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CHIEF DIRECTORATE: WATER ECOSYSTEMS
DIRECTORATE: RESERVE DETERMINATION

DETERMINATION, REVIEW AND IMPLEMENTATION OF THE RESERVE IN THE OLIFANTS/LETABA SYSTEM

REPORT TITLE: ECOLOGICAL SPECIFICATIONS REPORT

Final

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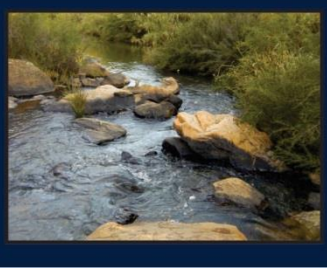
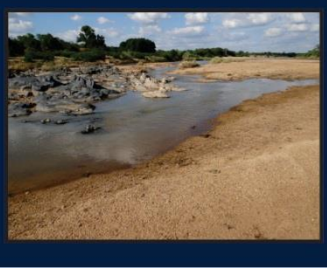

DEPARTMENT: WATER AND SANITATION

Directorate: Reserve Determination

DETERMINATION, REVIEW AND IMPLEMENTATION OF THE RESERVE IN THE OLIFANTS/LETABA SYSTEM

WP10940

ECOLOGICAL SPECIFICATIONS REPORT

FINAL

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2.0	RDM/WMA02/00/CON/0215	Information and Data Gap Analysis Report
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4.0	RDM/WMA02/00/CON/0116	Eco-Classification Report
5.0	RDM/WMA02/00/CON/0216	Quantification of Ecological Water Requirements Report
6.0	RDM/WMA02/00/CON/0316	Groundwater Component Report
7.0	RDM/WMA02/00/CON/0416	Wetlands Component Report
8.0	**RDM/WMA02/00/CON/0516**	**Ecological Specifications Report**

LIST OF ABBREVIATIONS

CD: WE	Chief Directorate: Water Ecosystems
DRM	Desktop Reserve Model
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DWAF	Department of Water Affairs and Forestry
EC	Electrical Conductivity
EIS	Ecological importance and sensitivity
ES	Ecological Sensitivity
EWR	Ecological Water Requirements
FIFHA	Flow, Invertebrate, Fish, Habitat Assessment
FRAI	Fish Response Assessment Index
GRA2	Groundwater Resource Assessment Phase II
GRDM	Groundwater Resource Directed Measures
KNP	Kruger National Park
MIRAI	Macro-invertebrate Response Assessment Index
MC	Management Class
NWA	National Water Act
PES	Presentation Ecological State
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RHP	River Health Programme
RQOs	Resource Quality Objectives
RQS	Resource Quality Services
TEC	Target Ecological Category
WE	Water Ecosystems
WMA	Water Management Area
WMS	Water Management System
WRCS	Water Resource Classification System
WRPM	Water Resources Planning Model
WWTW	Wastewater Treatment Works

EXECUTIVE SUMMARY

The Chief Directorate: Water Ecosystems has recently completed the study 'Determination, Review and Implementation of the Reserve in the Olifants/Letaba System'. With water resources in the Olifants Water Management Area (WMA 2) having been classified and Resource Quality Objectives determined (2011-2014), the preliminary Reserve determined in 2001 for the Olifants System and in 2006 for the Letaba System, is now required to be superseded by the Reserve. With the preliminary Reserve having been determined nine years prior to the water resource classification, a review and update was required to ensure that the Reserve is in accordance with the water resource classes and is applicable to the current system needs and demands.

The purpose of this study was thus to determine the Reserve in the Olifants\Letaba System; with the aim of specifically addressing ecological gaps and reviewing and updating the preliminary Reserves that have been determined.

The Ecological Water Requirements (EWR) were determined for the rivers in the Olifants/Letaba system. The groundwater Reserve has also been determined and wetland systems have been prioritised. Based on these results and the review of the eco-classification, the objectives for the protection of the ecosystem have now been defined through Ecological Specifications (ecospecs) and monitoring requirements for the maintenance at each Ecological Water Requirement (EWR) sites as well as biological moitoring at additional sites. The Ecospecs are intended to provide the quantifiable and enforceable descriptors of the quantity, quality and habitat and biotic integrity as they pertain to the ecological objectives for a particular water resource. These are the values of parameters (usually maximum concentrations) that should not be exceeded in order to meet the Target Ecological Category (TEC) specified for the water resource. The ecospecs (ecological information only) relate to and expand on the resource quality objectives that have been set for the Olifants/Letaba system.

This report describes the ecological specifications and monitoring requirements for maintenance of the Reserve in the water resources of the Olifants, Letaba and Shingwedzi catchment area as they relate to hydrology, water quality, habitat and biota of rivers, and groundwater and wetlands.

