Africa
Armour	Jack	Free State Agriculture
Atwaru	Yakeen	Department of Water Affairs (DWA)
Augoustinos	Mario	Vaaldam Catchment Executive Committee
Bakane-Tuoane	Manana Anne	Emfuleni Local Municipality
Barnard	Hendrik	Ga-Segonyana Local Municipality
Basson	Noeline	Sedibeng Water
Batchelor	Garth	Department of Economic Development Environment and Tourism
Bezuidenhout	P J	Overberg District Council
Bierman	Bertus	Joint Water Forum and Anglo American Platinum
Blair	Vernon	Department of Water Affairs (DWA)
Boden	Denis	National Petroleum Refiners of S A (Pty) Ltd (NATREF)
Bosch	Gert	Sishen Iron Ore Mine
Bosman	Lourie	Agri Mpumalanga (Plaas Uitgezogt)
Botha	Hannes	Mpumalanga Tourism and Parks Agency
Bothes	Elizabeth	Department of Tourism, Environment and Conservation
Brink	Fanie	Grain South Africa
Broderick	Maylene	Economic Development, Environment and Tourism
Burger	Alwyn	City of Tshwane Metropolitan Municipality
Chamda	Yunus	Sedibeng District Municipality
Chauke	Lucia	Eskom
Chauke	Sydney	Emfuleni Municipality
Chewe	Victor	City of Tshwane Metropolitan Municipality
Claassens	Johan	TCTA
Cloete	Riekie	Conningworth Economists
Cogho	Vik	Optimum Coal Holdings
Collins	Nacelle	Free State Department of Tourism, Environmental and Economi
Cornelius	Steven	Gauteng Department of Agriculture and Rural Development
Critchley	John	Rand Water
Cronje	Barry	Rural Foundation
de Fontaine	Marc	Rand Water Rietspruit Blesbokspruit Forum
de Jager	Steyn	Greater Taung Municipality
de Klerk	Albert	Midvaal Local Municipality
De Kock	Abe	Farm: Mooidraai
de Villiers	D W	Koppieskraal Irrigation Board
Dhluwayo	Boy	Sol Plaatjie Municipality (Kimberley)
Dini	John	South African National Biodiversity Institute
Diniza	Maria	Gamagara Local Municipality
Dippenaar	Gideon	Sedibeng Water
Dippenaar	Gideon	Sedibeng Water
Dlabantu	Mpumelelo	Working for Water
Dlamini	Mavela	City of Johannesburg Metropolitan Municipality
Dlamini	Thami	Msukwaligwa Local Municipality
Donaldson	R	Manganese Mines
Driver	Mandy	SANBI
du Plessis	Rickus	Department of Agriculture and RuraL Development
du Toit	Hanke	Department of Water Affairs (DWA)
Du Toit	Tienie	Renoster River Water Users Association
Eilard	J	Dikgatlong Local Municipality
Eilerd	Johannes	Dikgatlong Local Municipality
Els	Nic	City Council of Klerksdorp
Erasmus	Coenie	Department of Tourism, Environment and Economic Affairs
Erasmus	Frik	Durban Roodepoort Deep Limited
Florence	Achmat	Frances Baard District Municipality
Fourie	A J	Griqualand Exploration & Finance Co Ltd
Fourie	Wynand	Department of Environmental Affairs (DEA)
Gabriel	Mary-Jean	Department of Agriculture, Forestry and Fisheries (DAFF)

