CLASSIFICATION OF SIGNIFICANT WATER RESOURCES IN THE OLIFANTS WATER MANAGEMENT AREA: (WMA 4) - WP 10383

MANAGEMENT CLASSES OF THE OLIFANTS WATER MANAGEMENT AREA REPORT

DRAFT

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LIST OF ABBREVIATIONS AND ACRONYMS

CD: RDM	*Chief Directorate: Resource Directed Measures*
DWA	*Department of Water Affairs*
EIS	*Ecological Importance and Sensitivity*
ESBC	*Ecologically Sustainable Base Configuration*
EWR	*Ecological Water Requirements*
ha	*Hectares*
HN	*Hydro-node*
IUA	*Integrated Unit of analysis*
IWRM	*Integrated Water Resource Management*
KNP	*Kruger National Park*
MAR	*Mean Annual Runoff*
MC	*Management Class*
NWA	*National Water Act*
PES	*Present Ecological State*
PSC	*Project Steering Committee*
REC	*Recommended Ecological Category*
RDM	*Resource Directed Measures*
RQOs	*Resource Quality Objectives*
WMA	*Water Management Area*
WRC	*Water Resource Classification*
WRCS	*Water Resource Classification System*

GLOSSARY

Some key terms and definitions as for Water Resource Classification as applied in the study:

Ecological Category (EC)	*The Ecological Category is a generic qualitative description of the ecological condition of a water resource, expressed as A to D. The category represents an integrated classification of the habitat, biophysical components (fish, riparian, vegetation, aquatic invertebrates and geomorphology) and water quality of a water resource, where A represents virtually unmodified, natural conditions (usually reference conditions) and D represents a degree of modification from natural conditions (conditions of optimum sustainable resource use). The ecological category D is the lowest ecological condition where the water resource is deemed sustainable. Categories E and F are deemed to be ecologically unsustainable (degraded).*
Ecological Importance and Sensitivity (EIS)	*Key indicators in the ecological classification of water resources. Ecological importance relates to the presence, representativeness and diversity of species of biota and habitat. Ecological sensitivity relates to the vulnerability of the habitat and biota to modifications that may occur in flows, water levels, physico-chemical conditions, etc.*
Ecological Water Requirements (EWR)	*The flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components.*
Ecological Water Requirement Sites	*Specific points on the river as determined through the site selection process. An EWR site consists of a length of river which may consist of various cross-sections for both hydraulic and ecological purposes. These sites provide sufficient indicators to assess environmental flows and assess the condition of biophysical components (drivers such as hydrology, geomorphology and physico-chemical) and biological responses (viz. fish, invertebrates, riparian vegetation).*
Integrated unit of analysis (IUAs)	*The basic unit of assessment for the classification of water resources. The IUAs incorporates socio-economic zones and are defined by catchment area boundaries.*
Management Class (MC)	*The MC is representative of those attributes that the DWA (as the custodian) and society require of different water resources (consultative process). The process requires a wide range of trade-offs to assessed and evaluated at a number of scales. Final outcome of the process is a set of desired characteristics for use and ecological condition each of the water resources in a given catchment. The WRCS defines three*

	management classes, Class I, II, and III based on extent of use and alteration of ecological condition from the predevelopment condition.
Present Ecological State (PES)	*The current state or condition of a water resource in terms of its biophysical components (drivers) such as hydrology, geomorphology and water quality and biological responses viz. fish, invertebrates, riparian vegetation). The degree to which ecological conditions of an area have been modified from natural (reference) conditions.*
Recommended Ecological Category (REC)	*The Recommended Ecological Category is the future ecological state (Ecological Categories A to D) that can be recommended for a resource unit depending on the EIS and PES. The REC is determined based on ecological criteria and considers the EIS, the restoration potential of the system and attainability there-of.*
River Node (Hydro-node)	*These are modelling point's representative of an upstream reach or area of an aquatic eco-system (rivers, wetlands, estuaries and groundwater) for which a suite of relationships apply.*
Scenario	*Scenarios, in the context of water resource management and planning, are plausible definitions (settings) of factors (variables) that influence the water balance and water quality in a catchment and the system as a whole. Each scenario represents an alternative future condition, generally reflecting a change to the present condition.*
Sub-quaternary catchments	*A finer subdivision of the quaternary catchments (the catchment areas of tributaries of main stem rivers in quaternary catchments). The update of the PES and EIS (2010) status has been determined per sub-quaternary.*

EXECUTIVE SUMMARY

Introduction

In 2010, the Department of Water Affairs (DWA) identified the need to undertake the classification of significant water resources in the Olifants Water Management Area (WMA) in accordance with the Water Resource Classification System (WRCS). Classification of water resources aims to ensure that a balance is reached between the need to protect and sustain water resources on one hand and the need to develop and use them on the other. The ultimate goal of the study is the implementation of the WRCS which has as its final product the selection of one of three Management Classes (MCs) for the 13 Integrated Units of Analysis (IUAs) that were identified in the Olifants WMA. The purpose of the MC is to establish clear goals relating to the quantity and quality of the relevant water resource, and conversely, the degree to which it can be utilised by considering the economic, social and ecological goals from an integrated water resource management perspective.

The WRCS places the following principles at the forefront of implementation: (1) Maximising economic returns from the use of water resources; (2) Allocating and distributing the costs and benefits of utilising the water resource fairly; and (3) Promoting the sustainable use of water resources to meet social and economic goals without detrimentally impacting on the ecological integrity of the water resource.

The Olifants WMA Water Resources Classification study was initiated in November 2010. The study has been primarily of a technical nature being guided by identified stakeholder groups in the WMA constituting the Project Steering Committee (PSC) (Appendix C). The Olifants WMA classification study is now at the final stage in terms of the WRCS process, the proposed MCs.

Study Area

The area covered by the study is the Olifants WMA which may be divided into four sub-areas, namely the Upper Olifants, Middle Olifants, Lower Olifants and Steelpoort sub-areas (Appendix A). The main tributaries of the Olifants River are the Wilge, Elands, Ga-Selati, Klein Olifants, Steelpoort, Blyde, Klaserie and Timbavati Rivers. The Olifants River is a tributary of the Limpopo River which is shared by South Africa, Botswana, Zimbabwe and Mozambique. The Olifants WMA excludes the Letaba River catchment.

Purpose of the Report

The purpose of this report is to present and describe the rationale for the proposed MCs for the identified IUAs in the Olifants WMA based on the outcomes of the scenario evaluation process and recommendations (DWA, 2012a). The proposed MCs or class configurations form the final deliverable of the study. The MCs presented in this report will be incorporated into the classification component of the Integrated Water Resource Management template (IWRM) for the Olifants WMA which will be presented to the Minister for consideration. Certain rivers were identified due to their conservation importance or sensitivity that require a higher level of protection than that specified for the overall IUA. These are mentioned with these final recommendations on the MC in order that specific conditions are afforded to them ensuring a higher level of protection is maintained.

This report specifies one of three MCs for each IUA, which will then be translated into resource quality objectives (RQOs) that will specify the actual targets and ranges for maintenance of a specific class of water resource.

The RQO development process is a separate process that has recently been initiated by the DWA and will run on from the outcome of the classification study.

Approach

To classify a water resource, the WRCS lays out a set of procedures grouped together in 7 steps that when applied to a specific catchment will result in the determination of a MC (refer to

Figure 1).

In terms of the process:

- *13 IUAs, several nodes and the significant water resources were defined for the Olifants WMA (Figure 2). This has been based on the socio-economics of the areas, water use and users, envisaged level of protection required and significance of the resource. Availability of representative Ecological Water Requirement (EWR) sites, catchment boundaries and catchment modelling schematics were also considered. A status quo assessment of each IUA was undertaken to understand ecological status, socio-economic conditions, ecosystem services and water resource infrastructure and availability.*

- *An evaluation and decision analysis framework was defined once the status quo of the WMA was understood and the IUAs and network of significant water resources was delineated. An economic model was developed based on this framework to assess the implications of different catchment scenarios at an IUA level on economic prosperity, social wellbeing and ecological condition.*

- *Ecological water requirements (EWR) were then quantified for the EWR sites and nodes in the system. These have been quantified from previous Reserve studies or through rapid assessments undertaken for the purpose of this classification study. Where little ecological information was available extrapolation using information from the previous studies was done, especially in those smaller tributaries where protection is required. The updated PES and EIS as at 2010 of the water resources was obtained from a recently completed DWA study and was used where no other information was available. During this step the information on the river Freshwater Ecosystem Priority Areas (FEPAs) identified through the National Freshwater Ecosystem Priority Areas Project of the Water Research Commission (WRC, 2011), was assessed to determine if they were adequately protected through the PES categories for the nodes in these catchments. FEPAs have been identified as those areas that are important for sustaining the integrity and continued functioning of their related ecosystems. Forty nine (49) FEPAs are present in the Olifants WMA (Refer to Appendix B for more detail on the incorporation of the FEPAs).*

- *The ecologically sustainable base configuration (ESBC) scenario was then established and tested. The ecological categories used as the base scenario was the PES as determined during previous Reserve studies as well as the 2010 PES at all the EWR sites in the Olifants WMA. The*

water resources yield model (WRYM) was run based on this EWR and water balance outputs were fed into the economic modelling assessment. Only maintenance low flows and drought flows were included in the yield modelling. Maintenance high flows and floods were excluded as proposed in the Reconciliation strategy.

- *Once appropriate levels of ecological protection are established for the water resources; the measures required to achieve these protection levels, can then be assessed in terms of the overall implications to the IUAs and the WMA. This forms the scenario evaluation component of the WRCS process. To support the decision making process for the Olifants WMA towards MCs, five additional catchment scenarios were then analysed and assessed as part of the scenario evaluation step (Step 5). These scenarios represent alternate ecological categories and growth scenarios for the Olifants WMA, and have been analysed to determine the water balances, socio-economic implications and ecological consequences of each. The outcome of this step was to inform the selection of scenarios for presentation to stakeholders. In the case of the Olifants Classification study, all six scenarios were presented.*

- *Based on the scenario evaluation and consultation with the stakeholders, it was recommended that the go forward options are Scenario 4 and 6 which supply the PES ecological categories and meet the future growth in water requirements in the WMA. In Scenario 6 additional treated mine water is released from the Upper Olifants to meet the water requirements of the Middle Olifants. In terms of the definition of Scenario 4 and 6, it is proposed as the outcome of the WRCS process that the PES ecological water requirements must be met at the EWR sites and selected nodes within the IUAs in the Olifants WMA.*

- *The IUA MCs associated with Scenario 4 and 6 are presented in this report. The approach applied to determining the proposed MCs for each of the IUAs was to follow the guidelines of the WRCS (DWA, 2007).*

Towards Management Class

The determination of the MC (Table E1) for the identified water resources in Olifants WMA will essentially describe the desired ecological condition of the resource, and conversely, the degree to which it can be utilised.

The WRCS guidelines (DWA, 2007) recommend that the MC be determined based on the ECs of the biophysical nodes residing in an IUA. The approach applied to determining the proposed MCs for each of the IUAs was to follow the guidelines of the WRCS.

This categorisation is based largely on the main stem Olifants River and major tributaries. Where a sub-node in a tributary catchment is different to the overall IUA MC the ecological category is accounted for by the implementation of this ecological water requirement at the sub-node. Where such instances occur the necessary explanations are provided in this report.

The proposed MCs are supported by the study PSC and are recommended for implementation. This report presents the set of ecological categories (% distribution of biophysical nodes) that define the MC per IUA. A MC for an IUA will guide water resource management and its planning. Based on the specific ecological configuration within a quaternary catchment the management objectives within an

IUA may also differ.

The implementation of the MCs (the ecological categories) will be realised to the RQOs that are in the process of being developed.

Table E1: Management classes for water resources

Management Class Descriptions	
Class I	**Minimally used** *Water resource is one which is minimally used and the overall condition of that water resource is minimally altered from its pre-development condition*
Class II	**Moderately used** *Water resource is one which is moderately used and the overall condition of that water resource is moderately altered from its pre-development condition*
Class III	**Heavily used** *Water resource is one which is heavily used and the overall condition of that water resource is significantly altered from its pre-development condition*

Conclusion and Study Recommendations

The IUA MCs proposed for the Olifants WMA are indicated in Table E2 and Figure E1.

Table E2: Proposed Management Classes for the Olifants WMA

Integrated Unit of Analysis (IUA)		Proposed Management Class
1	*Upper Olifants River catchment*	**III**
2	*Wilge River catchment area*	**II**
3	*Selons River area including Loskop Dam*	**II**
4	*Elands River catchment area*	**III**
5	*Middle Olifants up to Flag Boshielo Dam*	**III**
6	*Steelpoort River catchment*	**III**
7	*Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River*	**III**
8	*Spekboom catchment*	**II**
9	*Ohrigstad River catchment area*	**III**
10	*Lower Olifants*	**II**
11	*Ga-Selati River area*	**III**
12	*Lower Olifants within Kruger National Park*	**II**

Integrated Unit of Analysis (IUA)		Proposed Management Class
13	*Blyde River catchment area*	**I**

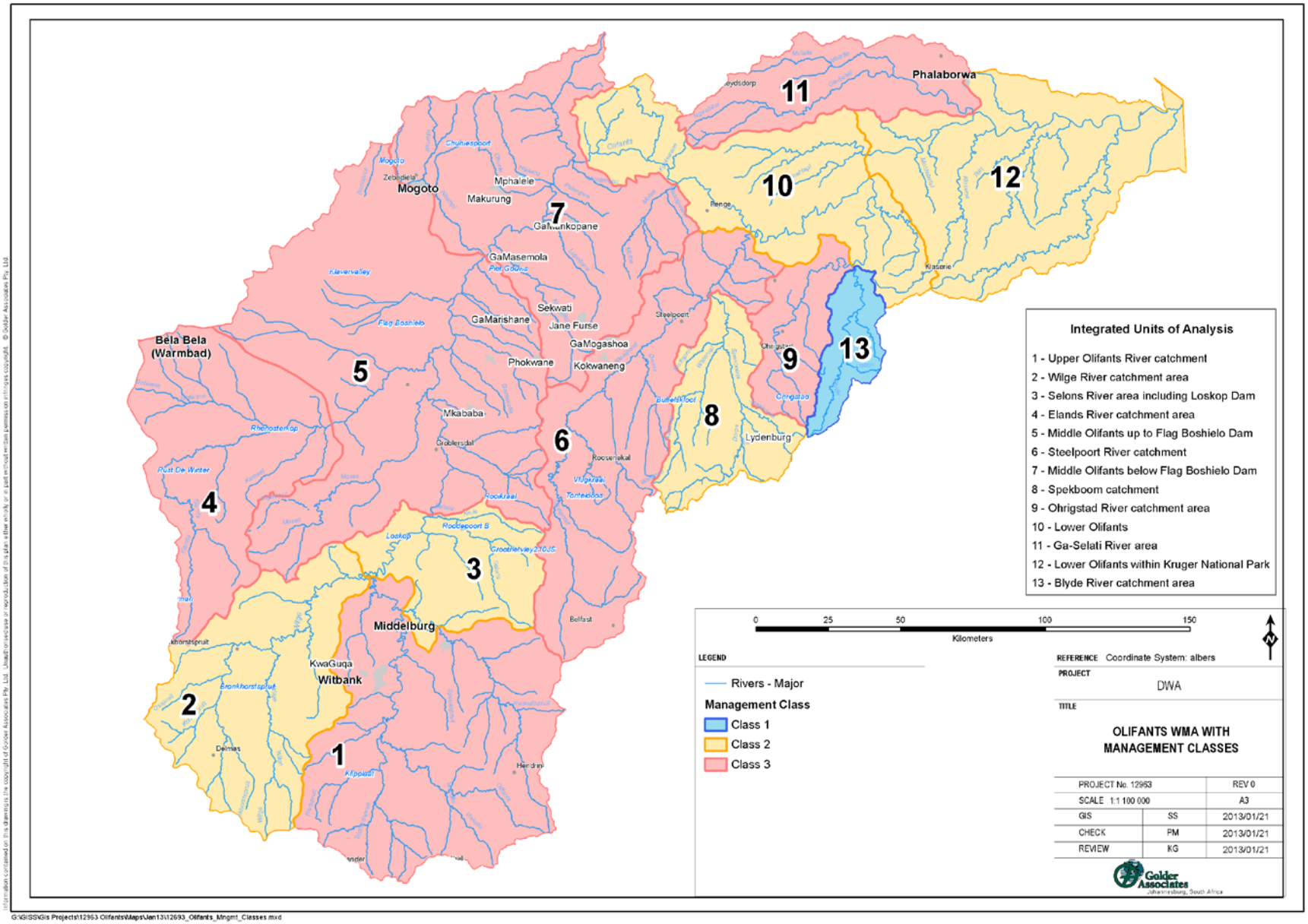

Figure E1: The Olifants WMA indicating proposed IUA MCs

In terms of the MCs proposed for the 13 IUAs in the Olifants WMA:

- *I IUA falls within an MC I (IUA 13),*
- *5 fall within and MC II (IUAs 2, 3, 8, 10, 12),*
- *7 IUAs fall within an MC III (IUAs 1, 4, 5, 6, 7, 9, 11)*

In IUAs 1 (Upper Olifants), 7 (Middle Olifants below Flag Boshielo Dam) and 11 (Ga Selati) the current state is improved from an ecological category of E to a D (Class III) by the proposed MC. IUAs 4 (Elands River) and 5 (Middle Olifants up to Flag Boshielo Dam) fall within the MC III, include areas lower than D EC. IUA 9 is a MC III due to the fact that main stem Ohrigstad River is highly impacted (D EC) even though the tributaries are in a higher ecological condition (75% C).