These ecospecs will support the the attainment of the Reserve and will need to be applied in conjunction with the implementation plan. The ecospecs form the basis of identified implementation actions that must be achieved.

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APPENDICES

APPENDIX A RUL AND EWR TABLES

1. INTRODUCTION

1.1 BACKGROUND

Chapter 3 of the National Water Act (Act No. 36 of 1998) (NWA) was specifically developed for the protection of the water resources of the country and requires the implementation of Resource Directed Measures (RDM) that is based on the guiding principles of sustainability and equity. Sustainability encompasses both the long- and short-term protection of water resources to ensure that they can be developed and used effectively into the future.

Resource Directed Measures provides for the protection of water resources through the Classification of water resources, determination of Resource Quality Objectives (RQOs) and determination of the Reserve. These measures collectively aim to ensure that a balance is reached between the need to protect and sustain water resources on one hand and the need to develop and use them on the other.

The Reserve specifies the quantity, quality, habitat and biotic integrity requirements necessary for the protection of the resource and has priority over other water uses. Two components are provided for, namely:

(i) Basic human needs (BHN), ensuring that the essential needs of individuals served by the water resource in question are provided for; and
(ii) The ecological Reserve ensuring the water required to protect aquatic ecosystems of the water resource are provided for.

The ecological Reserve is not intended to protect the aquatic ecosystem *per se*, but to maintain aquatic ecosystems in such a way that their integrity remains intact and they can continue to provide the goods and services to society and is specified for groundwater, wetlands, rivers and estuaries.

The Chief Directorate: Water Ecosystems has through a recently completed study determined the Reserve for the water resources in the Olifants Water Management Area (WMA 2) specifically for the Olifants and Letaba Systems; with a preliminary Reserve being determined for the Shingwedzi catchment.

1.2 PURPOSE OF THE STUDY

The study was aimed at specifically addressing ecological gaps and reviewing and updating the preliminary Reserves that had been previously determined.

The previous relevant studies completed for these systems were:

- Determination of the preliminary Reserve for the Olifants System (2001) and for the Letaba system (2006); and
- Classification and determination of RQOs for the water resources of the Olifants River catchment (2011-2013) and for the water resources of the Letaba River catchment (2012-2014);

Due to the preliminary Reserve having been determined in 2001 and 2006 prior to the water resource classification in 2011-2014, a review and update was required to ensure that the Reserve is in accordance with the water resource classes and is applicable to the current system

needs. In addition the hydrology applied to the Olifants preliminary Reserve in 2001, was out of date, and the Eco-Classification models and other tools did not exist or were in its infancy.

As the classes of the water resources for the Olifants/Letaba system have now been determined, the Reserve can be determined and gazetted.

1.3 STUDY METHODOLOGY

The update and review of the preliminary Reserve was achieved through:

- Review and analysis of existing information;
- Filling in of the ecological gaps through Rapid III Reserve determinations and biological surveys of the priority sites identified in the Olifants, Letaba and Shingwedzi catchments. Where possible, the EcoClassification models (required to evaluate scenarios) were populated and run to obtain updated results.
- The EWRs were determined using new hydrology and in other instances adjusted EWRs considering new present day hydrology.
- Evaluation of ecological consequences and operational considerations based on the planning scenarios that considered the impact of the different ecological categories on the yield of the dams in the system;
- Adoption of the recommended scenario and defining the ecological specifications and monitoring requirements for maintenance of the Reserve for the rivers in the Olifants, Letaba and Shingwedzi catchments.
- Specifications for the groundwater resources and wetlands are also determined based on the assessments undertaken.

The priority sites selected for this study included the following:

- Re-surveying of existing EWR sites where no new information after the initial preliminary Reserves in 2001 and 2006 were available; and
- The re-assessment of existing EWR sites using the hydraulic information from the previous Reserve studies with updated biological information.
- Additional sites were also identified in terms of Water Resource Classification where protection of the ecological integrity of certain water resources is required, due to the present ecological state being in a better condition than the overall IUA Class and nested ecological category.

The quantification of the Ecological Water Requirements (EWR), based on the Rapid III level of detail for the Priority Rivers as identified for the study area has been determined and evaluation of ecological consequences of meeting these has been evaluated. Based on the assessment, the Reserve (selected target ecological category (TEC)) for all the key EWR and priority sites has been determined.

In order that quantifiable and descriptive information regarding flows, water quality, habitat and biotic integrity, which describe both the present state of the system and conditions for the TEC, ecological specifications and monitoring requirements for maintenance of the Reserve for the rivers in the Olifants, Letaba and Shingwedzi catchments are defined.

The specifications for the groundwater resources and wetlands are also determined based on the assessments undertaken.