Last Name	First Name	Company
Galane	Malesela	Environmental Justice Networking Forum (EJNF)
Gamede	Andries	Gert Sibande District Municipality
Gaobusiwe	Benjamin	Kgalagadi District Municipality
Gincane	Ruben	Mamusa Local Municipality
Ginster	Martin	Sasol
Gondo	Joe	National African Farmers Union (NAFU)
Gopane	Ruth	Dikgatlong Local Municipality
Gosani	Ntsikelelo	TCTA
Greeff	Henry	Kgalagadi District Municipality
Greyling	Jan	Matjhabeng Local Municipality
Greyling	S P J	Schoonspruit Irrigation Scheme
Grobler	Willem	Department of Water Affairs (DWA)
Gungubele	Mondli	Ekurhuleni Metropolitan Municipality
Hadebe	Slindokuhle	Ekurhuleni Metropolitan Municipality
Hall	Peter	Sasol Infrachem (Leeu Spruit, Taaibosch Spruit Forum)
Hanekom	Dirk	Eskom
Harrison	Pienaar	Department of Water Affairs (DWA)
Hauman	Louis	Kuruman Agricultural Union
Hendriksz	Johan	East Rand Water Company (ERWAT)
Itholeng	Kebalepile	Gauteng Department of Agriculture and Rural Development
Itumeleng	Clement	Gamagara Local Municipality
Izaaks	Saul	Siyanda Water and Sanitation District
Jacobs	Gideon	Distrik Boere Unie
Jooste	Sebastian	Department of Water Affairs (DWA)
Joubert	Andre	Zitholele Consulting (Pty) Ltd
Kadiaka	Mamogala	Department of Water Affairs (DWA)
Keet	Marius	Department of Water Affairs (DWA)
Kekesi	Albert	Bophirima District Municipality
Khan	Rafat	Midvaal Water Company
Kleynhans	Neels	Department of Water Affairs (DWA)
Kokobela	Mosimanegape	House of Traditional Leaders
Komape	Martha	Department of Water Affairs (DWA)
Kruger	Marina	Midvaal Water Company
Leeto	Nokwanje	Lejweleputswa District Municipality
Leeuw	David	Sol Plaatjie Local Municipality
Lekoko	Simon	Directorate of Traditional and Corporate Affairs
Lethoko	Itumeleng	Ditsobotla Local Municipality
Letlhogile	Tshiamo	Ditsobotla Local Municipality
Letsoalo	Mokopane	Waterberg District Municipality
Leuschner	Andries	Gold Fields South Africa Ltd
Liefferink	Mariette	Federation for a Sustainable Environment (FSE)
Liphadzi	Stanley	Water Research Commission
Lobelo	Govan	Dr Ruth Segomotisi Mompati District Municipality
Lodewijks	Henk	Anglo Coal Environmental Services
Louw	Delana	Rivers for Africa
Louw	Lonnox	Tosca Dolomite Water User Association
Mabalane	Itumeleng	Chamber of Mines
Maboe	Paul	Sasolburg Transitional Local Council
Mabuda	Solly	Department of Water Affairs (DWA)
Mafejane	Ariel	Johannesburg Water
Magodi	Omphemetse	Kgalagadi District Municipality
Mahonde	Kay	Birdlife South frica
Mahusi	Christopher	Molopo Local Municipality
Makape	G G	Tsantsabane Municipality
Makena	Gladys	Magareng Local Municipality
Makgalemane	Itumeleng	Greater Taung District Municipality
Makodi	Rebecca	Leekwa Teemane Local Municipality
Makuapane	Andrew	Leekwa Teemane Local Municipality
Malaka	Tebogo	Department of Water Affairs (DWA)

Last Name	First Name	Company
Malebye	Patrick	Dipaliseng / Balfour Local Municipality
Manamela	Sadimo	Department of Water Affairs (DWA)
Manele	Sorrious	Sedibeng District Municipality
Mapholi	Masindi	Maquassi Hills Local Municipality
Maposa		Delportshoop TLC
Marx	Karin	Wildlife and Environment Society of South Africa (WESSA)
Maseng	Benardo	Kgatelopele Local Municipality
Masondo	Amos	City of Johannesburg Metropolitan Municipality
Maswuma	Zacharia	Department of Water Affairs (DWA)
Matseba	Mogale	Department of Water Affairs (DWA)
Mazwi	Nosie	Department of Water Affairs (DWA)
McCourt	Liz	Department of Environmental Affairs (DEA)
Meintjes	Louis	Transvaal Agricultural Union South Africa (TAUSA)
Mere	Shedrick	Magareng Local Municipality
Midgley	Ian	Eskom
Mlambo-Izquierdo-Rodriguez	Poppy	Kgatelopele Local Municipality
Mmarete	Charles	Department of Water Affairs (DWA)
Mmoiemang	Kenneth	Kgalagadi District Municipality
Mngomezulu	Willy	Pixley Ka Seme Local Municipality
Mnisi	Jones	Johannesburg Water (Pty) Ltd
Mochware	Ontlametse	Kagisano Local Municipality
Modisakeng	Busisiwe	Lesedi Local Municipality
Mofokeng	Mahole	Sedibeng District Municipality
Mofokeng	Mpho	Greater Taung District Municipality
Mofokeng	Puleng	Department of Agriculture, Forestry and Fisheries
Mogotlhe	Paul	North West Department of Agriculture, Conservation, Environment and Tourism
Mohapi	Ndileka	Department of Water Affairs (DWA)
Mokadi	Andrew	Vaal University of Technology
Mokgosi	Mantebo	Moqhaka Local Municipality
Mokgosi	Mantebu	Moqhaka Local Municipality
Molema	Kemonna	Tribal Authority
Molema	Shelley	Bophirima District Council
Mompati	Rose	Naledi Local Municipality
Mongake	Monty	Fezile Dabi District Municipality
Mongolola	Gift	Ga-Segonyane Municipality
Moraka	William	South African Local Government Association (SALGA)
Mosai	Sipho	Rand Water
Mothibi	Dimakatso	Department of Agriculture and Land Reform
Motlhale	Kelehile	Tswelopele Local Municipality
Motoko	Phihadu	Ratlou Local Municipality
Mshudulu	S A	Emfuleni Local Municipality
Mthimunye	George	Naledi Local Municipality
Mtsuku	Samuel	Department of Tourism, Environment and Economic Affairs
Mudau	Stephinah	Chamber of Mines South Africa
Mulangaphuma	Lawrence	Department of Water Affairs (DWA)
Muller	Anton	Bloemhofdam Kom
Mutyorauta	J J	Department of Agriculture
Mutyorauta	Julius	Department of Tourism, Environment and Conservation (DTEC)
Mvula	Obed	Department of Land Affairs
Mwaka	Beason	Department of Water Affairs (DWA)
Mweli	Zandisile	Maquassi Hills Local Municipality
Nagel	Marius	Government Communication and Information Systems (GCIS)
Naidoo	Shane	Department of Water Affairs (DWA)
Nakana	Lesego	Greater Taung Local Municipality
Namusi	Sedirilwe	Molopo Local Municipality
Nast	Timothy	Midvaal Local Municipality
Naude	Piet	Free State Agricultural Water Committee