Based on the results of the study, the following recommendations are proposed:

- *The PES EC be implemented as the ecological Reserve at the EWR sites and selected nodes. This will improve the system ecological health by implementation of EWRs, additional flow and an improved water quality in some cases. The implementation of these flows will only be the maintenance low and drought fows. Freshets and floods will still occur in un-dammed tributaries and larger floods in the main stem of the Olifants and larger tributaries with major dams. It is recommended that a monitoring programme is initiated as soon as possible to monitor the response of the system due to the lack of freshet and flood releases as to ensure changes to these requirements if the system is deteriorating.*
- *In terms of the flow scenario assessment, the flows at some EWR sites, viz. EWR 4 (Wilge), EWR 16 (Lower Olifants in KNP), EWR 6 (Elands River), EWR 14a (Upper Ga-Selati), OLI-EWR3 (Kranspoortspruit) and OLI-EWR8 (Ohrigstad) cannot be fully met. This needs to be addressed in the catchment strategy development.*
- *The implementation of the MCs will require management of water quality which includes source directed measures, regulatory and institutional structures.*
- *Concerted and regular monitoring and compliance management is required to ensure the successful implementation of the MCs.*
- *Due to the water resource constraints in the WMA, the implementation and updating of the Olifants WMA Reconciliation Strategy is central to the implementation of the proposed MCs.*
- *An integrated Water Quality Management Plan is required.*
- *How the excess mine water has been earmarked to supply the future water requirements will be utilised has not been decided yet. This will be addressed. In the further development of the Reconciliation Strategy. At this stage, the release of the mine water into the river system cannot be relied upon. A monitoring programme will have to be*

implemented to ensure that the releases reach their desired destination.

- *The treatment of mine water in the Upper Olifants will be in perpetuity after the closure of the mines. The financing of treatment schemes will have to be adequately provided for.*

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1 INTRODUCTION

1.1 BACKGROUND

Chapter 3 of the National Water Act (NWA, Act 106 of 1998) provides for the protection of water resources through the implementation of Resource Directed Measures (RDM) which includes the Classification of water resources, setting the Reserve and Resource Quality Objectives (RQOs). Classification of water resources aims to ensure that a balance is reached between the need to protect and sustain water resources on one hand and the need to develop and use them on the other.

In 2010, the Department of Water Affairs (DWA) identified the need to undertake the classification of significant water resources in the Olifants Water Management Area (WMA) in accordance with the Water Resource Classification System (WRCS).

The Olifants WMA is a highly utilised and regulated catchment and like many other WMAs in South Africa, its water resources are becoming more stressed due to an accelerated rate of development and the scarcity of water resources. There is an urgency to ensure that water resources in the Olifants WMA are able to sustain their level of uses and be maintained at their desired states. The ultimate goal of the study is to determine the management class (MC) for the water resources by implementing the WRCS. The purpose of the MC once set, is to establish clear goals relating to the quantity and quality of the relevant water resource in order to facilitate a balance between protection and use of water resources.

The study area comprises the Olifants WMA. The Olifants River originates near Bethal in the Highveld of Mpumalanga. The river initially flows northwards before curving in an easterly direction through the Kruger National Park and into Mozambique where it joins the Limpopo River before discharging into the Indian Ocean. The main tributaries are the Wilge, Elands and Ga-Selati Rivers on the left bank and the Klein Olifants, Steelpoort, Blyde, Klaserie and Timbavati Rivers on the right bank.

Formal economic activity in the WMA is highly diverse and is characterised by commercial and subsistence agriculture (both irrigated and rain fed), diverse mining activities, manufacturing, commerce and tourism. Large coal deposits are found in the Emalahleni and Middelburg areas (Upper Olifants) and large platinum group metal (PGM) deposits are found in the Steelpoort, Polokwane and Phalaborwa areas. The WMA is home to several large thermal power stations, which provide energy to large portions of the country. Extensive agriculture can be found in the Loskop Dam area, the lower catchment near the confluence of the Blyde and Oilfants Rivers as well as the in the Steelpoort Valley and the upper Selati catchment.

A large informal economy exists in the Middle Olifants, with many resource-poor farmers dependent upon ecosystem services. The area has many important tourist destinations, including the Blyde River Canyon and the Kruger National Park. Land use in the Olifants WMA is diverse and consists of irrigated and dryland cultivation, improved and unimproved grazing, mining, industry, forestry and urban and rural settlements

1.2 THE STUDY PROCESS

To classify a water resource, the WRCS lays out a set of procedures grouped together in 7 steps that when applied to a specific catchment will result in the determination of a MC. The study process has been completed and a set of MCs is now recommended. The DWA has initiated a study to set the Resource Quality Objectives (RQOs) based on the MCs set. The RQOs and MCs will be gazetted together at the conclusion of the RQO study. This study has been primarily of a technical nature and was guided by stakeholder participation and engagement.

The main components that have been addressed through the study process (Figure 1) include the:

- *Study scope definition and water resource information and data gathering.*
- *Definition of the Integrated Units of Analysis (IUAs) and significant water resources.*
- *Status quo assessment of the WMA (assessment of present state water resource quality, identification of water resource issues, determination of the institutional environment, assessment of the socio-economic) etc.*
- *The application of the WRCS, i.e. establishing the MC by integration of the economic, social and ecological goals through a suitable analytical decision-making system (scenario analysis).*
- *Stakeholder engagement and consultation processes, and*
- *Recommendation of management classes.*

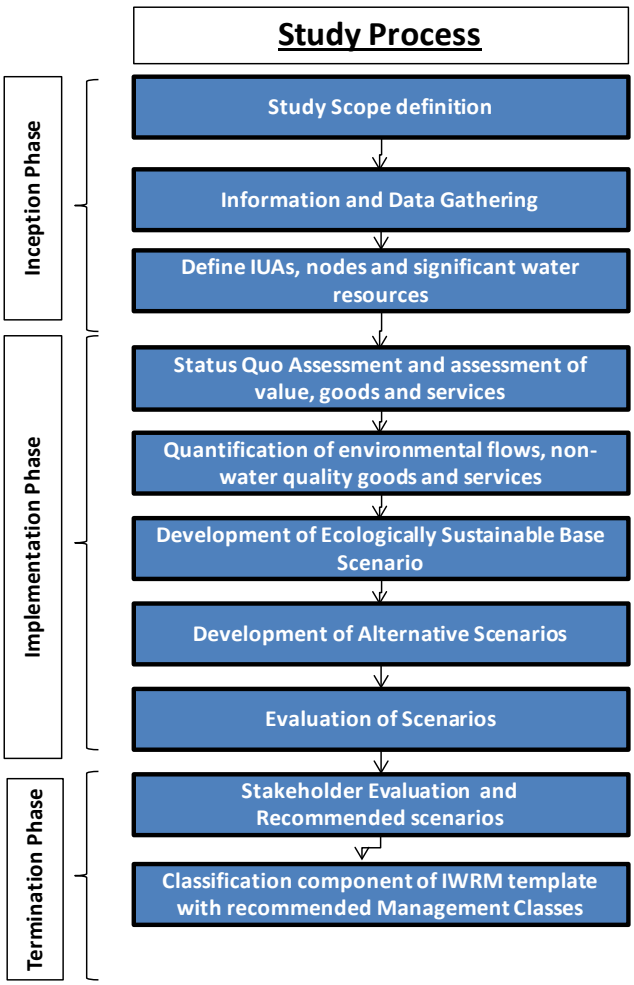

Figure 1: Study process followed for classification of water resources in the Olifants WMA

In terms of the process defined above, the approach undertaken by the study team in terms of the implementation and application is outlined below.

- *13 IUAs, nodes and the significant water resources were defined for the Olifants WMA (Figure 2). This has been based on the socio-economics of the areas, water use and users, envisaged level of protection required and significance of the resource. Availability of representative Ecological Water Requirement (EWR) sites, catchment boundaries and catchment modelling schematics were also considered. A status quo assessment of each IUA was undertaken to understand ecological status, socio-economic conditions, ecosystem services and water resource infrastructure and availability.*

- *An evaluation and decision analysis framework was defined once the status quo of the WMA was understood and the IUAs and network of significant water resources was delineated. An economic model was developed based on this framework to assess the implications of different catchment scenarios at an IUA level on economic prosperity, social wellbeing and ecological condition.*

- *Ecological water requirements (EWR) weere then quantified for the EWR sites and nodes in the system. These have been quantified from previous Reserve studies or through rapid assessments undertaken for the purpose of this classification study. Where little ecological information was available extrapolation using information from the previous studies was done, especially in those smaller tributaries where protection is required. The updated PES and EIS as at 2010 of the water resources was obtained from a recently completed DWA study. During this step the information on the river Freshwater Ecosystem Priority Areas (FEPAs) identified through the National Freshwater Ecosystem Priority Areas Project of the Water Research Commission (WRC, 2011), was assessed to determine if they were adequately protected through the PES categories for the nodes in these catchments. FEPAs have been identified as those areas that are important for sustaining the integrity and continued functioning of their related ecosystems. Forty nine (49) FEPAs are present in the Olifants WMA (Refer to Appendix B for more detail on the incorporation of the FEPAs).*

- *The ecologically sustainable base configuration (ESBC) scenario was then established and tested. The ecological categories used as the base scenario was the PES as determined during previous Reserve studies as well as the 2010 PES at all the EWR sites in the Olifants WMA. The water resources yield model (WRYM) was run based on this EWR and water balance outputs were fed into the economic modelling assessment. Only maintenance low flows and drought flows were included in the yield modelling. Maintenance high flows and floods were excluded as proposed in the Reconciliation strategy.*

- *Once appropriate levels of ecological protection are established for the water resources; the measures required to achieve these protection levels, can then be assessed in terms of the overall implications to the IUAs and the WMA. This forms the scenario evaluation component of the WRCS process. To support the decision making process for the Olifants WMA towards MCs, five additional catchment scenarios were then analysed and assessed as part of the scenario evaluation step (Step 5). These scenarios represent alternate ecological categories and growth scenarios for the Olifants WMA, and have been analysed to determine the water balances,*

socio-economic implications and ecological consequences of each. The outcome of this step was to inform the selection of scenarios for presentation to stakeholders. In the case of the Olifants Classification study, all six scenarios were presented.

- *Based on the scenario evaluation and consultation with the stakeholders, it was recommended that the go forward options are Scenario 4 and 6 which supply the PES ecological categories and meet the future growth in water requirements in the WMA. In Scenario 6 additional treated mine water is released from the Upper Olifants to meet the water requirements of the Middle Olifants. In terms of the definition of Scenario 4 and 6, it is proposed as the outcome of the WRCS process that the PES ecological water requirements must be met at the EWR sites and selected nodes within the IUAs in the Olifants WMA.*

- *The IUA MCs associated with Scenario 4 and 6 are presented in this report. The approach applied to determining the proposed MCs for each of the IUAs was to follow the guidelines of the WRCS (DWA, 2007).*

- *The recommended scenarios and proposed MCs will be submitted to the Minister for consideration. The final proposed MCs together with the established Resource Quality Objectives (RQOs) for the Olifants WMA will be gazetted by November 2013, which includes a 60 day public comment period.*

The above has been conducted in terms of the prescribed steps of the WRCS as outlined in the DWA guidelines (DWA, 2007) as best suited to circumstances and conditions that prevailed.

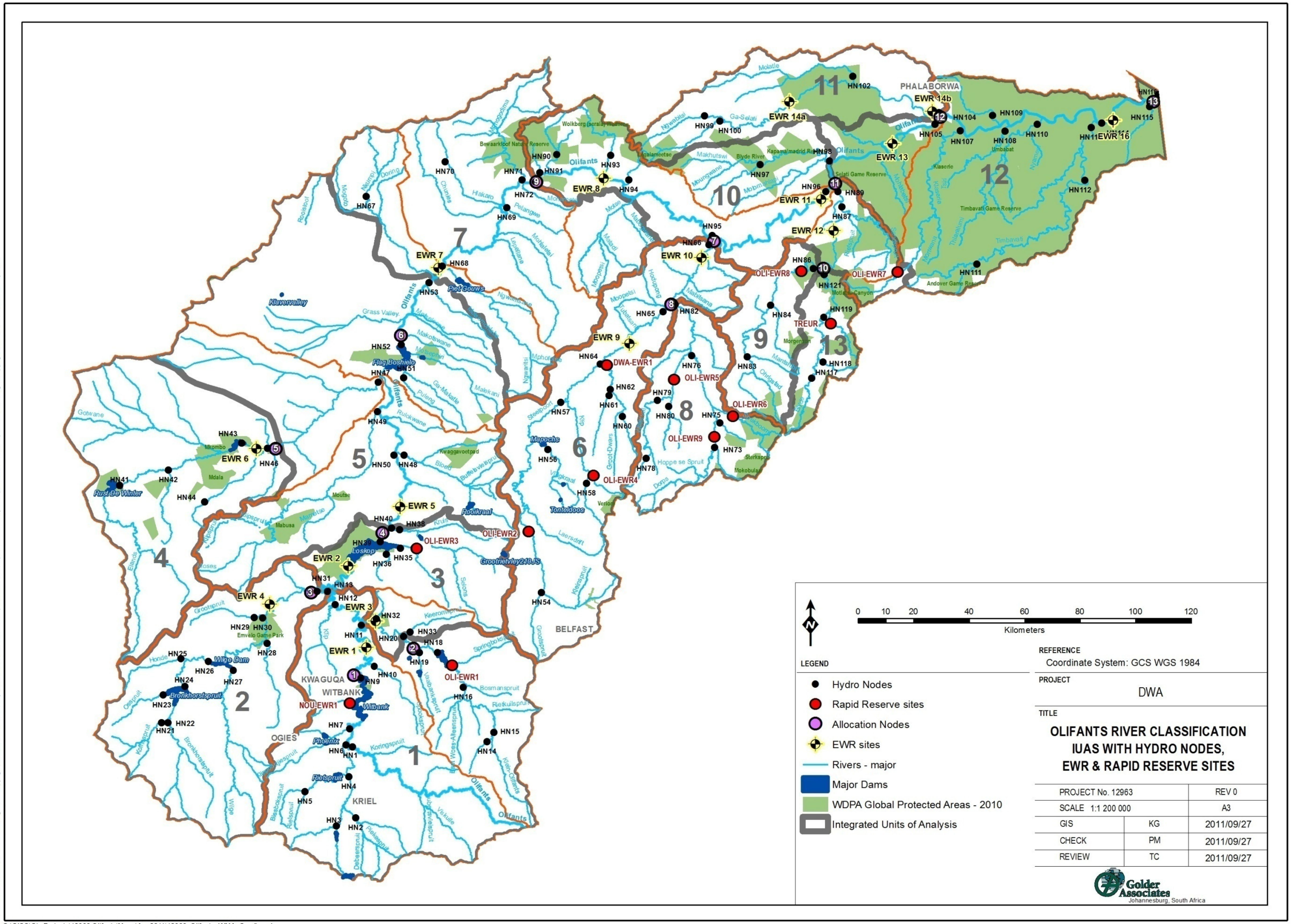

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Figure 2 : Integrated Units of Analysis, hydro nodes and EWR sites within Olifants WMA

1.3 PURPOSE OF THE REPORT

The purpose of this report is to present and describe the rationale for the proposed MCs for the identified IUAs in the Olifants WMA based on the outcomes of the scenario evaluation process and recommendations (DWA, 2012a).

The proposed MCs or class configurations form the final deliverable of the study, the class configuration. The MCs presented in this report will be incorporated into the classification component of the Integrated Water Resource Management (IWRM) template for the Olifants WMA which will be presented to the Minister for consideration.

The NFEPA and PES study as well as stakeholders identified specific river systems within an IUA a being environmentally important and sensitive. These systems require a higher level of protection than the overall MC set for the IUA. Nodes have been established for these river reaches for which RQOs need to be set to afford the required level of protection for these systems.

2 APPROACH TO DETERMINATION OF MANAGEMENT CLASSES IN THE OLIFANTS WMA

The determination of a management class for a water resource represents the first stage in the water resource protection process. The MC essentially describes the desired condition of the resource, along with the degree to which it can be utilised. In terms of the WRCS, the MCs will range from minimally used to heavily used.

Regulation 810 (Government Gazette No. 33541, September 2010) that establishes the WRCS defines three water resource MCs:

- *Class I - minimally used and configuration of ecological categories of that water resource minimally altered from its pre-development condition;*
- *Class II - moderately used and configuration of ecological categories of that water resource moderately altered from its pre-development condition; and*
- *Class III - heavily used and configuration of ecological categories of that water resource significantly altered from its pre-development condition.*

The implementation of the WRCS in the Olifants WMA has to this point presented recommended scenarios specifying an ecological condition per IUA (ecological categories based on the scenario analysis and evaluation). The final step requires the summarising of this data into an IUA Class.

The WRCS guidelines (DWA, 2007) states the following "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."

The WRCS guidelines recommend that the MC be determined based on the ecological categories (ECs) of the biophysical nodes in an IUA. Among other methods, the guidelines recommend the application of Table 1 below, where the percentage of biophysical hydro-nodes falling into the indicated EC groups determines the IUA's MC.

Table 1: Preliminary guidelines for determining the IUA class for a scenario

		Percentage (%) of nodes in the IUA falling into the indicated EC groups				
		> = A/B	>= B	> = C	> = D	< D
Class I		40	60	80	99	-
Class II			40	70	95	-
Class III	Either			30	80	-
	Or				100	-

In order to apply the preliminary guidelines of the WRCS (Table 1) to arrive at a MC, the desired ecological condition of the water resources in the WMA need to be determined within the context of the integrated water resource management dynamics in the WMA. Therefore various configurations of ecological condition, socio-economics, water resource availability and water quality were assessed by the scenario evaluation task of the study (DWA, 2012a). In doing so, Scenario 4 and 6 that specify that PES EC must be implemented for the IUAs in the Olifants WMA have been recommended as an output of the evaluation process. Scenario 4 and 6 which supply the PES ecological categories of the water resources and meet the future growth in water requirements in the Olifants WMA were selected as the recommended scenarios through the study stakeholder engagement processes. In Scenario 6, additional treated mine water is released from the Upper Olifants to meet the water requirements of the Middle Olifants. The details of how the excess mine water will be used in future has still to be decided. There is therefore uncertainity around additional flows in Scenario 6.