1.4 ECOLOGICAL SPECIFICATIONS

Ecological specifications (ecospecs) are derived from the Resource Quality Objectives (RQOs) for the resource (specifically rivers, wetlands, estuaries and groundwater). RQOs are requirements for water quantity, quality and habitat and biotic integrity to be maintained in the resource. RQOs may encompass ecological, economic, social and political objectives. The ecospecs are intended to provide the quantifiable and enforceable descriptors of the RQOs as they pertain to the ecological objectives for a particular resource (in this case a particular river reach).

1.5 PURPOSE OF THE REPORT

This report:

- identifies the Ecospecs that must be monitored that represent the condition of the target ecological categories of the Reserve (at key sites) ;
- provides a pragmatic monitoring programme of the Reserve as determined for the key rivers of the Olifants, Letaba and Shingwedzi catchments;
- defines the specifications for groundwater resources, and
- refers to the specifications for the wetlands and wetland systems (separate report).

The ecological specifications are not intended as a stand-alone report, and should be read in conjunction with Report 4: Eco-classification Report (Report No. RDM/WMA02/00/CON/0116) and Report 5: Quantification of the Ecological Water Requirements (Report No. RDM/WMA02/00/CON/0216), as the ecological consequences and much of the background information and reasoning behind the Ecospecs and related monitoring activities presented in here is contained in these reports.

2 STUDY AREA, ECOLOGICAL CLASSIFICATION AND RECOMMENDED RESERVE

The study area is the Olifants WMA (WMA 2) and includes the Olifants, Letaba and Shingwedzi systems. The spatial extent of the area includes tertiary drainage regions B11, B12, B20, B31, B32, B41, B42, B51, B52, B60, B71, B72 and B73 in the Olifants system, B81, B82 and B83 in the Letaba area, and B90, the Shingwedzi catchment.

The Olifants River originates at Trichardt, east of Johannesburg, and flows through the Kruger National Park. The Letaba River joins the Olifants River upstream of the border into Mozambique, where they join the Limpopo River before discharging into the Indian Ocean. The Shingwedzi River is located mostly in the Kruger National Park and then into Mozambique before it joins the Limpopo River.

The Olifants System falls within three provinces (Gauteng, Mpumalanga and the Limpopo Province). The main tributaries of the Olifants River 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.

The Letaba River catchment is drained by the Groot Letaba River and its major tributaries are the Klein-Letaba, Middle Letaba, Letsitele and Molototsi Rivers. The Shingwedzi River and its major tributaries the Shisha, Mphongolo and Phugwane drain the Shingwedzi River catchment.

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 ecological states.

The map of the study area is shown in **Figure 1**.

Figure 2 and **Figure 3** shows the catchment areas of the Olifants WMA and the EWR sites for which the Reserve has been determined. Additional sites for biological monitoring have been included to ensure the ecological integrity and necessary protection of these rivers remains intact. This additional sites will support the monitoring required for measuring compliance with the RQOs.