Last Name	First Name	Company
Nengovhela	Rufus	Department of Water Affairs (DWA)
Ngamole	G	Masilonyana Municipality
Ngangelizwe	Sebenzile	Matjhabeng Local Municipality
Ngcobo	Mbuleleni	Gert Sibande District Municipality
Ngcobo	Sonwabo	Tswaing Local Municipality
Ngema	Khaya	Ekurhuleni Metropolitan Municipality
Ngila	Zelna	Siyanda District Municipality
Ngomane	Lulu	Gauteng Water Sector Forum
Ngxanga	Eric	Siyanda District Municipality
Nkonyane	Martha	
Nkwane	Oupa	City of Tshwane Metropolitan Municipality
Nosi	Thabo	Frances Baard District Municipality
Ntili	Tseliso	Department of Water Affairs (DWA)
Ntsepe	Sello	Mantsopa Local Municipality
Ntsizi	Thembile	Wes Vaal Chamber of Commerce
Ntwe	Francisco	Ratlou Local Municipality
Nyamande	Tovhowani	Department of Water Affairs (DWA)
Oagile	Mothus	Kagisano Local Municipality
Oosthuizen	Christo	Louwna/Coetzerdam Water User Association
Opperman	Dirk	Land Affairs
Opperman	Nic	Agri SA
Peek	Bobby	GroundWork - Friends of the Earth South Africa
Petersen	Thabo	Matjhabeng Local Municipality
Phukuntsi	Rosy	Tswelopele Local Municipality
Pienaar	Harrison	Department of Water Affairs (DWA)
Pienaar	P G	Vyf Hoek South Management Board
Pillay	Nava	Metsweding District Municipality
Potgieter	Ampie	Sasol Mining Rights Department (SMRD)
Potgieter	Jan	Department of Agriculture, Forestry and Fisheries
Potgieter	Sandra	Dow Plastics
Pretorius	Theuns	Kaalfontein Boerevereniging Distriks Landbou Unie
Pyke	Peter	Department of Water Affairs (DWA)
Radebe	Khulu	Male Development Agency
Rademeyer	Seef	Department of Water Affairs (DWA)
Ramaema	Lowrence	Department of Tourism, Enviroment and Economic Affairs
Ramokgopa	Kgosientsho	City of Tshwane Metropolitan Municipality
Ramokhoase	Jonas	Fezile Dabi District Municipality
Rampai	Constance	Mantsopa Local Municipality
Rampine	M K	South African National Civic Organisation (SANCO) Boikhotsong
Reinecke	C J	Potchefstroom Univ for CHE
Reitz	J J C	Kalahari East Water User Association
Rossouw	Lourens	Tokologo Local Municipality
Rust	Nelia	Matjhabeng Local Municipality
Sales	Malcolm	Lebalelo Water User Association
Samson	Paballo	Moshaweng Local Municipality
Sebusho	Sipho	Kgalagadi District Municipality
Seikaneng	Tefo	Moshaweng Local Municipality
Shabalala	Sam	Emfuleni Local Municipality
Shone	Steve	Grain SA
Sindane	Jabulani	Lekwa Local Municipality
Slabbert	Nadene	Department of Water Affairs
Smit	Hennie	Department of Water Affairs (DWA)
Snyders	Louis	Department of Water Affairs (DWA)
Stoch	Leslie	Geotech (Lower Wonderfonteinspruit Forum)
Stoltz	Gert	Molopo Farmers Union
Surendra	Anesh	Eskom
Sutton	Malcolm	Anglogold
Swart	Susan	WRP Consulting Engineers (Pty) Ltd
Takalo	Mmabatho	City of Tshwane Metropolitan Municipality