This recommendation is based on the following considerations which met the criteria of achievability, affordability, practical to implement and most important, sustainable:

- *The ecological consequences evaluation showed that the Present Ecological State (PES) EC flow requirements at the EWR sites in general are met in the Olifants WMA. However, the flow requirements for some components at EWR sites 4 (Wilge River) and 16 (Olifants in Kruger National Park) could not be met.*
- *Reconciliation options for EWRs incurs implementation costs. However, the reconciliation options also generate revenues in the economy. Most important, they ensure the constant delivery of aquatic ecosystem services. In Scenarios 4 and 6, the ecosystem service benefits increase across the WMA. Where GDP decreases, this is because company profits are reduced (reduction in GDP) to pay for new water infrastructure. The Platinum group mining grows significantly and the rest of the economy grows by 1%.*
- *With Scenario 6, the increase in flows results in an improvement in water quality in the middle reaches of the Olifants River. The higher flows could potentially increase the ecological categories at EWR sites 5 and 7. However this option requires that necessary management measures are put in place to ensure that the water reaches the middle Olifants river.*

The recommended scenarios are associated with an ecological condition (ECs at each node) for the water resources and this is translated into the MC for the IUA.

Based on Table 1, the PES EC representation of the nodes within an IUA (Figure 3) are summarised into a MC for the IUAs within the Olifants WMA. This is presented in Section 3 of the report. The EC and MC that is presented for the OIifants IUAs is associated with the implications summarised above.

To broadly interpret the preliminary guidelines indicated above, the link between ecological categories and the MCs maybe defined as follows:

- *Class I – Mostly B ecological category water resources and higher;*
- *Class II - Mostly C ecological category water resources; and*
- *Class III - Mostly D ecological category water resources.*

The MC categorisation for the Olifants IUAs is based largely on the ecological condition of the main stem Olifants River and major tributaries. Where the EC of a sub-node in a tributary catchment is different to the overall IUA MC (Figure 4), this ecological category is accounted for by the implementation of the required ecological flows at the sub-node. Based on the specific ecological configuration, the management objectives within an IUA may also differ.

This report presents the set of ecological categories (% distribution of biophysical nodes) that define the MC per IUA. A MC for an IUA will guide water resource management and its planning.

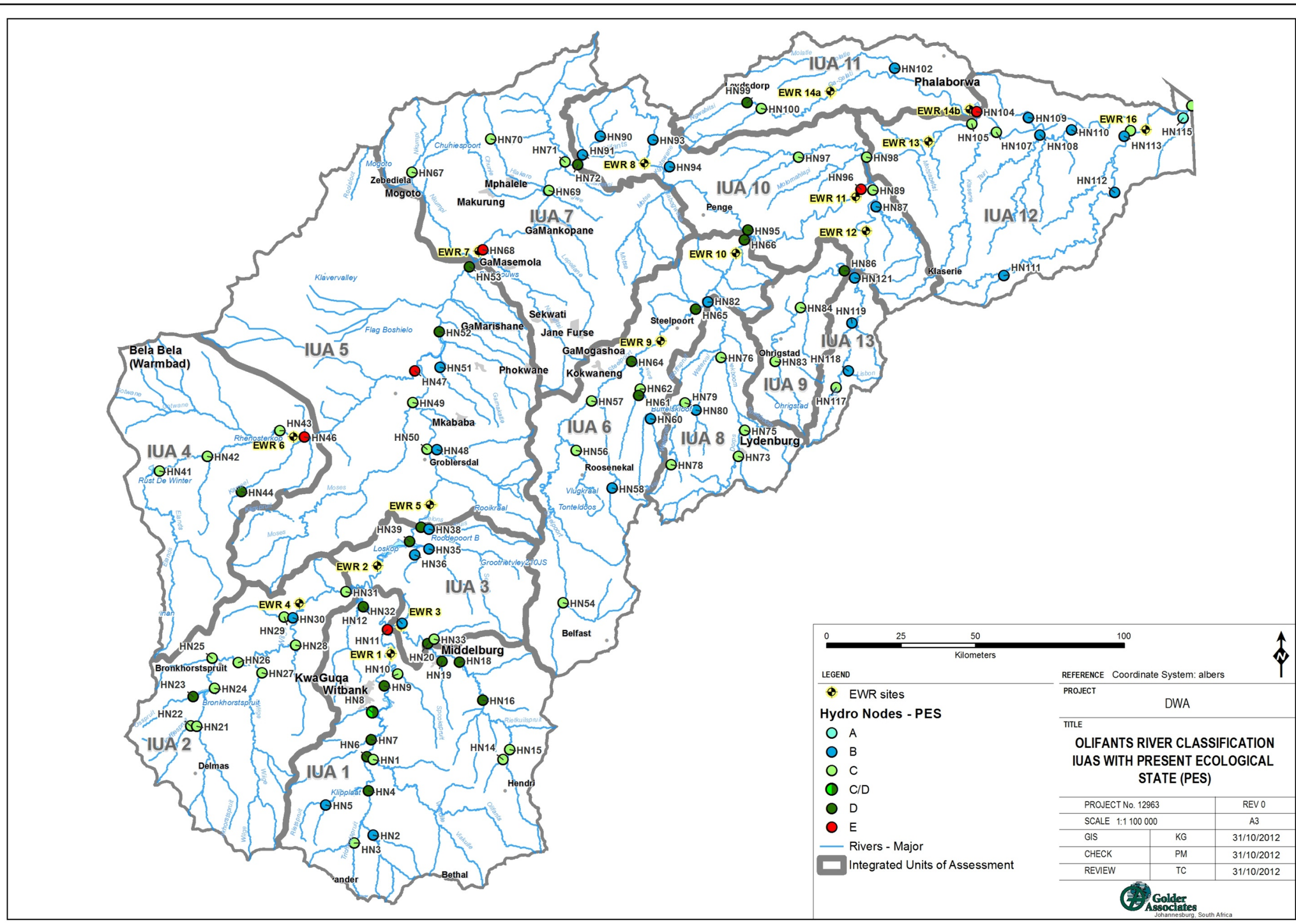

Figure 3: PES ecological category of the selected hydro nodes within the Olifants WMA

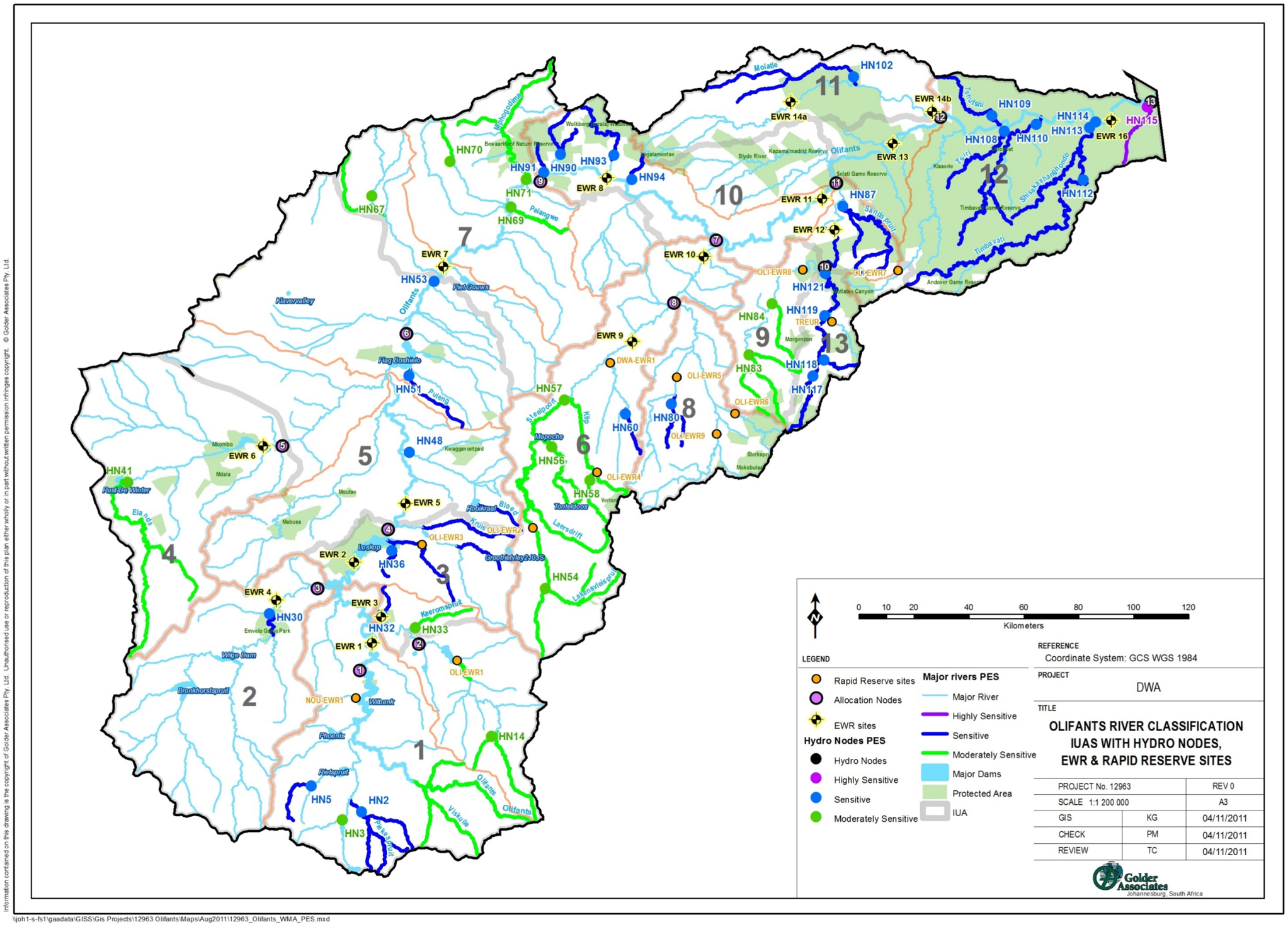

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Figure 4: Hydro-nodes with higher PES than overall IUA ecological category (requiring higher level of protection)

3 MANAGEMENT CLASSES OF THE OLIFANTS WMA

3.1 OVERVIEW

The establishment of MCs for the significant water resources in the Olifants WMA and its implementation in the near future will set the framework for the level of water resource protection, and conversely, the degree to which the water resources can be utilised. The MCs will form the basis for management strategy development and direct water resource management and its planning. By the establishment of MCs for the water resources in the Olifants WMA as per the scenario configurations, the following objectives are achieved:

- *Implementation of a certain protection level of water requirements for the ecology (river health) (maintenance or improvement of present status);*
- *Protection of identified tributaries and conservation areas;*
- *Maintenance of the main stem Olifants River (and larger tributaries) in a sustainable condition, while supporting the developmental needs of the WMA; and*
- *Provision of water requirements for future socio-economic growth.*

In all three MCs, aquatic ecosystem conditions (or resource quality objectives) need to be set to ensure that the MC is maintained into the future. These conditions depend on water flow characteristics, water quality characteristics and terrestrial conditions. Generally speaking, MC III IUAs are characterised by heavy water use and maximum utilisation of the allocatable water quality, whereas Class I IUAs are characterised by very low water use and minimum utilisation of the allocatable water quality. During the WRCS process, several scenarios were developed which envisaged different permutations of MCs for the IUAs. Some of the scenarios envisaged heavier use characteristics (i.e. more Class III IUAs) and others envisage lesser use characteristics (i.e. more Class II IUAs).

Based on the Olifants scenario evaluation process, the MC permutations for each IUA that are being recommended is Scenario 4 and 6 which supply the PES ecological categories and meet the future growth in water requirements in the WMA. It is proposed as the outcome of the WRCS process that the PES ecological water requirements (maintenance low and drought flows only) must be met at the EWR sites and selected nodes within the IUAs in the Olifants WMA. Please refer to other deliverables of the Olifants WRC study for detailed information on the scenario evaluation process (DWA, 2012).

Some of the IUAs in the Olifants WMA are currently in a state that is worse than a Class III, and this is not ecologically sustainable and therefore unacceptable and need to be corrected.

3.2 INTEGRATED UNITS OF ANALYSIS

Thirteen IUAs have been defined for the Olifants WMA (refer to Figure 2). The process followed in terms of IUA delineation is described in the WRCS Guidelines, Volumes 1 and 2 (Overview and the 7-step classification procedure; and Ecological, hydrological and water quality guidelines for the 7-step classification procedure) (DWA, February 2007b).

The IUAs delineated are indicated in Table 2 below.

Table 2: Catchment areas of the thirteen IUAs defined for the Olifants WMA

IUA	Delineation	Quaternary Catchment
1	*Upper Olifants River catchment*	*B11A, B11B, B11C, B11D, B11E, B11F, B11G, B11H, B11J, B11K, B11L, B12A, B12B, B12C, B12D*
2	*Wilge River catchment area*	*B20A, B20B, B20C, B20D, B20E, B20F, B20G, B20H, B20J*
3	*Selons River area including Loskop Dam*	*B12E, B32A, B32B, B32C*
4	*Elands River catchment area*	*B31A, B31B, B31C, B31D, B31E, B31F, B31G*
5	*Middle Olifants up to Flag Boshielo Dam*	*B32D, B31H, B31J, B32E, B32F, B32G, B32H, B32J, B51A, B51B, B51C, B51D, B51E*
6	*Steelpoort River catchment*	*B41A, B41B, B41C, B41D, B41E, B41F B41G, B41H, B41J, B41K*
7	*Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River*	*B51F, B51G, B51H, B52A, B52B, B52C, B52D, B52E, B52F, B52G, B52H, B52J*
8	*Spekboom catchment*	*B42A, B42B, B42C, B42D, B42E, B42F B42G, B42H*
9	*Ohrigstad River catchment area*	*B60E, B60F, B60G,B60H*
10	*Lower Olifants*	*B60J, B71A, B71B, B71C, B71D, B71E, B71F, B71G, B71H, B71J, B72A, B72B, B72C*
11	*Ga-Selati River area*	*B72E, B72F,B72G, B72H, B72J, B72K*
12	*Lower Olifants within Kruger National Park*	*B72D, B73A, B73B, B73C, B73D, B73E B73F, B73G, B73H, B73J*
13	*Blyde River catchment area*	*B60A,B60B, B60C, B60D*

3.3 ECONOMIC DEVELOPMENT AND WATER USE

The development of the Olifants WMA economy is to a large extent, dependent upon the agricultural and mining sectors. South Africa's National Development Plan identifies South Africa's mineral wealth as a key driver of economic development and also identifies the agriculture sector as the key sector for developing an inclusive rural economy. Both these sectors, and their respective value chains, are dependent on water as an input into production. More than 50% of the GDP produced in the Olifants WMA are dependent upon water use licences (DWA 2012b).

3.4 TOURISM ECONOMY

The Olifants WMA contains important natural heritage, especially in its lower reaches. These areas are water-dependent and play an important role in the tourism economy of the region. Some of these areas are closely associated with cultural heritage. Key areas include:

- *The Kruger National Park (KNP) and adjoining protected areas (Klaserie, Timbavati, Olifants Conservancy, Umbaba)*
- *The Wolkberg Wilderness Area on the northern rim of the Olifants catchment;*
- *The Legalametse Nature Reserve south east of the Wolkberg; and*

- *The Loskop Dam Nature Reserve.*

Dullstroom, Lydenburg and parts of the Steelpoort River and Burgersfort in the north is another important tourism area, with natural beauty and as well as being a premier fly-fishing destination.

The Kruger to Canyons Biosphere Reserve is an internationally recognised development initiative that complies with and is accredited to UNESCO's Man and the Biosphere programme. In such areas the widely accepted principle of planning around a core-protected area, surrounded by areas where varying forms of conservation/utilisation take place, are applied. Also in the Olifants WMA is an area that abuts onto the western boundary of the KNP. It lies between Acornhoek and Phalaborwa and is the largest area of privately owned conservation land in the world. The inclusion of the Timbavati, Balule, Klaserie, Umbabat and other private nature and game reserves has effectively added in excess of 250,000 ha (more than 10%) to the conservation area of the KNP (DWA 2012,b).

The economic benefits of the tourism industry are measured in a number of economic sectors, including the accommodation, transport and trade sectors.

3.5 WATER USE IN THE OLIFANTS WMA

The DWA Olifants Reconciliation Strategy Report (DWA, 2011a) describes the water use in the Olifants WMA (Table 3).

Diverse economic activities drive increasing demand for water in the Olifants WMA. These activities include power generation, mining, urban development, improved service delivery to rural communities, and irrigation. The Olifants WMA supplies water to Polokwane (Limpopo WMA) for urban consumption and will likely in future also supply Mokopane (Limpopo WMA) from the Flag Boshielo Dam, for PGM mining consumption.

The water balance for the Olifants River catchment as a whole indicates a small surplus in 2010, but a deficit from 2016. The future demand for water by mining and rural communities precipitated the De Hoop Dam development, due for commissioning in 2012. However, the DWA Olifants Reconciliation Strategy Report finds that even the additional yield provided by the De Hoop Dam and the raised Flag Boshielo Dam, will not be sufficient to supply the future water requirements.

Table 3: Summary of water requirements (units: million m^3/year) (DWA 2011)

Sub-area	Irrigation	Urban	Rural	Industrial	Mining	Power Generation	Total
Upper	*249*	*93*	*4*	*9*	*26*	*228*	*609*
Middle	*81*	*56*	*22*	*0*	*28*	*0*	*187*
Lower	*156*	*29*	*3*	*0*	*32*	*0*	*220*
Total	**486**	**178**	**29**	**9**	**86**	**228**	**1016**

The DWA Olifants Reconciliation Strategy Report (2011) summarises future water use for 2016 and 2035. Future demand for irrigation, power generation and heavy industrial use are expected to remain stable. Urban and Rural water requirements are expected to grow with population growth

and improved service level. The largest increase in water requirements is expected within the mining sector, and especially the PGM mining sector.

The DWA Olifants Reconciliation Strategy Report proposes a range of water demand management and water supply augmentation measures for meeting the water requirements.

3.6 ECOSYSTEM SERVICES

Ecosystem services collectively refer to environmental goods and services. Ecosystem services are the benefits provided to both households and firms by ecosystems. These services include provisioning services (including the production of fresh water, foods, fuels, fibres and biochemical and pharmaceutical products), cultural services (including non-consumptive uses of the ecosystem for recreation, amenity, spiritual renewal, aesthetic value and education) and regulating services (including the absorption of pollutants, storm buffering, erosion control and the like). The estimation of the value of aquatic ecosystem services is done through environmental and resource economics (ERE) studies which seek to value the stream of benefits delivered by the set of ecosystem services associated with an ecosystem. An estimation of the value of ecosystem services produced by the water resources of the Olifants WMA was undertaken through the Classification study (DWA, 2012b).