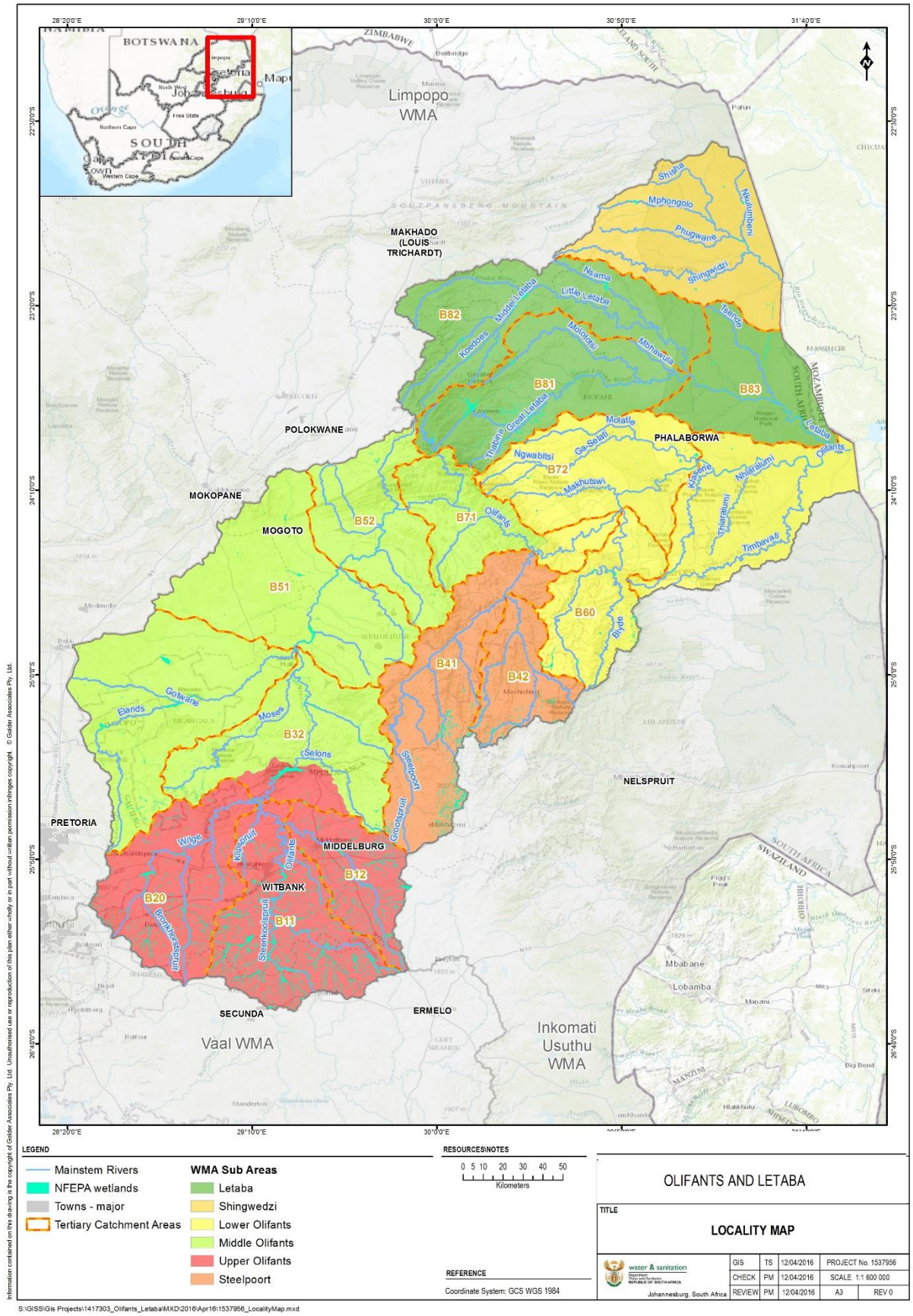

Figure 1: Olifants/Letaba System study area

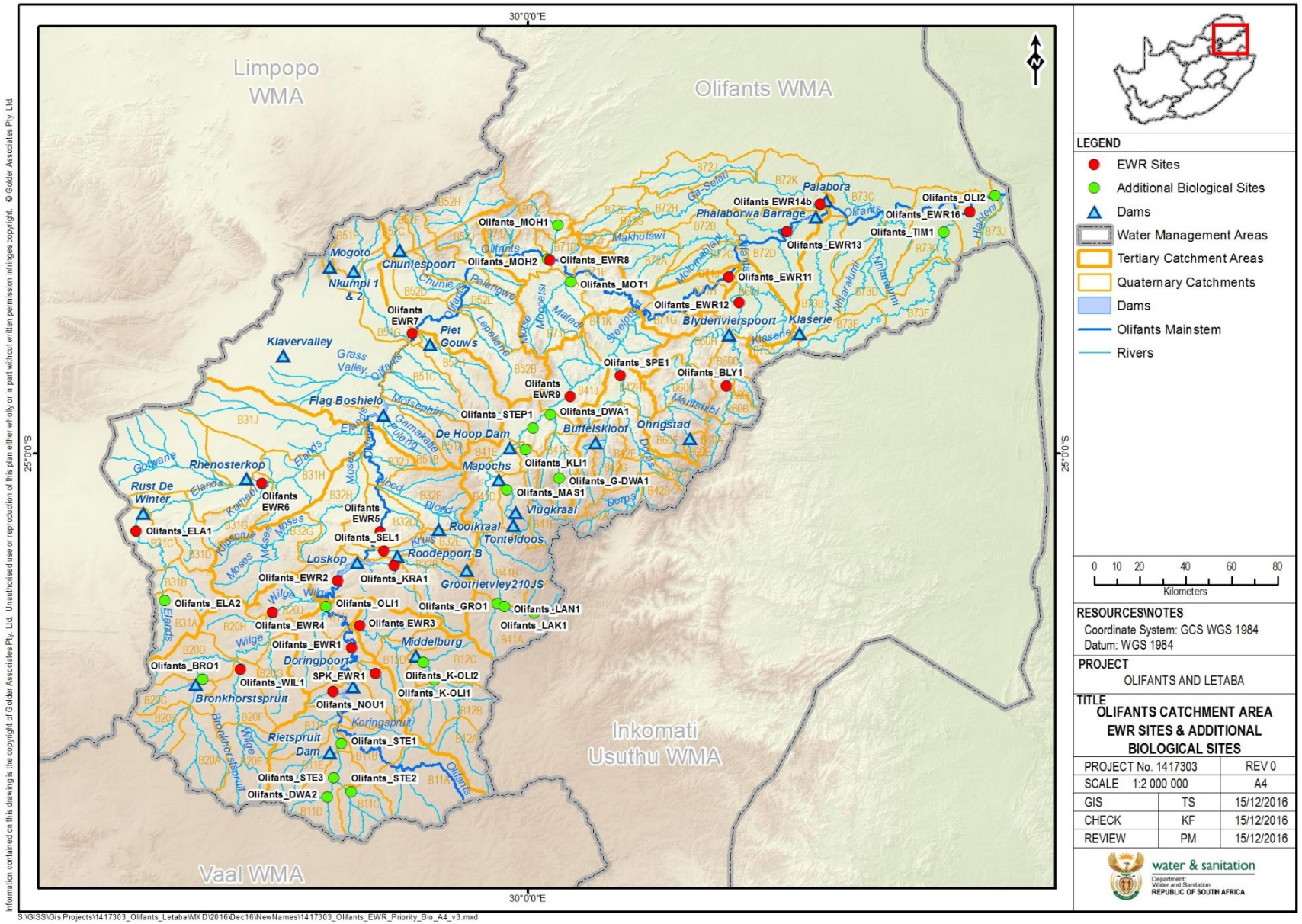

Figure 2: Map of the Olifants Catchment with EWR sites, and additional biological monitoring sites