Last Name	First Name	Company
Terrè-Blanche	Riana	Namaqualand Water and Sanitation Support Group (NAWASAN)
Thakurdin	Manisha	Department of Water Affairs (DWA)
Theron	Danie	Christiana Farmers Association
Theron	J H	Vaalharts Water Users Association
Theron	Piet	Munisipaliteit van Delportshoop
Thirion	Christa	Department of Water Affairs
Thompson	Isa	Department of Water Affairs (DWA)
Tlhape	Manketse	Tswaing Local Municipality
Tshipelo	Kenneth	Mamusa Local Municipality
Tsotetsi	Mabalone	Dipaliseng Local Municipality
Ubisi	Makumu	Sedibeng Water
van Aswegen	Johann	Department of Water Affairs (DWA)
van den Berg	J W	Saamstaan Agricultural Union
van den Berg	Ockie	Department of Water Affairs (DWA)
van den Bon	Patrick	Vadex Consulting cc
van der Heever	Piet	Lesedi Local Municipality
van der Merwe	Ben	Emfuleni Local Municipality
van der Merwe	Danie	Ekurhuleni Metropolitan Municipality
van der Merwe	Johan	Rand Water
van der Walt	Philip	City of Tshwane Metropolitan Municipality
van der Westhuizen	Walther	Department of Water Affairs (DWA)
van Rooyen	Johan	Department of Water Affairs (DWA)
van Rooyen	Pieter	WRP Consulting Engineers (Pty) Ltd
van Schalkwyk	V	South African Rivers Association
van Tonder	Dean	Sasol Mining
van Vuuren	Hennie	Regina Farmers Union
van Vuuren	J L	Frankfort TLC
van Wyk	Francois	Rand Water
van Wyk	Jurgo	Department of Water Affairs (DWA)
van Wyk	Niel	Department of Water Affairs (DWA)
van Zyl	Andre	Fezile Dabi District Municipality
Van Zyl	Chris	TAU SA Agricultural Union
van Zyl	J F C	Bloemhof TLC
Venter	Gerda	Department of Water Affairs (DWA)
Venter	Petrus	Department of Water Affairs (DWA)
Vilakazi	Bheki	Msukwaligwa Local Municipality
Viljoen	Peter	Vereeniging Refractories Ltd
Vorster	Albert	Kimberley Agricultural Union
Watson	Marie	Centre for Environmental Management
Wepener	Lotter	River Property Owners' Association - Save the Vaal
Williams	Bruce	Klerksdorp Irrigation Board
Woodhouse	Philip	Goldfields (West Driefontein Gold Mine)
Yawitch	Joanne	Department of Environmental Affairs (DEA)

Appendix E:

Comments and Responses

COMMENTS RECEIVED	ADDRESSED IN REPORT?	COMMENT
Comments from Ms T Nyamande (received on 11 September 2012)		
Editorial Comments:		
1. Title page - Reference should date August 2012 (not June 2012).	Yes	
2. Page 13 has no text, move text to page 13.	Yes	
Comments from PJ van der Walt (Tshwane Metro) received on 27 September 2012:		
1. The City of Tshwane is of course mainly concerned with the upper Vaal catchment which is the source of over 70% of the potable water supplied in the city. The proposed IUA's and MC's in this portion of the Vaal system is acceptable.	No. See Comment.	Noted.
2. The eventual discharge of treated AMD from the Eastern Basin (Grootvlei) could further reduce the ecological state if not managed strictly in compliance with the MC.	No. See Comment.	Noted.
Comments from Ms T Nyamande (received on 15 October 2012):		
The Final Management Class Report also need to include the NFEPA consideration.	Yes	See description of **Step 2** on pages vi and 1. The NFEPAs, together with the IUAs and proposed Management Classes, are shown on the maps provided in **Appendix A**. Information on NFEPAs is summarised in **Appendix B**.