The water resources (rivers and wetlands) in the Olifants WMA provide a variety of provisioning, regulating and cultural ecosystem services viz. domestic water use, grazing, livestock watering, harvested products, carbon sequestration, tourism, recreation, aesthetic value, education, flood attenuation and angling (DWA, 2012b).

The results of the scenario evaluation process indicated that all scenarios result in an increase in ecosystem service value due to an increase in flow and improved water quality through the implementation of the EWR. Thus the proposed MCs will increase the value of ecosystem services across the IUAs of the Olifants WMA.

3.7 MANAGEMENT CLASS IUA 1: UPPER OLIFANTS

IUA Description

This IUA principally includes the local economy of eMalahleni (Witbank) and includes the towns of Middelburg, Hendrina, Douglas, Kriel and Kinross. The southern border of the IUA is located just north of Evander, Secunda and Bethal. The IUA includes the upper Olifants River and the Klein Olifants, Witbank Dam, Middelburg Dam and the Klipspruit. The IUA is characterized by intensive coal mining and an associated energy and manufacturing economy. The IUA is highly used and impacted. The population of IUA 1 is approximately 369 808 (Census 2001) with approximately 104 648 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 4. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 4: IUA1 Upper Olifants: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC [1)]	Natural *MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN1	*B11A, B11B*	*Olifants (confluence with Steenkoolspruit)*	*High*	*High*	*C*		*B*	*61.3*	*10.25*	
HN2	*B11C*	*Piekespruit (confluence with Steenkoolspruit)*	*High*	*High*	*B*		*B*	*-*	*-*	
HN3	*B11D*	*Dwars-indieWegspruit (confluence with Trichardtspruit)*	*Moderate*	*High*	*C*		*B*	*-*	*-*	
HN4	*B11D*	*Steenkoolspruit (outlet of quaternary)*	*Moderate*	*High*	*D*		*B*	*44.6*	*4.70*	
HN5	*B11E*	*Blesbokspruit (confluence with Rietspruit)*	*High*	*High*	*B*		*B*	*-*	*-*	
HN6	*B11E*	*Steenkoolspruit (confluence with Olifants)*	*Moderate*	*High*	*D*		*B*	*65.4*	*4.70*	
HN7	*B11F*	*Olifants (outlet of quaternary)*	*Moderate*	*High*	*D*		*B*	*147.9*	*4.70*	
HN8	*B11G*	*Noupoortspruit (EWR site – NOU-EWR1) (existing)*	*Moderate*	*Moderate*	*C/D*	*C/D*		*4.28*	*13.90*	
HN9	*B11G*	*Olifants (releases from Witbank Dam)*	*Moderate*	*High*	*D*		*B*	*164.0*	*4.70*	
HN10	*B11H*	*Spookspruit (confluence with Olifants)*	*High*	*High*	*C*		*B*	*11.4*	*10.25*	**III**
HN11	*B11J*	*Olifants (EWR site 1 – EWR1) (existing)*	*Moderate*	*Moderate*	*(E) D*	*D*		*184.5*	*4.70*	
HN12	*B11K, B11L*	*Klipspruit (confluence with Olifants)*	*High*	*Moderate*	*(E) D*		*B*	*45.7*	*4.67*	
HN14	*B12A*	*Boschmansfontein (confluence with Klein Olifants)*	*Moderate*	*High*	*C*		*B*	*-*	*-*	
HN15	*B12A*	*Klein Olifants (outlet of quaternary)*	*High*	*High*	*C*		*B*	*12.7*	*18.85*	
HN16	*B12B*	*Klein Olifants (outlet of quaternary)*	*Moderate*	*High*	*D*		*B*	*16.9*	*8.11*	
HN17	*B12C*	*Klein Olifants (EWR site – OLI-EWR1) (Rapid site)*	*Low*	*Low*	*C*	*C*		*44.5*	*18.85*	
HN18	*B12C*	*Klein Olifants (releases from Middelburg Dam)*	*Moderate*	*High*	*D*		*B*	*53.5*	*5.52*	
HN19	*B12D*	*Vaalbankspruit (confluence with Klein Olifants)*	*Moderate*	*High*	*D*		*B*	*-*	*-*	
HN20	*B12D*	*Klein Olifants (outlet of quaternary)*	*Moderate*	*High*	*D*		*B*	*67.3*	*5.52*	

***MAR: Mean Annual Run-off**

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The ecological condition of the Olifants, Steenkoolspruit and Upper Klein Olifants rivers are degraded in places. These river reaches are in an E category presently due to the coal mining activities, large dams, urbanisation and deterioration in water quality status. The PES EC is reflected as a D category in Table 4 above as an E category is considered unsustainable and cannot be recommended as an ecological condition. The ecological importance of these areas is low except around the Witbank Dam area. This area still has some local, undeveloped areas. A number of wetlands are present in the upper reaches of the catchment.

One Comprehensive EWR site is present on the Olifants River downstream of Witbank Dam (EWR1, B11J); and two Rapid III sites located on Noupoortspruit (B11G) and Upper Klein Olifants (B12C). There are 19 nodes in the IUA, with majority being in a C and D ecological category. Two

nodes are in the B category. The REC of EWR site 1 is a D category and PES EC is an E. As this is considered undesirable, the PES is taken as a D EC. The Noupoortspruit Rapid site is in a C/D category and the Upper Klein Olifants is in a C category. Improvement is required at EWR site 1, and this is not flow related. The impacts are primarily water quality related and require an integrated management strategy to deal with the upstream wastewater discharges and the mine water impacts. The influence of the tributaries causes significant water quality deterioration at EWR site 1. However regular routine in-stream water quality monitoring of the Upper Olifants River is required to monitor and better understand the situation. In terms of the recommended scenario the PES EC and REC is a D.

Economy

The area includes a large number of coal mines, steel industry, power generation, urban areas and return flows. Coal mining is the predominate sector in this IUA. Much of the IUA falls within the Witbank Coalfield, where most of South Africa's coal is mined. Within the IUA, there are five major coal companies (BHP Billiton, Anglo Coal, Xstrata, Exxaro and Optimum Coal) that produce the bulk of coal in South Africa (DWA, 2011a). In addition there are a host of other smaller coal companies that produce coal in the IUA. The above-mentioned companies produced approximately 143,9 Mt of coal in 2010, which was approximately 57% of the total coal produced in SA for 2010.

IUA 1 is also home to a large number of thermal power plants, which provide a large proportion of SA's energy requirements. The eight thermal power plants (the 8th, Kusile, is still under construction) will produce approximately 70% of South Africa's coal-fired electricity.

Secondary economic activities include dryland agriculture and a wide variety of industrial and commercial sectors. Maize (107 106 ha) is the most common crop planted in IUA 1, followed by pasture (65 529 ha) (DWA, 2011a).

Conclusions and Proposed MC

The recommended scenario maintains the PES ecological category at all nodes, except at those sites where the ecologically condition is an E EC. At these sites where improvement is required such as EWR site 1, the PES is increased to the D EC, and will be managed to this ecological condition. A MC III is recommended for IUA 1 (Table 5).

The ecological consequences assessment indicated that there might be too much flow in the system at EWR 1 for Scenario 6. Should this scenario be implemented in future, the flow in the Olifants River will have to be managed adequately to ensure that the ecosystem health is maintained.

Table 5: IUA Class for the Upper Olifants (IUA 1) based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	Management Class
% representation	*11*	*37*	*53*	*III*

3.8 MANAGEMENT CLASS IUA 2: WILGE RIVER CATCHMENT AREA

IUA Description

The Wilge River catchment principally includes the towns of Bronkhorstspruit and Delmas as well as the Ezemvelo Game Reserve to the north. The town of Ogies is located on the border of the Wilge River IUA and the Upper Olifants IUA (IUA 1). The town of Cullinan is located on the border of the IUA 2 and IUA 4. The IUA includes the Wilge River and tributaries. The economy of IUA 2 is dominated by mixed coal mining and dryland agricultural activities, supported by local economies around the key towns. The population of IUA 2 is approximately 146 647 (Census 2001) and has approximately 38 227 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 6. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 6: IUA 2 Wilge River Catchment: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN21	*B20A*	*Bronkhorstspruit (outlet of quaternary)*	*Moderate*	*High*	*C*		*B*	*27.7*	*13.38*	**II**
HN22	*B20B*	*Koffiespruit (confluence with Bronkhorstspruit)*	*Moderate*	*High*	*C*		*B*	*15.5*	*13.38*	
HN23	*B20C*	*Osspruit (inflow to Bronkhorstspruit Dam)*	*Moderate*	*High*	*D*		*B*	*-*	*-*	
HN24	*B20C*	*Bronkhorstpruit (outlet from Bronkhorstspruit Dam)*	*High*	*High*	*C*		*B*	*56.4*	*13.44*	
HN25	*B20D*	*Hondespruit (confluence with Bronkhorstspruit)*	*High*	*High*	*C*		*B*	*11.9*	*13.39*	
HN26	*B20D*	*Bronkhorstpruit (confluence with Wilge)*	*High*	*Very high*	*C*		*A*	*79.9*	*13.45*	
HN27	*B20E, B20F*	*Wilge (confluence with Bronkhorstspruit*	*High*	*Very high*	*C*		*A*	*45.8*	*13.42*	
HN28	*B20G*	*Saalboomspruit (confluence with Wilge)*	*Moderate*	*High*	*C*		**B**	*22.1*	*13.40*	
HN29	*B20H*	*Grootspruit (confluence with Wilge)*	*High*	*Very high*	*C*		*A*	*12.8*	*13.40*	
HN30	*B20H*	*Wilge (outlet of quaternary)*	*High*	*Very high*	*B*		*A*	*158.2*	*17.92*	
HN31	*B20J*	*Wilge (EWR site – EWR4, outlet of IUA2) (existing)*	*High*	*High*	*C*	**B**		*175.5*	*12.16*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The Bronkhorstspruit, Saalboomspruit and Upper Wilge rivers are in a moderately modified state (category C) with less developed areas present in the catchment. Impacts within the catchment are related to urban areas, agriculture, dams and some mining. The importance of the resources is moderate especially in terms of good water quality they contribute to the main stem Olifants River above Loskop Dam. A comprehensive EWR site (EWR site 4) is situated on the lower Wilge, just

below Emvelo Game Park. The REC of EWR site 4 is a B category and PES EC is a C. There are 11 nodes in the IUA, with majority being in a C ecological category.

Economy

The manufacturing sector supplied the largest number of jobs in IUA 2. The mining and quarrying sector is also an important sector in terms of employment. There are two significant thermal power plants found in IUA 2, one of which is the proposed Kusile Power Station and the other is Kendal Power Station which is located at the catchment divide between IUA 1 and 2. The new power station will have an installed capacity of 4 800 MW, making it one of the largest thermal power stations in the world. Agricultural activities in the IUA consist of dryland, irrigated and subsistence farming with maize being the most common crop grown followed by pasture (DWA, 2012b).

Conclusions and Proposed MC

The recommended scenario maintains the PES ecological category at all nodes within the IUA. A MC II is recommended for IUA 1 (Table 7).

The EWR as determined in 2001 and later adjusted with new hydrology from the Reconciliation Strategy (DWA, 2011a) was found not to be adequate to provide the flow necessary at EWR 4 to maintain the fish and macroinvertebrates in the REC of B. SPATSIM was used to determine the flows required for PES of a C. The results showed that 32% (total EWR) of the natural MAR is required for the EWR in the Wilge River for a C category. The consequences of this on water availability in the Wilge River catchment needs to be further assessed.

Additional considerations to be noted:

- *Central sandy bushveld and Loskop mountain bushveld (vulnerable) vegetation types with a few FEPA wetlands are present in the catchment. The main threats to the water resources are urban and mining developments.*
- *Terrestrial biodiversity consists of protected area (1), irreplaceable (2), highly significant (3), least concerned (5) and no natural habitat remained (6) with the aquatic biodiversity being protected (1) and ecosystem maintenance (5).*
- *Water quality from the Saalklapspruit should be addressed.*

Table 7: IUA Class for the Wilge River catchment (IUA 2) based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	Management Class
% representation	*9*	*82*	*9*	*II*

3.9 MANAGEMENT CLASS IUA 3: SELONS RIVER CATCHMENT INCLUDING LOSKOP DAM

IUA Description

IUA 3 includes the Loskop Dam and its surrounding protected area. The IUA starts below the confluence of the Olifants and the Wilge Rivers and also includes the Selons River and Kruis rivers. The IUA includes a section of the lower Klein Olifants between Mhluzi and the Doornkop protected area. The IUA has a largely natural and rural character and the agriculture sector is an important source of employment. The population of IUA 3 is approximately 42 682 (Census 2001). The IUA has approximately 11 347 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 8. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 8: IUA 3 Selons River Catchment: Summary of Eco-classification and EWR

Node	Quart-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN32	*B12E*	*Doringboomspruit (confluence with Klein Olifants)*	*High*	*High*	*B*		*B*	*-*	*-*	**II**
HN33	*B12E*	*Keeromspruit (confluence with Klein Olifants)*	*High*	*Very High*	*C*		*A*	*-*	*-*	
HN34	*B12E*	*Klein Olifants (EWR site – EWR3) (existing)*	*Moderate*	*Moderate*	*C*	*C*		*81.5*	*12.72*	
HN35	*B32A*	*Kranspoortspruit (EWR site – OLI-EWR3) (Rapid site)*	*Very high*	*Very high*	*B*	*A/B*		*4.7*	*24.42*	
HN36	*B32A*	*Boekenhoutloop (inflow to Loskop Dam)*	*High*	*High*	*B*		*B*	*-*	*-*	
HN37	*B32A*	*Olifants (EWR site – EWR2) (existing)*	*High*	*High*	*C*	*B*		*500.6*	*12.53*	
HN38	*B32B, B32C*	*One node at confluence of Selons with Olifants in B32C. Included: Klipspruit (confluence with Selons) Kruis (confluence with Selons) Selons (confluence with Olifants)*	*High*	*High*	*B*		*B*	*-*	*-*	
HN39	*B32C*	*Olifants (releases from Loskop Dam)*	*High*	*High*	*D*		*B*	*568.6*	*7.22*	
HN40	*B32C*	*Olifants (outlet of quaternary – outlet of IUA3)*	*High*	*High*	*D*	*B*		*576.8*	*7.22*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The state of the water resources in the IUA have been degraded (B to C category), mainly due to the upstream impacts from the Olifants and Klein Olifants rivers. The PES EC of the main stem of the Olifants River is a C with the REC of a B due to upstream flow regulation and water quality. However, the presence of un-proclaimed wilderness areas and nature reserves provides habitats for the various biota in the system that give this area a high ecological importance. The IUA includes two Comprehensive EWR sites, EWR 3 on Klein Olifants River (B12E) and EWR 2 on the Olifants River upstream Loskop Dam (B32A). A Rapid III site is also present on Kranspoortspruit

(B32A). The IUA includes 9 nodes with majority being in the B and C EC.

Economy

The private households sector supplied the largest number of jobs in IUA 3. The wholesale and retail trade; repairs, hotels and restaurants sector is also an important sector in terms of employment in IUA 3. The area includes dryland, irrigated and subsistence agriculture with maize (14 678 ha) being the most common crop grown in IUA 3 followed by pasture (DWA, 2011b).

Conclusions and Proposed MC

The recommended scenario maintains the PES ecological category at all nodes within the IUA. A MC II is recommended for IUA 3 (Table 9). The following should be noted:

- *The simulation showed that the EWR flow at OLI –EWR3 Kranspoortspruit cannot be met during September and June for the PES EC.*
- *Vulnerable Rand high veld grassland vegetation types and FEPA wetlands are present in the system. Urban expansion, coal mining and water abstraction are serious threats to the Klein Olifants River. Mining activities in the upper catchment of the Kranspoortspruit is a serious threat to the rare and unique BLIN (Barbus lineomaculatus) and BBIF (Barbus bifrenatus) fish populations. The Kranspoortspruit is a conservation/protection area for BBIF as this is the only population occurring in Mpumalanga.*
- *Terrestrial biodiversity includes irreplaceable, very sensitive (2), highly significant (3) and important and necessary (4) areas with irreplaceable (2), highly significant (3), important and necessary (4) aquatic biodiversity.*
- *Upstream water quality needs to be addressed.*

Table 9: IUA Class for the Selons River catchment including Loskop Dam (IUA 3) based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	Management Class
% representation	*44*	*33*	*22*	*II*

3.10 MANAGEMENT CLASS IUA 4: ELANDS RIVER CATCHMENT

IUA Description

IUA 4 includes the town of Cullinan in the South, Kwamahlanga, the Rust De Winter Dam, and the rural settlements (Siyabuswa) around the Mkhombo Dam. Bela Bela (Warmbaths) falls outside of the IUA on the western boundary. The IUA includes the Elands, Kameel and Mkhombo Rivers. The IUA includes the Dinokeng protected area and Mdala Nature Reserve.

The Elands River is mainly rural in the upper reaches with impacts from agriculture, dams and settlements in the lower reaches of the catchment.

The population of IUA 4 is approximately 164 250 (Census 2001) and has approximately 38 772 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 10. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 10: IUA 4 Elands River Catchment: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC [1)]	Natural MAR (mcm/ a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN41	*B31A, B, C*	*One node at outlet of B31C, releases from Rust de Winter Dam. Included:B31A (Elands B31B (Hartbeesspruit) B31C (Elands)*	*High*	*Very High*	*C*		*A*	*33.5*	*12.34*	**III**
HN42	*B31D*	*Enkeldoringspruit (confluence with Elands)*	*High*	*High*	*C*		*B*	*-*	*-*	
HN43	*B31F*	*Elands (releases from Mkumbe Dam)*	*High*	*High*	*C*		*B*	*59.8*	*12.34*	
HN44	*B31G*	*Kameel (upper part only*	*Moderate*	*High*	*D*		*B*	*-*	*-*	
HN45	*B31G*	*Elands (EWR site – EWR6) (existing)*	*Moderate*	*Moderate*	*D*	*D*		*60.3*	*6.32*	
HN46	*B31G*	*Elands (outlet of quaternary – outlet of IUA4)*	*Low*	*Moderate*	*E*		*D*	*69.6*	*6.32 (D)*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The IUA is mainly rural in the upper reaches of the catchment with impacts from agriculture, dams, towns and informal settlements in the lower reaches of the catchment. The upper reaches of the Elands River are still in a very good ecological state (C category), but degrades along the river to a D category below the dams. The river is a moderately important system as it provides good habitats for the biota present. Some conservation areas are present in this IUA. The IUA includes a Comprehensive EWR site, EWR 6, Elands River below Mkhombo Dam (B31G), and 6 nodes. The nodes fall primarily into the C and D EC.