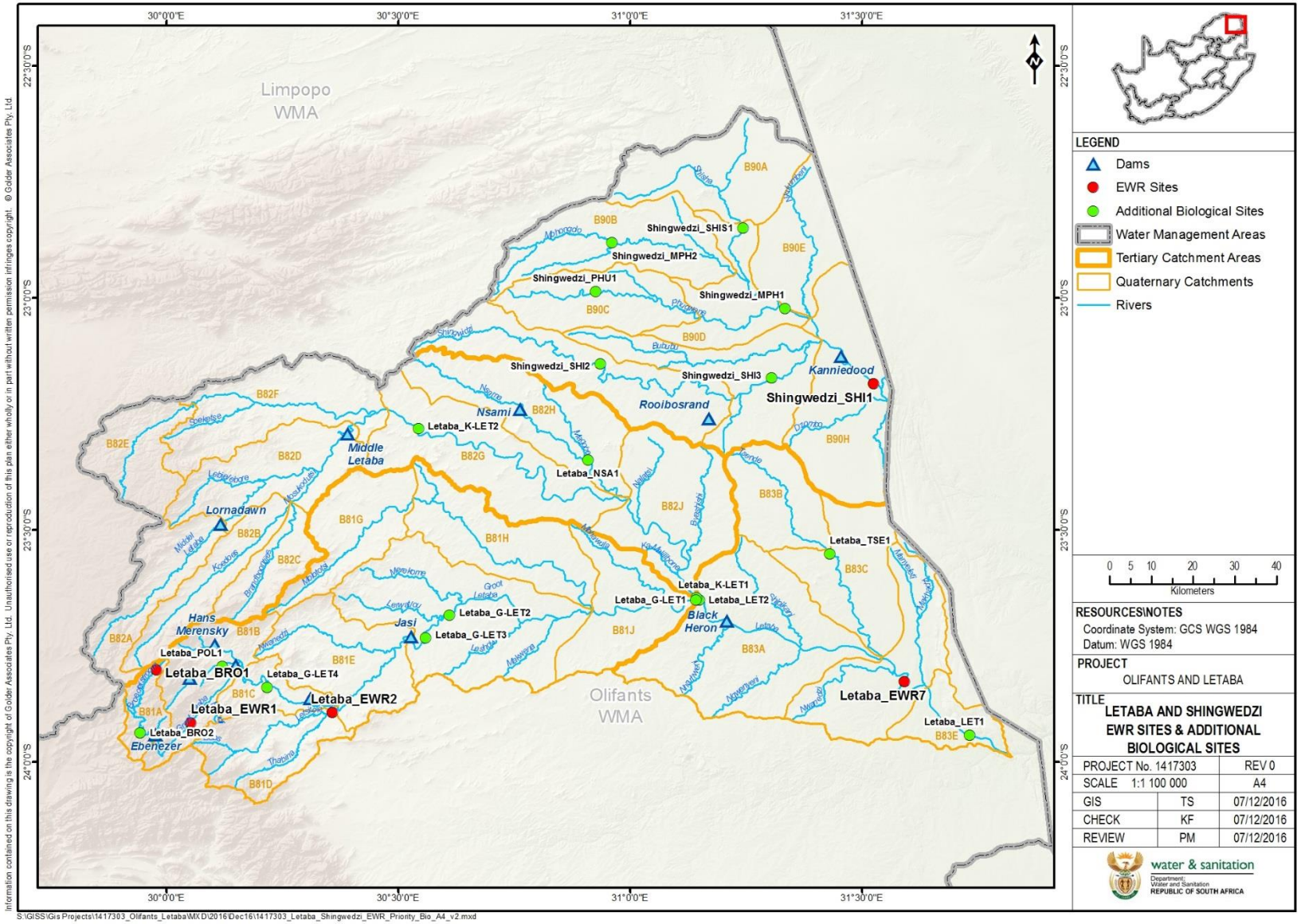

Figure 3: Map of the Letaba Shingwedzi Catchments illustrating the EWR sites and additional biological monitoring sites

2.1 ECOLOGICAL SITES AND CLASSIFICATION

Table 1 provides a summary of the information for all the EWR sites. These sites are where the ecological Reserve has been specified within the Olifants, Letaba and Shingwedzi catchments and ecological specifications are recommended. Furthermore**, Table 1** provides the site location coupled with the surrounding land based impacts.

These sites were selected based on the following criteria:

- Representative of a site per IUA;
- Should the site be located downstream of a large impoundment;
- Should the site be located within a protected area in terms of a Class 1 IUA;
- Where water quality was identified to be a major issue and further taking into account quality issues upstream of that particular site;
- Where flow was identified to be a major issue, and to further ensure adequate flow downstream of that site; and
- Whether the site requires protection with the purpose of achievinf the recommended ecological category in the Lower Olifants River within the Kruger National Park.

It is vital to ensure attention is placed on these priority EWR sites, as should the set ecological specifications be attained at these sites and provide an indication of the attainment of the Target Ecological Category (TEC), the crucial TEC of a C downstream at site Olifants_S16 (EWR16) on the Olifants in the Kruger National Park will be achieved. With this said, the DWS should still aim to implement the other EWR sites.

Table 2 provides a summary of additional monitoring sites in the study area where biotic specifications and/or conditions have been set to maintain the ecological integrity of the aquatic ecosystem (response components). This however defined in the absence of an EWR.This additional monitoring is related largely to rivers that are in a better ecological condition than that specified in terms of the water Resource Management Class. In such instances the present ecological state of these rivers is higher ecological category than that of the ecological category configuration of the IUA. Alternatively these include rivers where the ecological integrity has been comprised or degraded and requires intervention to a sustainable state.

A description of the most impacted sites are indicated in **Table 3**

Table 1: Locality and EWR site information

EWR site	Quaternary catchment/ Sub-reach	River	Coordinates	PES	EI_ES	REC	TEC	Site Location	Surrounding Impacts
Olifants Catchment									
Olifants_ELA1	B31C-00770	Upper Elands	-25.3031; 28.4631	C/D	Very high	C	C	The site is located on the Upper Elands River	• Very low flows • Exposed soils (erosion) • Agricultural activities • Several small dams • Artificial widening of river owing to a bridge • High organic material content observed namely algae and silt. This can be attributed largely to leaves from canopy
Olifants_EWR4	B20J-00998	Lower Wilge	-25.6196; 28.9991	C	High	B	B	The site is located on the Wilge River downstream of the confluence of Saalboomspruit and Bronkhortspruit river.	• Flow velocity was very low • Dense algae and fine sediments were observed • Green algae dominate in fast flowing water • Sediments noted out of channel and as a result less green algae • Agricultural activities • Upstream abstraction activities
Olifants_WIL1	B20F-01150	Upper Wilge	-25.8439; 28.8719	C/D	High	C	C	The site is located on the Upper Wilge River before the confluence with the Bronkhorstspruit River but upstream from the confluence with the Klein-Olifants	• Deeply incised banks that are collapsing. • High abundance of algae and silt • Some embeddedness. • Low flow is restricted by undercut and root wads. • Agricultural activities • Open cast mining – lowering of baseflow capacities
Olifants_EWR1	B11J-01086	Olifants	-25.7592; 29.3096	D	Moderate	C/D	D	The site is located on the Olifants downstream of the confluence with the Spookspruit	• Very low flow rate • Algae is dense • Some silt present • Water had a chemical smell • Upstream cultivation • Return flows from waste water treatment plants and inadequate treatment
Olifants_EWR3	B12E	Klein Olifants	-25.6736; 29.342	D	High	C	C/D	The site is located on the Klein-Olifants downstream from the Middleburg Dam and upstream of the confluence with the Olifants River.	• Very low flows • Algae present • Solid waste was observed in the river channel. Invasive plants (riparian) present • Town development • Downstream Middleburg dam • Mining activities • Industrial activities • Informal settlements
Olifants_EWR2	B32A-00937	Olifants	-25.4963; 29.2546	C	High	B/C	B/C	The site is located on the Olifants River downstream from the confluence of the Wilge and Klein-Olifants River just upstream of Loskop Dam.	• Very low flows • High algae
OLI_EWR3	B32A-00950	Kranspoortspruit	-25.4377; 29.4756	C	Very high	B	B	The site is located on the Kraanspoortspruit below the confluence of the Klip River.	• Water was discoloured • Algae and silt was observed covering cobbles. • Limited agricultural activities
Olifants_SEL1	B32C-00936	Selons	-25.3799; 29.4356	D	Very high	C	C	The site is located on the Selons upstream of the confluence with the Olifants and includes the Bobbejaansdoom and the Kruis rivers.	• Very low flows • Exposed soils (erosion) • Agricultural activities • Several small dams • Artificial widening of river due to incised and collapsing river banks • High organic material content observed namely algae and silt. This can be attributed largely to bank collapse
Olifants_EWR8	B71D-00412	Olifants	-24.2399; 30.0825	C	Moderate	C	C/D	The site is located on the Olifants downstream of the Flag Boshielo Dam below the confluence with the Mohlapitse River.	• Very low flows • High silt
Olifants_SPE1	B42H-00553	Lower Spekboom	-24.6942; 30.3613	C	High	B/C	C	The site is located on the Spekboom River	• Very low flows • Water discoloured green with some silt present. • Agricultural activities