Economy

The economy has a rural characteristic with a large number of smallholdings upon which a variety of economic activities take place (agriculture, grazing, light manufacturing, associated commercial activities and some tourism).

The community, social and personal services sector supplied the largest number of jobs in IUA 4. The private households sector is also an important sector in terms of employment in the IUA. Dryland, irrigated and subsistence agriculture is practiced with vegetables being the most common crop grown followed by maize.

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at all nodes, except at those sites where the ecologically condition is an E EC. At these sites the PES will be managed to a D ecological category. A MC of III is recommended for IUA 4 (Table 11).The simulations showed that the EWR flow at EWR6 on the Elands River cannot be met during June (low flow months) for the PES EC.

Table 11: IUA Class for the Elands River catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	C	D	E	Management Class
% representation	*50*	*33*	*17*	*III*

3.11 MANAGEMENT CLASS IUA 5: MIDDLE OLIFANTS UP TO FLAG BOSHIELO DAM

IUA Description

IUA 5, the Middle Olifants up to Flag Boshielo area includes the towns of Marble Hall, Groblersdal and Roedtan. The IUA contains the Flag Boshielo Dam, the Bloed, Klipspruit and Grass Valley Rivers. Several protected areas occur within the IUA and include Mbusa, Moutse, Kwaggavoetpad and Schuinsdraai Nature Reserves. The population of IUA 5 is approximately is 366 051 (Census 2001) and has approximately 81 474 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 12. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 12: IUA 5 Middle Olifants up to Flag Boshielo Dam: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN47	*B31H, B31J*	*Elands (outlet of quaternary, confluence with Olifants)*	*Low*	*Moderate*	*E*		*D*	*84.1*	*6.32 (D)*	**III**
HN48	*B32E, B32F*	*One node at confluence with Olifants in B32F Included: B32E (Bloed), B32F (Doringpoortloop, Diepkloof and Bloed)*	*Moderate*	*High*	*B*		*B*	*17.2*	*13.90*	
HN49	*B32G, H*	*One node at outlet of B32H, confluence with Olifants Included: B32G (Moses) B32H (Mametse and Moses)*	*High*	*High*	*C*		*B*	*35.4*	*9.93*	
HN50	*B32D*	*Olifants (EWR site – EWR5) (existing)*	*Moderate*	*Moderate*	*C*	*C*		*570.9*	*9.96*	
HN51	*B51B*	*Puleng (upper part only)*	*High*	*High*	*B*		*B*	*-*	*-*	

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN52	*B51B*	*Olifants (releases from Flag Boshielo Dam)*	*Moderate*	*High*	*D*		*B*	*723.4*	*3.91*	
HN53	*B51D, B51E*	*Olifants (outlet of quaternary– outlet of IUA5)*	*Moderate*	*High*	*D*		*B*	*726.6*	*3.81*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The water resources are mainly in a C to D category as the upstream impacts (mainly water quality related) are somewhat mitigated by Loskop Dam. The ecological importance of the rivers in the IUA is moderate with a few conservation areas present. Large areas of this IUA are almost endoreic and groundwater is the major source of water in these catchments. The IUA includes one Comprehensive EWR site, EWR 5 on Olifants River below Loskop Dam (B32D) and 6 nodes. The EWR site has a PES EC and REC of a C.

While the ecological condition at EWR site 5 is good, the health of the river downstream requires improvement. This is due to both flow and non-flow related impacts. The impacts are primarily water quality related (sedimentation problems and land based activities).

Economy

The economy of the IUA is characterised by some intensive irrigation agriculture (specifically around Marble Hall and Groblersdal), commercial dryland agriculture (in the Springbok Flats region), some subsistence agriculture and some platinum mining. The community, social and personal services sector supplied the largest number of jobs in IUA 5. The private households sector is also an important sector in terms of employment (DWA, 2011b). Pasture is the most common crop type in IUA 5 followed by maize. The IUA is highly reliant on the agricultural sector and several farms in the IUA grow high value crops such as citrus and grapes.

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at all nodes, except at those sites where the ecologically condition is an E EC. At these sites the PES will be managed to a D ecological category. A MC of III is recommended for IUA 5 (Table 13).The flow scenario assessment indicated that the EWR flows can be met in the system.

In terms of Scenario 6, the additional treated mine water released to the river system to supply the water requirements in the Middle Olifants, flows through EWR site 5. The ecological consequence assessment indicates that this does have a positive impact on the system ecology through the Middle Olifants River.

Points to note:

- *Loskop thornveld, Loskop mountain bushveld (vulnerable) and central sandy bushveld (vulnerable) vegetation types are present in the catchment. No FEPA wetlands are listed in the area. The main threats are urban and mining developments and irrigation return flows.*

- *Irreplaceable (2), highly significant (3), important and necessary (4) terrestrial biodiversity are present at the EWR site with highly significant (3) and ecosystem maintenance (5) aquatic biodiversity downstream.*

- *The impacts of irrigation on water quality need to be considered.*

Table 13: IUA Class for the Middle Olifants up to Flag Boshielo Dam based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	E	Management Class
% representation	*29*	*29*	*29*	*14*	*III*

3.12 MANAGEMENT CLASS IUA 6: STEELPOORT RIVER CATCHMENT

IUA Description

IUA 6 follows the Steelpoort River valley, starting from the Grootspruit River in the south; up to its confluence in the north with the Olifants River mainstem. It includes the towns of Belfast in the south, Steelpoort in the north and Stoffberg. The IUA includes a section of the Verloren Vallei Nature Reserve near Dullstroom. The population of IUA 6 is approximately 37 958 and has approximately 8 489 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage natural MAR) is indicated in Table 14. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 14: IUA 6 Steelpoort River Catchment: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN54	*B41A*	*One node at outlet of B41A. Included: Grootspruit (outlet of quaternary) Langspruit, including Lakenvleispruit and Kleinspruit*	*High*	*High*	*C*		*B*	*41.9*	*20.78*	**III**
HN55	*B41B*	*Steelpoort (EWR site – OLI-EWR2) (Rapid site)*	*Moderate*	*Moderate*	*C*	*C*		*63.5*	*20.78*	
HN56	*B41C*	*Masala (confluence with Steelpoort), including Tonteldoos and Vlugkraal)*	*High*	*High*	*C*		*B*	*-*	*-*	
HN57	*B41D, B41E*	*Steelpoort (inflow to De Hoop Dam)*	*High*	*Very high*	*C*		*A*	*117.0*	*20.78*	
HN58	*B41F*	*Draaikraalspruit (confluence with Klip)*	*High*	*Very high*	*B*		*A*	*-*	*-*	
HN59	*B41F*	*Klip (EWR site – OLI-EWR4) (Rapid site)*	*Moderate*	*Moderate*	*C*	*B/C*		*5.2*	*12.44*	

Node	Quarte -nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/ a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN60	*B41G*	*Kraalspruit (confluence with Groot Dwars)*	*High*	*Very high*	*B*		*A*	*-*	*-*	
HN61	*B41G*	*Klein Dwars (Confluence with Groot Dwars)*	*High*	*High*	*D*		*B*	**-**	**-**	
HN62	*B41G*	*Upper reaches of Dwars (before mining impacts)*	*High*	*Very high*	*C*		*A*	*24.5*	*13.33*	
HN63	*B41H*	*Dwars (EWR site – DWA-EWR1) (existing)*	*High*	*High*	*B/C*	*B/C*		*31.4*	*19.41*	
HN64	*B41H*	*Steelpoort*	*Moderate*	*Moderate*	*D*		*C*	*-*	*-*	
HN65	*B41J*	*Steelpoort (EWR site – EWR9) (existing)*	*High*	*High*	*D*	*D*		*120.2*	*7.97*	
HN66	*B41J, B41K*	*Steelpoort (EWR site – EWR10) (existing) (confluence with Olifants – outlet of IUA6)*	*Moderate*	*High*	*D*	*D*		*336.6*	*7.43*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The present state of the Steelpoort River has been modified from natural to a PES of a D category due to impacts from agriculture and settlements. The Klip and Dwars rivers are still in a good present state. However, the impacts from mining on the Dwars River have resulted in a moderately modified state (B/C category).

The main stem Steelpoort River is of moderate ecological importance. However, the Klip and Dwars rivers have a high importance and sensitivity due to the presence of the Veloren Vallei nature reserve, the transition from mountain to bushveld and the unique geology.

The IUA includes two Comprehensive EWR sites on the Steelpoort River, EWR site 9, below De Hoop Dam (B41H) and EWR site 10 just before its confluence with the Olifants River (B41K). Both sites have a PES of D and a D REC. An intermediate site is also present on the Dwars River just before the confluence with the Steelpoort (B41H). A Rapid III site OLI-EWR2, is located on the Upper Steelpoort River (B41B), and a Rapid I site OLI-EWR4 is present on the Klip River.

Economy

The economy of the IUA is characterized by mining, manufacturing, some irrigation and tourism. The agriculture, hunting, forestry and fishing sector supply the largest number of jobs in IUA 6. The community, social and personal services sector is also an important sector in terms of employment.

Platinum mining is a major contributor to GDP in the Olifants WMA. The bulk of the platinum mining falls within IUA 6, with some mining occurring in IUA 5 near Groblersdal. The IUA falls within the eastern limb of the Bushveld Complex, which contains the largest platinum deposits in the world.

Conclusions and Proposed MC

The recommended scenario maintains the PES ecological category at all nodes within the IUA. A MC III is recommended for IUA 6 (Table 15). The impact on water quality in the lower Steelpoort due to mining in the Dwars River catchment and sedimentation need to be considered.

Table 15: IUA Class for the Steelpoort river catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	Management Class
% representation	*23*	*38*	*38*	*III*

3.13 MANAGEMENT CLASS IUA 7: MIDDLE OLIFANTS BELOW FLAG BOSHIELO DAM TO THE STEELPOORT RIVER CONFLUENCE

IUA Description

IUA 7 consists primarily of dryland agriculture and rural subsistence farmers. It encompasses the Local Municipalities of Polokwane, Lepele-Nkumpi, Fetakgomo Makhuduthamaga. Some platinum mining occurs within the IUA. The population of IUA 7 is approximately 550 871 and has approximately 123 234 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 16. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 16: IUA 7 Middle Olifants below Flag Boshielo Dam: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC [1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN67	*B51F*	*Upper Nkumpi (outlet of quaternary)*	*High*	*Moderate*	*C*		*B*	*3.8*	*10.73*	**III**
HN68	*B51G*	*Olifants (EWR site – EWR7) (existing)*	*EIS=Moderate*		*E*	*D*		*726.5*	*3.84 (D)*	
HN69	*B52E*	*Palangwe (confluence with Olifants)*	*High*	*High*	*C*		*B*	-	-	
HN70	*B52F*	*Hlakaro (outlet)*	*High*	*High*	*C*		*B*	-	-	
HN71	*B52J*	*Mphogodima (confluence with Olifants)*	*High*	*High*	*C*		*B*	-	-	
HN72	*B52A, E, G, J*	*Olifants (outlet of quaternary – outlet of IUA7)*	*Modera te*	*High*	*D*	*D*		*799.7*	*3.88*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The ecological importance of main stem Olifants river is low to moderate, with the small tributaries being moderate to high. The present state of the main stem is in an E category that is mainly due to changes in flows as a results of Flag Boshielo Dam upstream and from agricultural impacts. The IUA includes one Comprehensive EWR site on the Oilfants River, EWR site 7, below Flag Boshielo Dam (B51G) and 5 nodes. The REC of the EWR site is a D.

While the tributaries are in a good state the present ecological condition at EWR site 7 is unacceptable and requires improvement. This is due to both flow and non-flow related impacts. The non-flow impacts are water quality related and primarily the deterioration of geormorphology and the river habitat.

Economy

The IUA includes an area of 259 267 ha of dryland, irrigated and subsistence agriculture. Subsistence agriculture makes up a large proportion of agriculture in this IUA (DWA, 2011b). The Marula Platinum Mine (operated by Impala Platinum) is situated north east of Burgersfort and produces 70 000 oz. of platinum annually. Approximately 23% of the population of IUA 7 are unemployed. The community, social and personal services sector supply the largest number of jobs in IUA 7(DWA, 2011b).

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at the nodes, except at EWR site 7 where the ecologically condition is an E EC. At this site the PES will be managed to a D ecological category. A MC of III is recommended for IUA 7 (Table 17). The flow scenario assessment indicated that the EWR flows cannot be met in the system at present at the EWR site 7.

In terms of Scenario 6, the additional treated mine water released to the river system to supply the water requirements in the Middle Olifants, flows through EWR site 7. The ecological consequence assessment indicates that the flows through the Middle Olifants River improves, however, these are more constant and it is uncertain if this is a positive impact on the river. It is however an improvement of the zero flows presently experienced for periods of time.

Table 17: IUA Class for Middle Olifants below Flag Boshielo Dam based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	C	D	E	Management Class
% representation	*66*	*17*	*17*	*III*

3.14 MANAGEMENT CLASS IUA 8: SPEKBOOM CATCHMENT

IUA Description

IUA 8 comprises the Spekboom catchment area. It includes the town of Mashishing (Lydenburg) in the south and Burgersfort in the north. Several protected areas occur within the IUA and include the Sterkspruit and Gustav Klingbiel Nature Reserves. The population of IUA 8 is approximately 30 026 and has approximately 9 029 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural

MAR) is indicated in Table 18. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 18: IUA 8 Spekboom catchment: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN73	B42A, B42B	One node for Dorpspruit at outlet of B42B. Included: Hoppe se Spruit (confluence) Doringbergspruit (confluence)	Moderate High	High High	C C		B B	-	-	II
HN74	B42B	Dorpspruit (EWR site – OLI-EWR9) (Rapid site)	EIS=Low		C/D	C/D		63.2	11.99	
HN75	B42C	Potloodspruit (confluence with Dorps)	High	High	C		B	-	-	
HN76	B42D, B42E	Dorps (confluence with Spekboom)	High	High	C		B	69.7	14.95	
HN77	B42D	Spekboom (EWR site – OLI-EWR6) (Rapid site)	EIS=High		C	B/C		28.0	17.15	
HN78	B42F	Potspruit (confluence with Watervals)	High	High	C		B	-	-	
HN79	B42F	Watervals (releases from Buffelskloof Dam)	High	Very high	C		A	28.6	17.36	
HN80	B42G	Rooiwalhoek-se-Loop (confluence with Watervals)	High	Very high	B		A	-	-	
HN81	B42G	Watervals (EWR site – OLI-EWR5) (Rapid site)	EIS=Moderate		C	C		36.4	15.47	
HN82	B42H	Spekboom (outlet of quaternary – outlet of IUA 8)	High	Moderate	B	B		149.0	24.84	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The present state of the rivers in IUA 8 ranges from almost natural (Waterfalls source) to degraded (Dorps). The ecological importance of the Spekboom and Waterfalls is high and moderate for the Dorps. A number of protected areas have been identified in the upper reaches of this IUA. The impacts are mainly from urbanisation, return flows from waste water treatment works in the Dorpspruit and some agriculture in the catchment.

No Comprehensive EWR site is present in the IUA. The IUA does however include two Rapid III sites, OLI-EWR 5 on the Watervals River and OLI-EWR6 on the Spekboom, with a Rapid I site OLI-EWR9 on the Dorpspruit. There are six additional biophysical nodes within the IUA, with the majority being in a C ecological category.

Economy

The economy of the IUA is characterized by platinum mining, tourism, dryland and irrigated agriculture. Pasture (2 720ha) is the most common crop type in IUA 8 followed by maize. The wholesale and retail trade, repairs, hotels and restaurants sector supplied the largest number of jobs with the community, social and personal services sector also an important sector in terms of employment in IUA 8 (DWA, 2011b). Xstrata Alloys operates the Lydenburg Ferrochrome plant

near the town of Mashishing. The Plant has the capacity to produce 396kt of Ferrochrome per annum and provides employment for 545 employees.

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at all the nodes. A MC of II is recommended for IUA 8 (Table 19). The flow scenario assessment indicated that the EWR flows can be met in the system at the Rapid sites.

The water quality impacts in the Lydenburg area must be addressed.

Table 19: IUA Class for the Spekboom catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	Management Class
% representation	*20*	*80*	*II*

3.15 MANAGEMENT CLASS IUA 9: OHRIGSTAD CATCHMENT

IUA Description

IUA 9 includes the town of Ohrigstad and comprises the Ohrigstad river catchment area. The Blyde Nature Reserve is located in the lower reaches of this IUA. The population of IUA 9 is approximately 16 527 and has approximately 5 201 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 20. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 20: IUA 9 Ohrigstad catchment: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC [1]	Natural MAR (mcm/a)	EWR as % of natural MAR [2]	Recom-mended Class
HN83	*B60E, B60F*	*One node at outlet of B60F. Included: Kranskloofspruit, Mantshibi, Ohrigstad (outlet of quaternary)*	*Moderate*	*Very high*	*D*		*A*	*35.6*	*6.31*	**III**
HN84	*B60G*	*Vyehoek (confluence with Ohrigstad)*	*High*	*Very high*	*C*		*A*	*-*	*-*	
HN85	*B60H*	*Ohrigstad (EWR site – OLI-EWR8) (Rapid site)*	*EIS = Moderate*		*C*	*C*		*65.5*	*16.59*	
HN86	*B60H*	*Ohrigstad (outlet of quaternary – outlet of IUA9)*	*High*	*Very high*	*D*	*D*		*69.7*	*8.05*	

[1] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2] Based on EWR for maintenance and drought flows only

The Ohrigstad River has been impacted by agricultural activities in the catchment and is presently in a C ecological category. The EI for the Ohrigstad River was determined as moderate. The Ohrigstad River is a small system that is sensitive to flow related water quality changes and forms part of the Blyde Nature Reserve.

The instream integrity is in a D category and the riparian zone integrity in a C category. The main impacts on the habitat integrity of the system are water abstraction for irrigation, dams that impacts on all the flow components and irrigation return flows that leads to increased nutrients.

The smaller tributaries in the IUA are in a good ecological state. No Comprehensive EWR site is present in the IUA. The IUA does however include a Rapid II site, OLI-EWR 8 on the Ohrigstad River (B60H). There are 3 additional biophysical nodes in the IUA.

Economy

The economy of the IUA is characterized by irrigated, dryland and subsistence agriculture. Irrigation is a major component of the economy of IUA 9 with several irrigated crops occurring along the Orhigstad River. Pasture (2 069 ha) is the most common crop type in IUA 9 followed by maize (1 831 ha). High value crops such as citrus are grown along the Orhigstad River. The manufacturing sector supplied the largest amount of jobs in IUA 9. The agriculture, hunting, forestry and fishing sector is also an important sector in terms of employment in IUA 9 (DWA, 2011b).

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at all the nodes. While the majority of the tributaries have a PES EC of a C, the Ohrigstad River is highly impacted and has a PES of D. Thus due to the ecological state of the main stem river (Ohrigsad), a MC of III is recommended for IUA 9 (Table 21), even though 75% of the nodes are in a C EC. The flow scenario assessment indicated that the EWR flow cannot be met in the system at the Rapid site.

The land based impacts in the catchment need to be addressed to ensure that the ecological condition of the Ohrigstad River does not deteriorate further.

Table 21: IUA Class for the Ohrigstad catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	C	D	Management Class
% representation	*75*	*25*	*III***

***Main stem Ohrigstad is highly impacted (D). Tributaries are in a higher ecological condition (C).*

3.16 MANAGEMENT CLASS IUA 10: LOWER OLIFANTS

IUA Description

The IUA includes the town of Hoedspruit and the semi-urban areas of Hlohlokwe, Sofaya and

Mahlomelong. The Lower Olifants IUA contains several conservation areas, which include the Bewaarkloof Nature Reserve, the Wolkberg Wilderness area and a portion of the Blyde River Canyon catchment area. Important water resources include the Olifants River and the lower Blyde and Mohlapitse tributaries. The population of IUA 10 is approximately 25 430 with approximately 5 665 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 22. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 22: IUA 10 Lower Olifants: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN87	B60J	Sandspruit, including Rietspruit and Qunduhlu	High	Moderate	B		B	-	-	II
HN88	B60J	Blyde (EWR site – EWR12) (existing)	EIS = High		B	B		383.7	27.9	
HN89	B60J	Blyde (confluence with Olifants)	Very high	Very high	C		A	385.7	16.13	
HN90	B71A	Paardevlei (confluence with Tongwane)	High	Very high	B		A	-	-	
HN91	B71A	Tongwane (confluence with Olifants)	High	High	B		B	-	-	
HN92	B71B	Olifants (EWR site – EWR8) (existing)	EIS = Moderate		D	D	C	813.0	4.30	
HN93	B71C	Mohlapitse (upper reaches)	Very high	Very high	B		A	42.1	26.5	
HN94	B71D	Kgotswane (confluence with Olifants)	High	Moderate	B		B	-	-	
HN95	B71D, B71F	Olifants (confluence with Steelpoort)	High	Very high	D		A	937.9	4.30	
HN96	B71G, H, J	Olifants (EWR11, confluence with Blyde) (existing)	EIS = High		E	D		1321.8	11.2 (D)	
HN97	B72A	Makhutswi, including Moungwane and Malomanye	High	High	C		B	38.0	12.89	
HN98	B72C	Olifants (outlet – outlet of IUA10)	High	High	C	C		1755.5	18.07	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The main stem Olifants in the Lower Olifants IUA is presently in a D ecological category with the lower Blyde and Mohlapitse in a B. The impacts on the Olifants River may be attributed to irrigation along the river and Flag Boshielo Dam. The ecological importance is high for the lower Blyde (links Olifants to the Highveld) and Mohlapitse (Wolkberg area is a declared wilderness area, Tufa's Waterfalls, caves).

The IUA includes two Comprehensive EWR sites on the Olifants River, EWR site 8, below

confluence with Mohlapitse (B71B) and EWR site 11, upstream confluence with Blyde (B71J). A third Comprehensive site, EWR 12 is located on the lower Blyde below Blyderivierspoort Dam (B60J). The IUA also includes nine additional nodes, with the majority being in a B category, and some in a C.

The PES EC of EWR site 11 is an E and the REC is a D category. As PES of E is considered unacceptable, it is taken as a D EC for the recommended scenario. Improvement is required at EWR site 11, and this is flow related. Reduced flows have impacted on the geomorphology, fish and habitat integrity of the river at this site.

Economy

The economy of the IUA is characterized by intensive agriculture (especially near Hoedspruit), rural subsistence, ecotourism and light commercial activities. The area of dryland, irrigated and subsistence agriculture for IUA 10 incorporates approximately 23 659 ha. There has been a significant increase in irrigation in IUA 10 over the last few years. High value crops such as citrus are grown around the Hoedspruit area. The agriculture, hunting, forestry and fishing sector supply the largest number of jobs in the Lower Olifants IUA. The community, social and personal services sector is also an important sector in terms of employment in IUA 10 (DWA, 2011b).

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at the nodes, except at EWR site 11 where the ecologically condition is an E EC. At this site the PES will be managed to a D ecological category. A MC of II is recommended for the Lower Olifants IUA (Table 23). The flow scenario assessment indicated that the EWR flows can be met in the system at the EWR sites.

Points to note:

- *Sediment related water quality impacts is a problem in the area and need to be addressed. The flow in the Olifants River in this IUA needs to be better regulated and optimised to suit the ecological requirements.*
- *Localised water quality impacts from irrigation and sedimentation is a problem and the operation of Blyderivierpoort Dam needs to be addressed.*
- *The high ecological condition of the tributaries (Mohlapitse, Paardevlei and Blyde) and the conservation areas need to be protected.*

Table 23: IUA Class for the Lower Olifants based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	E	Management Class
% representation	*50*	*25*	*17*	*8*	*II*

3.17 MANAGEMENT CLASS IUA 11: GA-SELATI RIVER

IUA Description

The IUA includes the towns of Phalaborwa, Gravelotte and Mica, and is bordered by the Kruger National Park to the west and other conservation areas to the east. The Ga-Selati IUA also encompasses the semi-urban areas of Ga-Mashishimale and Namakgale. Important water resources include the Ga-Selati River. The population of IUA 11 is approximately 134 894 and has approximately 33 156 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2012b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 24. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 24: IUA 11 Ga-Selati River: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN99	B72E	Ngwabatse (confluence with Ga-Selati)	High	Very high	D		A	25.7	9.05	III
HN100	B72F, G	Ga-Selati (outlet of quaternary)	High	Very high	C		A	13.5	19.59	
HN101	B72H	Ga-Selati (EWR site – EWR14a) (existing)	EIS=Moderate		C	C		52.2	19.59	
HN102	B72J	Molatle (confluence with Ga-Selati)	Moderate	Moderate	B		C	11.4	12.67	
HN103	B72K	Ga-Selati (EWR site – EWR14b) (existing)	EIS=Moderate		E	D		72.7	11.99 (D)	
HN104	B72K	Ga-Selati (outlet of quaternary – outlet of UIA11)	High	High	E	D		72.7	11.95 (D)	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The present state of the Ga-Selati River ranges from a C (in the upper reaches) to an E category just before the confluence with the Olifants. This is mainly due to the impacts from mining and town development in the lower reaches. The PES EC is reflected as a D category in the Table 24 above as an E category is considered unsustainable and cannot be recommended as an ecological condition.

The ecological importance of the system is high for the upper part (foothills zone) to low. The middle reaches of the IUA forms part of a protected area.

Two Comprehensive EWR sites are present on the Ga-Selati River, EWR site 14a (B72H) in the upper reaches of the catchment and EWR site 14b (B72K) before its confluence with the Olifants River. There are 4 additional nodes in the IUA. Improvement is required at EWR site 14b, and this is non flow related. The non-flow impacts are primarily water quality related and require an

integrated management strategy to deal with the upstream wastewater discharges and the mine water impacts.

Economy

The economy of the IUA is characterized by intensive mining, ecotourism and agriculture.

The area of dryland, irrigated and subsistence agriculture for IUA 11 is 12 527 ha. There has been a significant increase in irrigation in the IUA over the last few years.

Several mining activities occur in the IUA with the largest being the Foskor and Phalaborwa Copper Mine near Phalaborwa. The operation encompasses a copper mine, smelter and refinery and produces approximately 80 000 tonnes of refined copper annually.

Other operations include the Consolidated Murchison Mine, which produces antimony and gold found near Mica and the mining of mica in the greater Gravelotte and Mica areas.

The mining and quarrying sector supplied the largest amount of jobs. The community, social and personal services sector is also an important sector in terms of employment in the Ga-Selati IUA.

Conclusions and Proposed MC

The recommended scenario maintains the PES EC at the nodes, except at EWR site 14b and HN 104 where the ecologically condition is an E EC. At these sites the PES will be managed to a D ecological category. A MC of III is recommended for the Lower Olifants IUA (Table 25). The flow scenario assessment indicated that the EWR flows can be met at EWR site 14b, however the flows are only partially met at EWR site 14a in June and not met in September.

Points to note:

- *Serious water quality impacts from mining and urban return flows in the lower reaches of the Ga-Selati River needs to be addressed.*
- *The high ecological condition in the upper parts of the catchment and the conservation areas in the middle reaches needs to be protected.*

Table 25: IUA Class for the Ga Selati catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007)

Ecological category	B	C	D	E	Management Class
% representation	*17*	*33*	*17*	*33*	*III*

3.18 MANAGEMENT CLASS IUA 12: LOWER OLIFANTS WITHIN KRUGER NATIONAL PARK (KNP)

IUA Description

The IUA incorporates the lower Olifants catchment area. This area is largely a protected area with a high conservation status. It includes the world renowned Kruger National Park. The Olifants River especially in these lower reaches contains important natural heritage. These areas are water-dependent and play an important role in the tourism economy of the region. The IUA incorporates the Olifants main stem river and Klaserie, Tsiri, Timbavati, Tshutsi and Hlahleni tributaries. The population of the IUA is approximately 7 721 and has approximately 2 471 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 26. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 26: IUA 12 Lower Olifants within KNP: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN105	B72D	Olifants (EWR site – EWR13) (existing)	EIS=Moderate		C	C		1760.7	11.36	II
HN106	B73A	Klaserie (EWR site – OLI-EWR7) (Rapid site)	EIS=High		B/C	B		25.5	22.31	
HN107	B73B	Klaserie (confluence with Olifants)	High	High	C		B	37.1	15.41	
HN108	B73C	Tsiri (confluence with Olifants)	High	High	B		B	-	-	
HN109	B73C	Tshutshi (confluence with Olifants)	High	High	B		B	-	-	
HN110	B73D	Nhlaralumi, including Machaton, Nyameni and Thlaralumi	High	High	B		B	6.8	13.65	
HN111	B73E	Sesete (confluence with Timbavati)	High	High	B		B	11.1	12.24	
HN112	B73F	Timbavati (outlet of quaternary)	High	High	B		B	18.7	12.12	
HN113	B73G	Timbavati, including Shisakashonghondo	High	High	B		B	-	-	
HN114	B73G, B73H	Olifants (EWR site – EWR16) (existing)	EIS=High		C	B		1916.9	10.75	
HN115	B73J	Hlahleni (confluence with Olifants)	High	High	A		A	-	-	
HN116	B73J	Olifants (outlet of quaternary – outlet of IUA12)	High	High	C	B		1918.3	14.72	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The water resources of this IUA fall almost entirely within the Kruger National Park and surrounding protected areas. The ecological importance is thus very high. However, the present

state of the Olifants River is in a C category that is mainly due to the impacts of the upstream developments.

The tributaries of the Olifants River within the IUA are in very good ecological condition with all having a high ecological importance. The ecological status of these rivers needs to be maintained. They form part of the FEPAs.

Two Comprehensive EWR sites are present on the Olifants River within the IUA. These include EWR site 13 (B72D), the Olifants River before its confluence with the Ga-Selati River and EWR site 16 (B73H), the Olifants River in the lower reaches of the KNP. The PES of the Olifants River at these sites is a C ecological category. The IUA also includes a Rapid III site OLI-EWR 7 on the Klaserie River (B73A). The PES EC of this site is a B/C with the REC being a B. The IUA includes 9 additional nodes. The PES ecological category of these nodes is a B, with the exception of the Hlahleni River which is in an A category.

Economy

The main economic activity of the IUA is eco-tourism. The Kruger to Canyons Biosphere Reserve (K2C) is an internationally recognised development initiative that complies with and is accredited to UNESCO's Man and the Biosphere programme. The inclusion of the Timbavati, Balule, Klaserie, Umbaba and other private nature and game reserves has effectively added in excess of 250,000 ha (more than 10%) to the conservation area of the KNP (DWA, 2011b).

The area of dryland, irrigated and subsistence agriculture covers approximately 4692 ha of the IUA.

Conclusions and Proposed MC

The recommended scenario maintains the PES ecological category at all nodes within the IUA. A MC II is recommended for IUA 12 (Table 27). The flow scenario assessment indicated that the EWR flows can be met at EWR site 13, but not for the REC at EWR site 16. However, recommended flows for the PES of a C category can be met. This needs to be addressed if the Olifants River need to be managed for a B category in the KNP due to it's high conservation status.

Points to note:

- *Sedimentation from scouring of the Phalaborwa Barrage needs to be addressed. Some actions are needed to manage the flow related impacts in the lower reaches of the Olifants River.*
- *The high ecological condition in the tributary catchments and the conservation status of the IUA needs to be protected.*

Table 27: IUA Class for the Lower Olifants within KNP catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007*)*

Ecological category	A	B	C	Management Class

% representation	*8*	*58*	*33*	*II*

3.19 MANAGEMENT CLASS IUA 13: BLYDE RIVER CATCHMENT AREA

IUA Description

The IUA incorporates the town Pilgrims Rest and contains the upper portions of the Blyde and Treur Rivers. The IUA is predominately rural in nature and is relatively undisturbed with a small area of forestry in the upper reach of the Treur River. The population of the Blyde River IUA is approximately 8 260 with approximately 2 600 households. The large majority of the households fall within the very poor and poor income categories (DWA, 2011b).

Ecological condition and the Ecological Reserve

A summary of eco-classification and ecological water requirement (as a percentage of natural MAR) is indicated in Table 28. The EWRs listed are based on maintenance low and drought flows only for the PES as indicated in the table.

Table 28: IUA 13 Blyde River catchment: Summary of Eco-classification and EWR

Node	Quarte-nary	Nodes	EI	ES	PES	REC	Default REC[1)]	Natural MAR (mcm/a)	EWR as % of natural MAR [2)]	Recom-mended Class
HN117	*B60A*	*Blyde (confluence with Lisbon)*	*High*	*Very high*	*C*		*A*	*87.1*	*18.73*	
HN118	*B60B*	*Lisbon, including Heddelspruit and Watervalspruit*	*High*	*Very high*	*B*		*A*	*-*	*-*	
HN119	*B60B*	*Blyde (outlet of quaternary)*	*High*	*Very high*	*B*		*A*	*183.8*	*32.86*	**I**
HN120	*B60C*	*Treur (EWR site – TRE-EWR1) (existing)*	*EIS=Very high*		*A/B*	*A/B*		*46.8*	*34.60*	
HN121	*B60D*	*Blyde (inflow to Blyderivierpoort Dam – outlet of IUA13)*	*High*	*Very high*	*B*		*A*	*283.9*	*31.57*	

[1)] Based on the argument that the higher the EI-ES, the closer to the reference the REC should be. Default REC: Very high = A; High = B; Moderate = C and Low to Very Low = D. This does not consider attainability. DWA 2010 PES update (DWA, 2010).

[2)] Based on EWR for maintenance and drought flows only

The ecological importance of the water resources in this IUA is very high with the present state of the Treur and upper Blyde almost natural. A number of protected and conservation areas are present in the IUA.

A Rapid III site, TRE-EWR 1 (B60C) is located on the Treur River before its confluence with the Blyde River. The PES EC and REC of this site is A/B. Four additional nodes are present in the IUA, with the majority being in a B category.

Economy

The economy of the Blyde River IUA is characterized by limited forestry and subsistence agriculture. The agriculture, hunting, forestry and fishing sector provided the most employment in IUA 13.

Conclusions and Proposed MC

The recommended scenario maintains the PES ecological category at all nodes within the IUA. A MC I is recommended for IUA 13 (Table 29). The flow scenario assessment indicated that the EWR flows can be met.

The high ecological condition of the water resources and the conservation status of the IUA needs to be maintained and protected.

Table 29: IUA Class for the Blyde River catchment based on percentage representation of indicated EC groups as per WRCS guidelines (2007*)*

Ecological category	B	C	Management Class
% representation	*80*	*20*	*I*

4 CONCLUSIONS AND RECOMMENDATIONS

Based on the scenario evaluation analysis and on recommendations from the PSC, the go forward options towards MCs for the Olifants WMA were Scenario 4 and 6 which supply the PES ecological categories and meet the future growth in water requirements in the WMA. In Scenario 6, additional treated mine water released from the Upper Olifants to meet the water requirements of the Middle Olifants. This flow contributes additional flow to the river system and supports the EWRs.

The IUA MCs associated with Scenario 4 and 6 have been presented in preceding sections of this report. The approach applied to determining the proposed MCs for each of the IUAs was to follow the guidelines of the WRCS. In summary the WRCS guidelines recommend that a MC be determined based on the ECs of the biophysical nodes residing in an IUA. This categorisation was based largely on the main stem of the Olifants River and major tributaries. Where a sub-node in a tributary catchment is different to the overall IUA MC (i.e. requiring a higher level of ecological protection), this higher ecological category is accounted by the implementation of this ecological water requirement at the sub-node. The RQO study will set the RQO's at these points to provide the appropriate protection at the sub-nodes.