EWR site	Quaternary catchment/ Sub-reach	River	Coordinates	PES	EI_ES	REC	TEC	Site Location	Surrounding Impacts
Olifants_BLY1	B60B-00566	Upper Blyde	-24.7344; 30.7783	C	High	B	B	The site is situated in the upper reaches of the Blyde River, upstream of the confluence with the Treur River and the Blyde River Canyon Reserve.	• Low flows • High silt loads observed. • Extensive agricultural activities (grazing, cultivation, forestry)
Olifants_EWR11	B71G-00428	Olifants	-24.3076; 30.7857	C	High	C	C/D	The site is located on the Olifants River upstream from the confluence of the Blyde River.	• Water was silty and substrate was smothered in fine silt • Return flows from agricultural activities • Upstream weir for water abstraction • Abstraction is high • Informal settlements • Cattle grazing
Olifants_EWR12	B60J-00444	Lower Blyde	-24.4075; 30.8274	C	High	B	B	The site is located on the Blyde River just upstream of the confluence with the Olifants River.	• Very low flows • Silt and algae present • Intensive agricultural activities • Excessive abstraction for agriculture • Upstream weir • Large upstream impoundment (Blyderivierpoort Dam)
Olifants_EWR13	B72D-00326	Olifants	-24.1284; 31.0146	C	Moderate	B/C	C	The site is located on the Olifants River 20km upstream from the Ga-Selati confluence, upstream of the Balule Nature Reserve Complex and Phalaborwa impacts (Ga-Selati River).	• Very low flows • Some silt • Low algae growth • Discharge at the gauging weir B7H007 was used • No hydraulic surveys undertaken • Agricultural activities • Human and cattle waste
Olifants_EWR16	B73H-00311	Olifants	-24.0494; 31.7318	D	High	B/C	C	This site is located on the Olifants River, the furthest downstream EWR site in the system approximately 6km upstream from the confluence with the Letaba River at the Olifants River Gorge (KNP Eastern border with Mozambique). It is below the confluence with the Timbavati River in the Park.	• Very low flows • Some stringy algae observed at site • Discharge at the gauging weir B7H015 as the weir just upstream of the site (B7H026) was still under construction) • Upstream weir • Industrial activities (Phalaborwa Industrial Complex)
Olifants_EWR5	B32D-00855	Olifants	-25.3040; 29.4220	C	High	C	C	The site is located on the Olifants River downstream from the confluence of the Selons River	• Exotic vegetation • Agricultural activities - irrigation • Effluent discharge
Olifants_EWR6	B31F-00654	Elands	-25.1160; 28.9565	E	Moderate	D	D	The site is located on the Elands River downstream of the Rhenosterkop Dam and Mkombo Nature Reserve	• Upstream weir • Large upstream impoundment (Rhenosterkop Dam) • Exotic vegetation
Olifants_EWR7	B51G-00482	Olifants	-24.5289; 29.5464	E	Moderate	D	D	The site is located on the Olifants River below Flag Bashielo Dam, upstream the confluence of the Ngwantsi	• Low flow • Setllements • Agricultural activities • Siltation • Human and cattle waste
Olifants_EWR9	B41H-00610	Steelpoort	-24.7750; 30.1650	D	High	C/D	C/D	The site is located on the middle reaches of Steelpoort River below the confluence of the Dwars (Steelpoort Park).	• Flow impacts • Water quality impacts
Olifants-EWR14b	B72K-00260	Lower Ga-Selati	-24.0225; 31.146667	E	Moderate	D	D	This site is located on the lower Ga-Selati River, near Foskor, (Lowveld Ecoregion), near the confluence with the Olifants River. This site was chosen because it is close to a biomonitoring site, and previous biological and hydraulic data were available.	• Water quality is poor • Algal growth • Sewage effluent impacts
SPK_EWR1	B11H-01161	Spookspruit	-25.8605; 29.4029	C	Moderate	C	C	This is an intermediate site located in lower reavhes of the Spookspruit upstream of its confluence with the Olifants River	• Extensive mining • Agricultural activities • Mine water discharges
DWA_EWR1	B41H-00640	Dwars	-24.8358; 30.08345	B/C	High	B/C	B/C	This site is located on the lower Dwars River upstream the confluence with the Steelpoort River	• Platinum mining
Olifants_EWR10	B41K-00487	Steelpoort	-24.4965; 30.399	D	High	D	D	This site is located on the lower reaches of the Steelpoort River towards the confluence of the Olifants River (Great Escarpment	• Large upstream impoundment (De Hoop Dam) – impact on flow