Based on the above, the proposed IUA MCs for the Olifants WMA are presented in Table 30 below and Figure 5.

Table 30: Proposed Management Classes for the Recommended Scenarios (PES ecological condition)

Integrated Unit of Analysis (IUA)		PES Ecological Category	Proposed Management Class
1	*Upper Olifants River catchment*	*D*	**III**
2	*Wilge River catchment area*	*C*	**II**
3	*Selons River area including Loskop Dam*	*C*	**II**
4	*Elands River catchment area*	*D*	**III**
5	*Middle Olifants up to Flag Boshielo Dam*	*D*	**III**
6	*Steelpoort River catchment*	*D*	**III**
7	*Middle Olifants below Flag Boshielo Dam to upstream of Steelpoort River*	*D*	**III**
8	*Spekboom catchment*	*C*	**II**
9	*Ohrigstad River catchment area*	*D*	**III**
10	*Lower Olifants*	*C*	**II**
11	*Ga-Selati River area*	*D*	**III**

Integrated Unit of Analysis (IUA)		PES Ecological Category	Proposed Management Class
12	*Lower Olifants within Kruger National Park*	*C*	**II**
13	*Blyde River catchment area*	*A/B*	**I**

In terms of the MCs proposed for the 13 IUAs in the Olifants WMA:

- *One IUA is in a MC I (IUA 13),*
- *Five IUAs are in a MC II (IUAs 2, 3, 8, 10, 12),*
- *Seven IUAs are in a MC III (IUAs 1, 4, 5, 6, 7, 9, 11)*

In IUAs 1 (Upper Olifants), 7 (Middle Olifants below Flag Boshielo Dam) and 11 (Ga Selati) the current state is improved from an ecological category of E to a D (Class III) by the proposed MC. IUAs 4 (Elands River) and 5 (Middle Olifants up to Flag Boshielo Dam) fall within the MC III, include areas lower than D EC. IUA 9 is a MC III due to the fact that main stem Ohrigstad is highly impacted (D EC) even though the tributaries are in a higher ecological condition (75% C). The Blyde River IUA is in an MC of I as the ecological importance of the water resources in this IUA is high with the present state of the Treur and upper Blyde almost natural.

Based on the results of the study, the following recommendations are proposed:

- *The PES EC be implemented as the ecological Reserve at the EWR sites and selected nodes. This will improve the system ecological health by implementation of EWRs, additional flow and an improved water quality in some cases. The implementation of these flows will only be the maintenance low and drought fows. Freshets and floods will still occur in un-dammed tributaries and larger floods in the main stem of the Olifants and larger tributaries with major dams. It is recommended that a monitoring programme is initiated as soon as possible to monitor the response of the system due to the lack of freshet and flood releases as to ensure changes to these requirements if the system is deteriorating.*
- *In terms of the flow scenario assessment, the flows at some EWR sites, viz. EWR 4 (Wilge), EWR 16 (Lower Olifants in KNP), EWR 6 (Elands River), EWR 14a (Upper Ga-Selati), OLI-EWR3 (Kranspoortspruit) and OLI-EWR8 (Ohrigstad) cannot be fully met. This needs to be addressed in the catchment strategy development.*
- *The implementation of the MCs will require management of water quality which includes source directed measures, regulatory and institutional structures.*
- *Concerted and regular monitoring and compliance management is required to ensure the successful implementation of the MCs.*

- *Due to the water resource constraints in the WMA, the implementation and updating of the Olifants WMA Reconciliation Strategy is central to the implantation of the proposed MCs.*

- *An integrated Water Quality Management Plan is required.*

- *How the excess mine water has been earmarked to supply the future water requirements will be utilised has not been decided yet. This will be addressed. In the further development of the Reconciliation Strategy. At this stage, the release of the mine water into the river system cannot be relied upon. A monitoring programme will have to be implemented to ensure that the releases reach their desired destination.*

- *The treatment of mine water in the Upper Olifants will be in perpetuity after the closure of the mines. The financing of treatment schemes will have to be adequately provided for.*

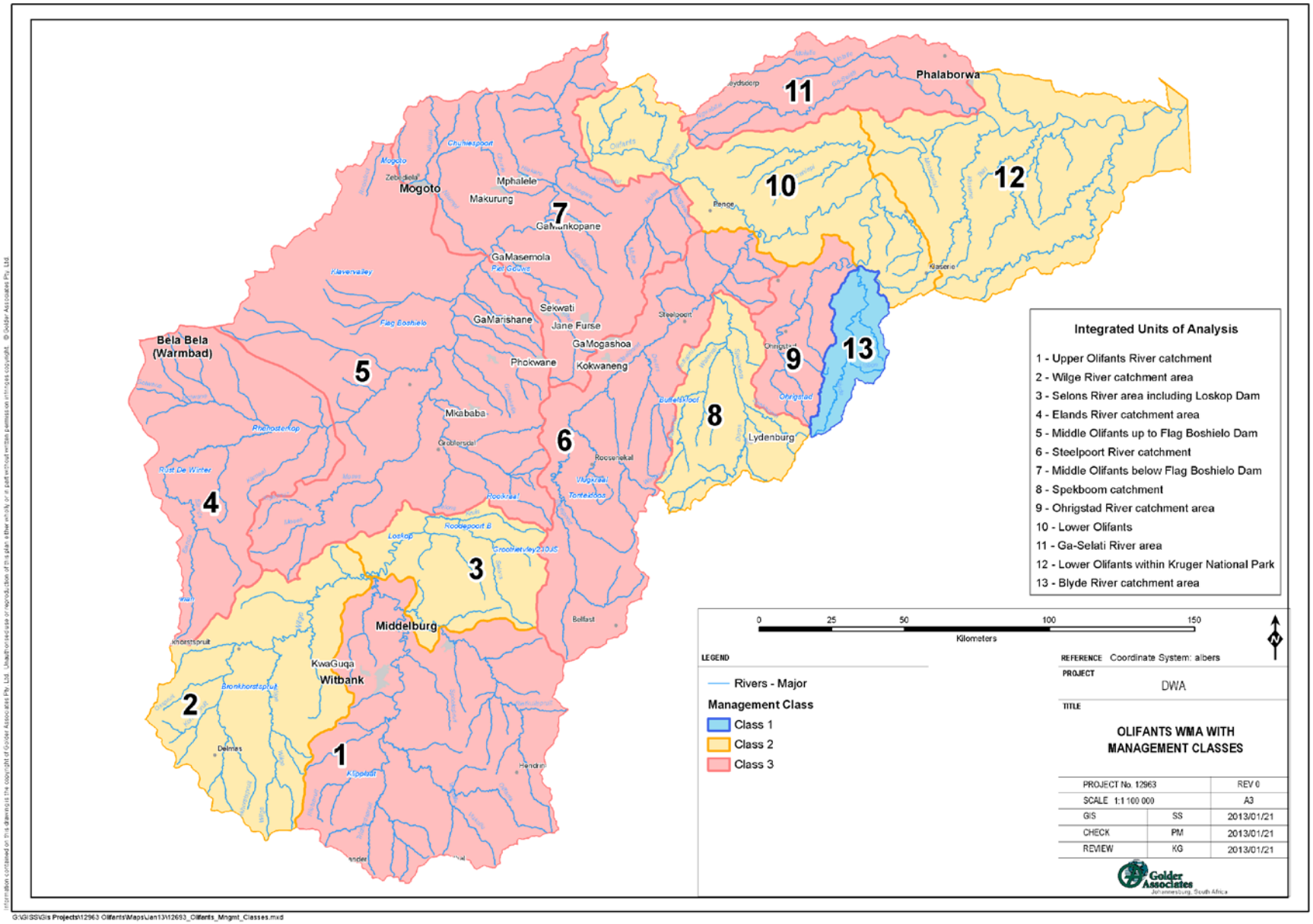

Figure 5: The Olifants WMA indicating proposed IUA MCs

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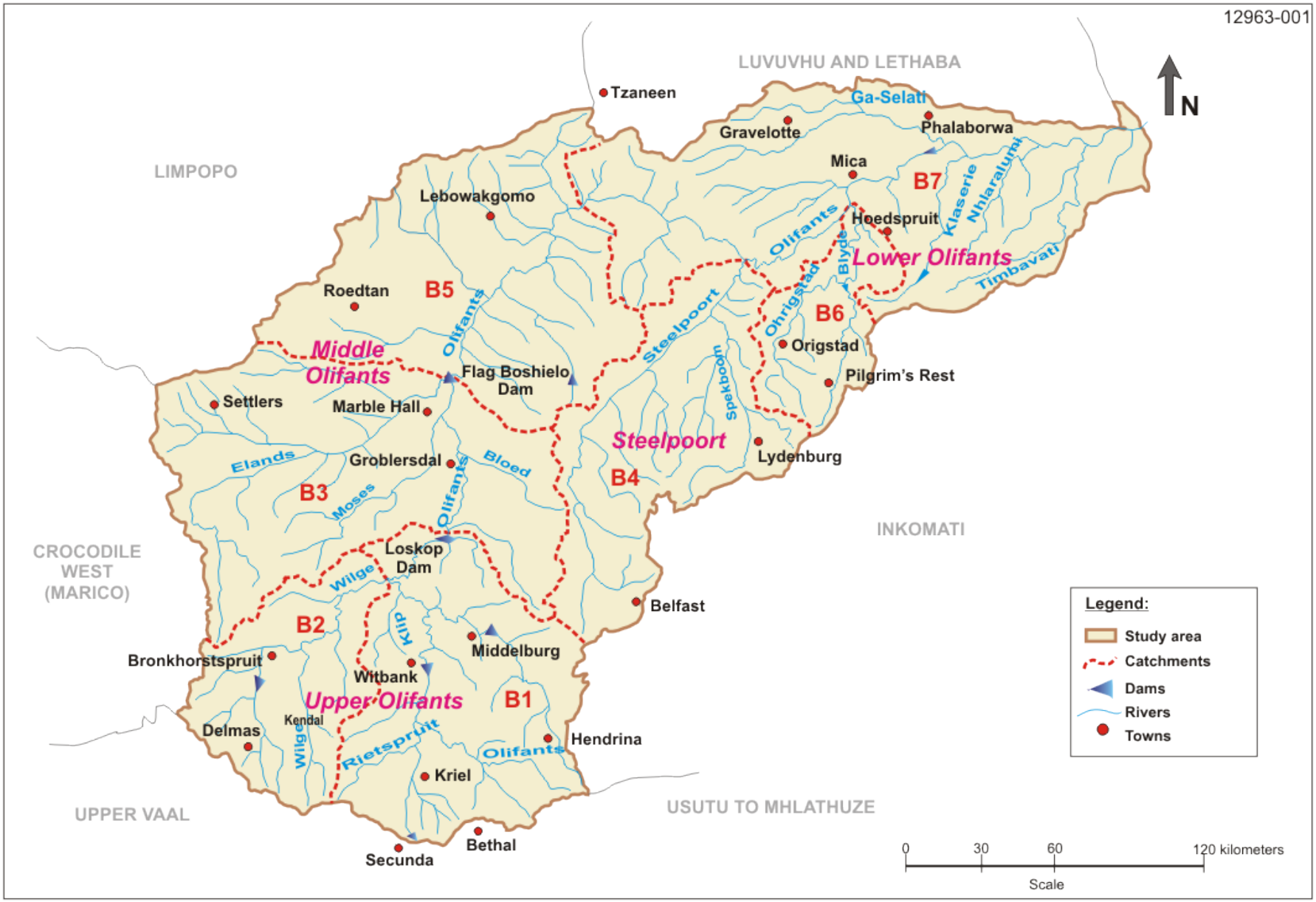
APPENDIX A

STUDY AREA



Study area – the Olifants WMA

APPENDIX B

FRESHWATER ECOSYSTEM PRIORITY AREAS (FEPAS) IN THE OLIFANTS WMA

FEPAs in the Olifants WMA and an indication of whether they are addressed through the Classification Process (MCs and Nodes)

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
1	*289*	*FEPA: Fish sp*	*B73J*	*yes (HN 115)*	*A*	*II*	*Y*
2	*292*	*FEPA: Fish sp*	*B71C*	*yes (HN93)*	*B*	*II*	*Y*
	292	*FEPA: Fish sp*	*B71C*				
	292	*FEPA: Fish sp*	*B71C*				
	292	*FEPA: River ecosystem type*	*B71C*				
	292	*FEPA: River ecosystem type*	*B71C*				
	292	*FEPA: River ecosystem type*	*B71C*				
	292	*FEPA: Wetland ecosystem type*	*B71C*				
3	*309*	*FEPA: River ecosystem type*	*B52F/B52G*	*yes (HN70)*	*C*	*III*	*Y*
	309	*FEPA: River ecosystem type*	*B52F/B52G*				
	309	*FEPA: River ecosystem type*	*B52F/B52G*				
	309	*FEPA: Wetland ecosystem type*	*B52F/B52G*				
	309	*FEPA: Wetland ecosystem type*	*B52F/B52G*				
	309	*FEPA: Wetland ecosystem type*	*B52F/B52G*				
4	*313*	*FEPA: River ecosystem type*	*B51F*	*yes (HN 67)*	*C*	*III*	*Y*
	313	*FEPA: River ecosystem type*	*B51F*				
5	*315*	*FEPA: River ecosystem type*	*B52J*	*yes (HN71)*	*C*	*III*	*Y*

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
6	317	FEPA: River ecosystem type	B51F	yes (HN67)		III	Y
7	320	FEPA: River ecosystem type	B52J	yes (HN71)	C	III	Y
	320	FEPA: River ecosystem type	B52J				
8	323	FEPA: Fish sp	B73J	yes (HN 115)	A	II	Y
	323	FEPA: Number of wetland clusters	B73J				
	323	FEPA: River ecosystem type	B73J				
	323	FEPA: River ecosystem type	B73J				
	323	FEPA: Wetland ecosystem type	B73J				
9	347	FEPA: River ecosystem type	B52J	yes (HN71)	C	III	Y
	347	FEPA: River ecosystem type	B52J				
10	361	FEPA: Fish sp	B71A	yes (HN90/HN91)	B	II	Y
	361	FEPA: River ecosystem type	B71A				
	361	FEPA: River ecosystem type	B71A				
11	367	FEPA: Fish sp	B71A	yes (HN90/HN91)	B	II	Y
	367	FEPA: River ecosystem type	B71A				
	367	FEPA: River ecosystem type	B71A				
12	368	FEPA: Fish sp	B71A				
	368	FEPA: River ecosystem type	B71A				
	368	FEPA: River ecosystem type	B71A				
13	378	FEPA: River ecosystem type	B71D	yes	B	II	Y

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	378	*FEPA: River ecosystem type*	*B71D*	*(HN94)*			
14	*381*	*FEPA: Fish sp*	*B71A*	*yes (HN90/HN91)*	*B*	*II*	*Y*
	381	*FEPA: River ecosystem type*	*B71A*				
	381	*FEPA: River ecosystem type*	*B71A*				
15	*391*	*FEPA: River ecosystem type*	*B73F*	*yes (HN112)*	*B*	*II*	*Y*
	391	*FEPA: River ecosystem type*	*B73F*				
16	*404*	*FEPA: Fish sp*	*B73G*	*yes (HN113)*	*B*	*II*	*Y*
	404	*FEPA: River ecosystem type*	*B73G*				
17	*424*	*FEPA: Fish sp*	*B60J*	*yes (HN87/HN88)*	*B*	*II*	*Y*
	424	*FEPA: Fish sp*	*B60J*				
	424	*FEPA: River ecosystem type*	*B60J*				
	424	*FEPA: River ecosystem type*	*B60J*				
18	*444*	*FEPA: Fish sp*	*B60J*	*yes (HN87/HN88)*	*B*	*II*	*Y*
	444	*FEPA: Fish sp*	*B60J*				
	444	*FEPA: River ecosystem type*	*B60J*				
	444	*FEPA: River ecosystem type*	*B60J*				
	444	*FEPA: River ecosystem type*	*B60J*				
19	*461*	*FEPA: Fish sp*	*B73A*	*No*	*B/C*	*II*	*Y*
	461	*FEPA: Number of wetland clusters*	*B73A*				
	461	*FEPA: River ecosystem type*	*B73A*				

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	461	*FEPA: River ecosystem type*	*B73A*				
	461	*FEPA: River ecosystem type*	*B73A*				
	461	*FEPA: Wetland ecosystem type*	*B73A*				
	461	*FEPA: Wetland ecosystem type*	*B73A*				
	461	*FEPA: Wetland ecosystem type*	*B73A*				
	461	*FEPA: Wetland ecosystem type*	*B73A*				
	461	*FEPA: Wetland ecosystem type*	*B73A*				
20	*496*	*FEPA: River ecosystem type*	*B41K*	*No*	*D*	*III*	*No*
	496	*FEPA: River ecosystem type*	*B41K*				
	496	*FEPA: River ecosystem type*	*B41K*				
21	*519*	*FEPA: River ecosystem type*	*B51B*	*yes (HN51)*	*B*	*III*	*Y*
	519	*FEPA: River ecosystem type*	*B51B*				
	519	*FEPA: River ecosystem type*	*B51B*				
22	*525*	*FEPA: Fish sp*	*B60D*	*yes (HN121)*	*B*	*I*	*Y*
	525	*FEPA: Fish sp*	*B60D*				
	525	*FEPA: River ecosystem type*	*B60D*				
	525	*FEPA: River ecosystem type*	*B60D*				
	525	*FEPA: River ecosystem type*	*B60D*				
23	*566*	*FEPA: Fish sp*	*B60B*	*yes (HN118/HN119)*	*B*	*I*	*Y*
	566	*FEPA: Fish sp*	*B60B*				

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	566	*FEPA: Fish sp*	*B60B*				
	566	*FEPA: Fish sp*	*B60B*				
	566	*FEPA: River ecosystem type*	*B60B*				
	566	*FEPA: Wetland ecosystem type*	*B60B*				
	566	*FEPA: Wetland ecosystem type*	*B60B*				
	566	*FEPA: Wetland ecosystem type*	*B60B*				
24	*581*	*FEPA: Fish sp*	*B60C*	*yes (HN120)*	*B*	*I*	*Y*
	581	*FEPA: Fish sp*	*B60C*				
	581	*FEPA: Fish sp*	*B60C*				
	581	*FEPA: Fish sp*	*B60C*				
	581	*FEPA: River ecosystem type*	*B60C*				
	581	*FEPA: River ecosystem type*	*B60C*				
	581	*FEPA: Wetland ecosystem type*	*B60C*				
	581	*FEPA: Wetland ecosystem type*	*B60C*				
	581	*FEPA: Wetland ecosystem type*	*B60C*				
25	*626*	*FEPA: Fish sp*	*B41J*	*No*	*D*	*III*	*N*
	626	*FEPA: River ecosystem type*	*B41J*				
	626	*FEPA: River ecosystem type*	*B41J*				
26	*650*	*FEPA: Fish sp*	*B60B*	*yes (HN118/HN119)*	*B*	*I*	*Y*
	650	*FEPA: Fish sp*	*B60B*				

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	650	*FEPA: Fish sp*	*B60B*				
	650	*FEPA: Fish sp*	*B60B*				
	650	*FEPA: Number of wetland clusters*	*B60B*				
	650	*FEPA: River ecosystem type*	*B60B*				
	650	*FEPA: River ecosystem type*	*B60B*				
	650	*FEPA: River ecosystem type*	*B60B*				
	650	*FEPA: Wetland ecosystem type*	*B60B*				
	650	*FEPA: Wetland ecosystem type*	*B60B*				
	650	*FEPA: Wetland ecosystem type*	*B60B*				
27	*653*	*FEPA: Fish sp*	*B60A*	*yes (HN117)*	*C*	*I*	*Y*
	653	*FEPA: Fish sp*	*B60A*				
	653	*FEPA: Fish sp*	*B60A*				
	653	*FEPA: Fish sp*	*B60A*				
	653	*FEPA: Fish sp*	*B60A*				
	653	*FEPA: Fish sp*	*B60A*				
	653	*FEPA: River ecosystem type*	*B60A*				
	653	*FEPA: River ecosystem type*	*B60A*				
	653	*FEPA: River ecosystem type*	*B60A*				
28	*667*	*FEPA: Fish sp*	*B60E/B60F*	*yes (HN83)*	*C*	*III*	*Y*
	667	*FEPA: Fish sp*	*B60E/B60F*				

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	667	*FEPA: Fish sp*	*B60E/B60F*				
	667	*FEPA: Fish sp*	*B60E/B60F*				
	667	*FEPA: River ecosystem type*	*B60E/B60F*				
	667	*FEPA: River ecosystem type*	*B60E/B60F*				
29	*674*	*FEPA: Fish sp*	*B41G*	*yes (HN60)*	*B*	*III*	*Y*
	674	*FEPA: River ecosystem type*	*B41G*				
	674	*FEPA: River ecosystem type*	*B41G*				
30	*685*	*FEPA: Fish sp*	*B41G*	*yes (HN60)*	*B*	*III*	*Y*
	685	*FEPA: Number of wetland clusters*	*B41G*				
	685	*FEPA: River ecosystem type*	*B41G*				
	685	*FEPA: River ecosystem type*	*B41G*				
	685	*FEPA: River ecosystem type*	*B41G*				
	685	*FEPA: Wetland ecosystem type*	*B41G*				
	685	*FEPA: Wetland ecosystem type*	*B41G*				
31	*699*	*FEPA: Fish sp*	*B41F*	*yes (HN58)*	*C*	*III*	*Y*
	699	*FEPA: River ecosystem type*	*B41F*				
	699	*FEPA: River ecosystem type*	*B41F*				
	699	*FEPA: River ecosystem type*	*B41F*				
32	*705*	*FEPA: Fish sp*	*B42D/E*	*No*	*C*	*II*	*N*
	705	*FEPA: Fish sp*	*B42D/E*				

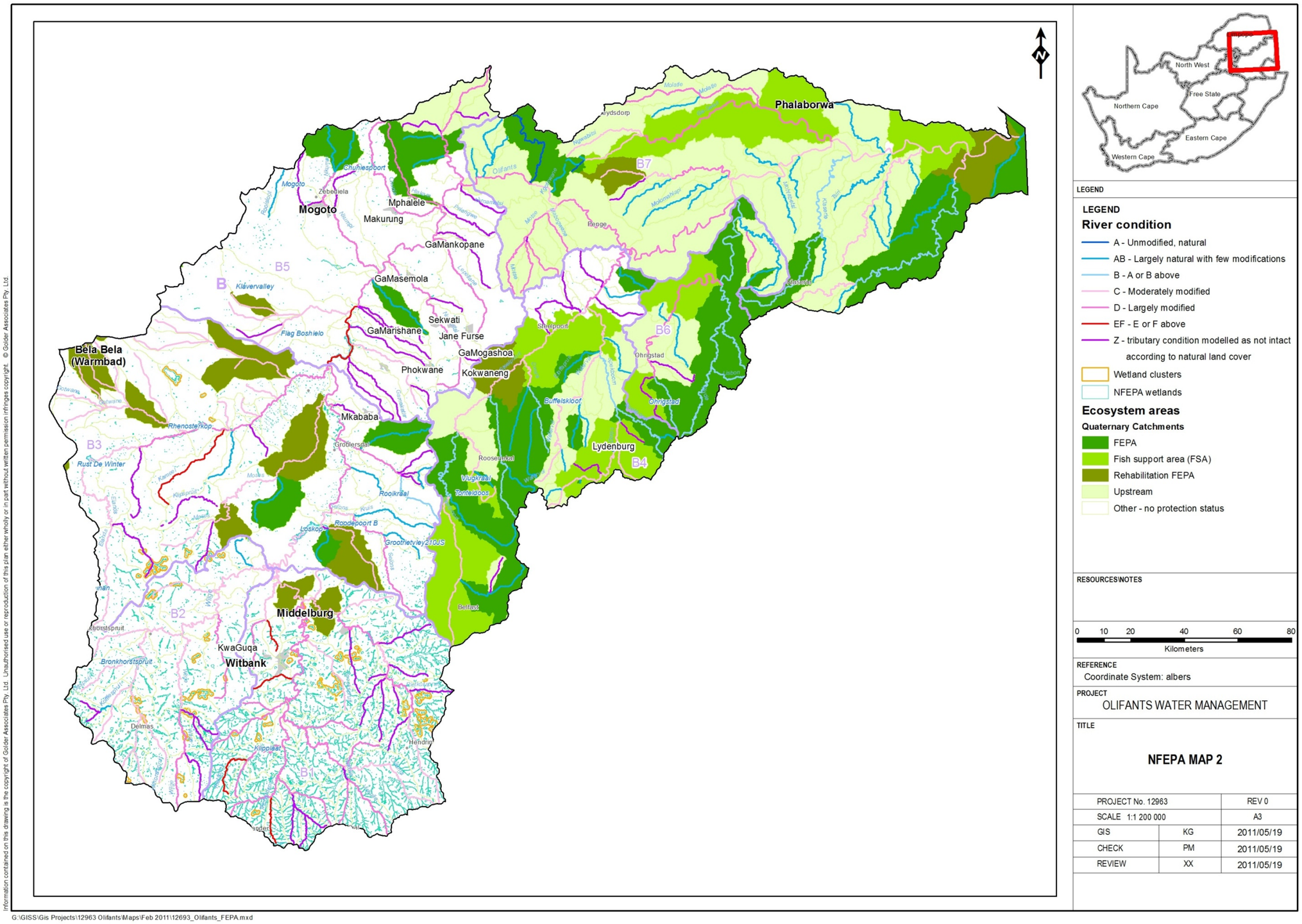
Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	705	*FEPA: River ecosystem type*	*B42D/E*				
	705	*FEPA: River ecosystem type*	*B42D/E*				
33	*721*	*FEPA: Fish sp*	*B41G*	*yes (HN60)*	*B*	*III*	*Y*
	721	*FEPA: River ecosystem type*	*B41G*				
	721	*FEPA: River ecosystem type*	*B41G*				
	721	*FEPA: River ecosystem type*	*B41G*				
34	*725*	*FEPA: Fish sp*	*B42D/E*	*No*	*C*	*II*	*N*
	725	*FEPA: Fish sp*	*B42D/E*				
	725	*FEPA: River ecosystem type*	*B42D/E*				
	725	*FEPA: River ecosystem type*	*B42D/E*				
35	*726*	*FEPA: Fish sp*	*B41G*	*yes (HN60)*	*B*	*III*	*Y*
	726	*FEPA: River ecosystem type*	*B41G*				
	726	*FEPA: River ecosystem type*	*B41G*				
36	*734*	*FEPA: Fish sp*	*B42G*	*yes (HN80)*	*B*	*II*	*Y*
	734	*FEPA: Fish sp*	*B42G*				
	734	*FEPA: River ecosystem type*	*B42G*				
	734	*FEPA: River ecosystem type*	*B42G*				
37	*743*	*FEPA: River ecosystem type*	*B32F*	*yes (HN48)*	*C*	*III*	
	743	*FEPA: River ecosystem type*	*B32F*				
38	*762*	*FEPA: Fish sp*	*B42D/E*	*No*	*C*	*II*	*N*

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	762	*FEPA: River ecosystem type*	*B42D/E*				
	762	*FEPA: River ecosystem type*	*B42D/E*				
	762	*FEPA: River ecosystem type*	*B42D/E*				
39	*777*	*FEPA: Fish sp*	*B41D*	*yes (HN57)*	*C*	*III*	*Y*
	777	*FEPA: River ecosystem type*	*B41D*				
	777	*FEPA: River ecosystem type*	*B41D*				
	777	*FEPA: River ecosystem type*	*B41D*				
40	*788*	*FEPA: Fish sp*	*B42D/E*	*No*	*C*	*II*	*N*
	788	*FEPA: River ecosystem type*	*B42D/E*				
	788	*FEPA: River ecosystem type*	*B42D/E*				
41	*848*	*FEPA: Fish sp*	*B41F*	*yes (HN58)*	*B*	*III*	*Y*
	848	*FEPA: Fish sp*	*B41F*				
	848	*FEPA: Number of wetland clusters*	*B41F*				
	848	*FEPA: River ecosystem type*	*B41F*				
	848	*FEPA: River ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	848	*FEPA: Wetland ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				
	848	*FEPA: Wetland ecosystem type*	*B41F*				
42	*851*	*FEPA: Fish sp*	*B41F*	*yes (HN58)*	*B*	*III*	*Y*
	851	*FEPA: Number of wetland clusters*	*B41F*				
	851	*FEPA: River ecosystem type*	*B41F*				
	851	*FEPA: River ecosystem type*	*B41F*				
	851	*FEPA: River ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
	851	*FEPA: Wetland ecosystem type*	*B41F*				
43	*862*	*FEPA: Fish sp*	*B41C*	*yes (HN56)*	*C*	*III*	*Y*
	862	*FEPA: River ecosystem type*	*B41C*				
	862	*FEPA: River ecosystem type*	*B41C*				

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
44	874	FEPA: River ecosystem type	B32H	No	D	III	N
	874	FEPA: River ecosystem type	B32H				
	874	FEPA: River ecosystem type	B32H				
45	905	FEPA: Fish sp	B41B	yes (HN54)	D	III	Y
	905	FEPA: Fish sp	B41B				
	905	FEPA: Number of wetland clusters	B41B				
	905	FEPA: River ecosystem type	B41B				
	905	FEPA: River ecosystem type	B41B				
	905	FEPA: River ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
	905	FEPA: Wetland ecosystem type	B41B				
46	965	FEPA: River ecosystem type	B32A	Yes (HN36)	B	II	N
	965	FEPA: River ecosystem type	B32A				
	965	FEPA: River ecosystem type	B32A				
47	1002	FEPA: Wetland ecosystem type	B41A	yes	C	III	Y

Olifants WMA FEPA	FEPA ID	Type of FEPA map category	Quartenary Catchment	Addressed by a biophysical node (yes/no) (Olifants Classification Sub-node No.)	Sub-node PES	IUA MC	FEPA Supported (Y/N) Higher level of ecological protection afforded to node in Classification process – higher than IUA MC. FEPA will be maintained.
	1002	*FEPA: Wetland ecosystem type*	*B41A*	*(HN54)*			
	1002	*FEPA: Wetland ecosystem type*	*B41A*				
48	*1005*	*FEPA: Fish sp*	*B41A*	*yes (HN54)*	*C*	*III*	*Y*
	1005	*FEPA: Number of wetland clusters*	*B41A*				
	1005	*FEPA: River ecosystem type*	*B41A*				
	1005	*FEPA: River ecosystem type*	*B41A*				
	1005	*FEPA: Wetland ecosystem type*	*B41A*				
	1005	*FEPA: Wetland ecosystem type*	*B41A*				
	1005	*FEPA: Wetland ecosystem type*	*B41A*				
	1005	*FEPA: Wetland ecosystem type*	*B41A*				
	1005	*FEPA: Wetland ecosystem type*	*B41A*				
	1005	*FEPA: Wetland ecosystem type*	*B41A*				
49	*1047*	*FEPA: Fish sp*	*B41A*	*yes (HN54)*	*C*	*III*	*Y*
	1047	*FEPA: Fish sp*	*B41A*				
	1047	*FEPA: River ecosystem type*	*B41A*				
	1047	*FEPA: River ecosystem type*	*B41A*				



LEGEND

LEGEND

River condition

- A - Unmodified, natural
- AB - Largely natural with few modifications
- B - A or B above
- C - Moderately modified
- D - Largely modified
- EF - E or F above
- Z - tributary condition modelled as not intact according to natural land cover
- Wetland clusters
- NFEPA wetlands

Ecosystem areas

Quaternary Catchments

- FEPA
- Fish support area (FSA)
- Rehabilitation FEPA
- Upstream
- Other - no protection status

RESOURCES\NOTES

0 10 20 40 60 80

Kilometers

REFERENCE

Coordinate System: albers

PROJECT

OLIFANTS WATER MANAGEMENT

TITLE

NFEPA MAP 2

PROJECT No. 12963		REV 0
SCALE 1:1 200 000		A3
GIS	KG	2011/05/19
CHECK	PM	2011/05/19
REVIEW	XX	2011/05/19

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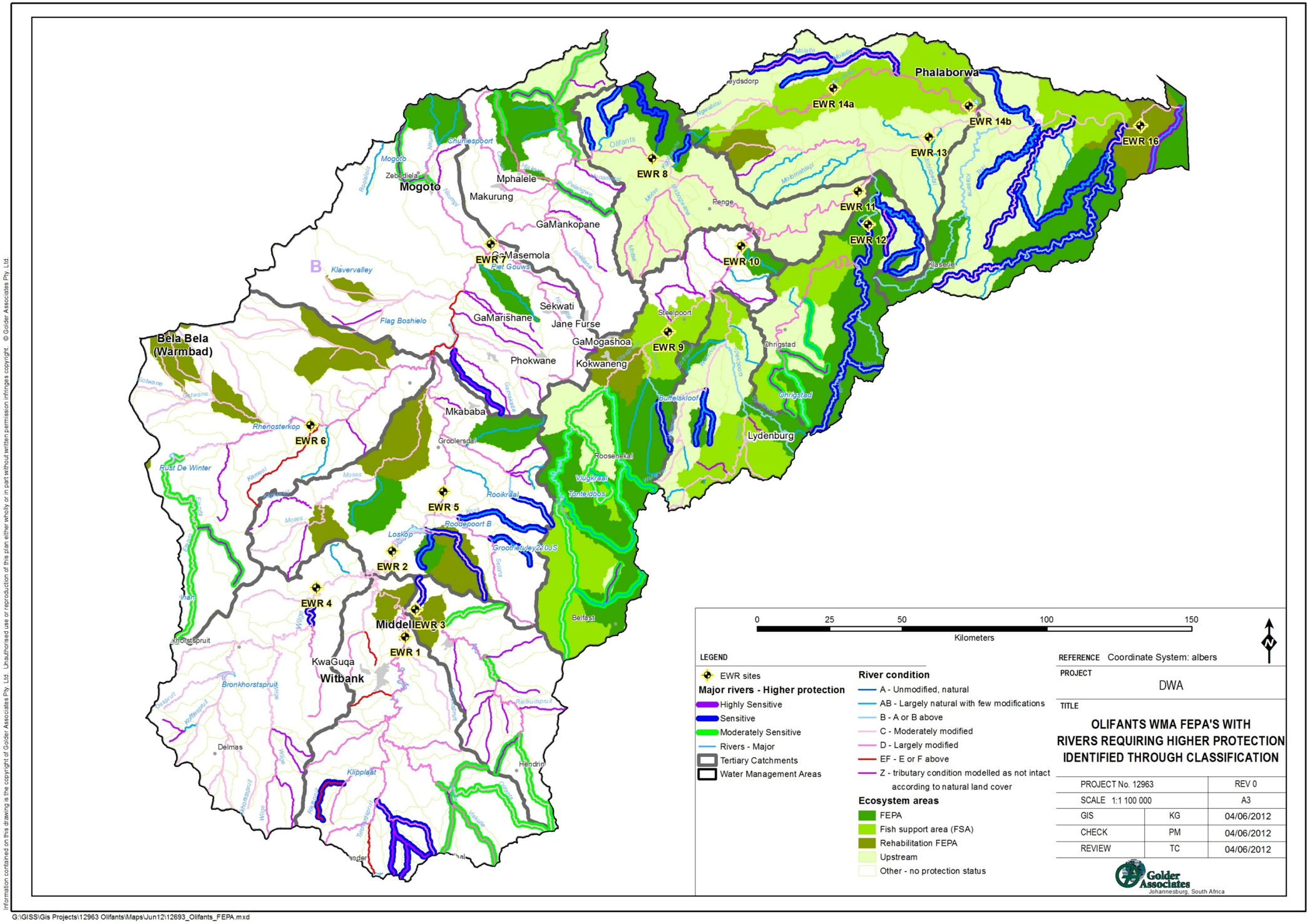
FEPAs identified for the Olifants WMA



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Correlation between FEPAs and hydro-nodes in Olifants WMA requiring higher level of protection

APPENDIX C

PROJECT STEERING COMMITTEE MEMBERS