EWR site	Quaternary catchment/ Sub-reach	River	Coordinates	PES	EI_ES	REC	TEC	Site Location	Surrounding Impacts
								Mountains Ecoregion)	
OLI_EWR8	B60H-00485	Ohrigstad	-24.5473; 30.73807	C	Moderate	C	C	This site is located in quaternary catchment B60H and is situated on the R532 road to Blyde River Canyon. The site falls within the Blyde Nature Reserve. No gauging weirs are present in the vicinity of the selected site.	• Land use impacts • Intensive irrigation • Water quality impacts
Olifants_EWR14a	B72H-00282	Upper Ga-Selati	-24.0012; 30.6823	C	Moderate	C	C	This site is located in Ermelo Ranch, on the middle Selati River (Lowveld Ecoregion)	• Land use impacts
Letaba Catchment									
Letaba-EWR7	B83D-00250	Letaba	-23.8268; 31.5906	C/D	High	C	C	The site is located on the Letaba River in the Kruger National Park just upstream of Letaba Rest Camp and the Engelhard Dam/weir.	• Very little upstream impacts • No invasive vegetation observed • Limited impacts from flow modifications • Some trampling by mega herbivores – increased erosion during the drought period • Some poor water quality related to anthropogenic impacts from outside the KNP
Letaba-EWR2	B81D-00271	Letsitele	-23.8932; 30.3576	D	High	D	D	The site is located on the Letsitele River just downstream gauging weir B8H010 and upstream the Letaba River confluence.	• Large scale town developments and informal settlements • Poor infrastructure planning • Wood harvesting • Over grazing and trampling • Removal of riparian vegetation • Cultivation and some commercial farming • Water abstraction • Forestry in the upper catchments • Poor sanitation and sewerage treatment • Alien invasive plants – aquatic and terrestrial
Letaba-EWR1	B81B-00264	Great Letaba	-23.9178; 30.0507	C/D	High	C	C	The site is located on the Great Letaba River between Ebenezer and Tzaneen Dams in the upper foothills geozone.	• Extensive forestry • Developments into the riparian zone • Limited sewerage into river – poor infrastructure • Alien invasive vegetation in the riparian zone • Limited erosion • Upstream informal settlements • Upstream impoundments (Dap Naude, Ebenezer)
Letaba_BRO1	B81A-00242	Broederstroom	-23.8011; 29.9772	B/C	High	B/C	B/C	The site is located in the upper catchment on the Broederstroom just upstream of Dap Naude Dam.	• Extensive forestry • Deposition (upstream forestry) • Invasive plants and fish
Shingwidzi catchment									
Shingwedzi_SHI1	B90H-00117	Shingwidzi	-23.1849; 31.5251	C	High	B/C	B/C	The site is located on the lower reaches of the Shingwedzi River before it enters Mozambique downstream of the Kanniedood Dam in the Kruger National Park.	• Abstraction outside KNP and for rest camp/staff village • Water quality pollution from outside Kruger National Park • Erosion and siltation – due to trampling

Table 2: Locality and Biological moitoring site information

Biological site	Quaternary catchment	River	Coordinates	Sub-reach	Site Location	Surrounding Impacts
Olifants Catchment						
Olifants_STE1	B11E	Steenkoolspruit	-26,0824.61; 29,1608.27	B11E-01297	The site is located on the lower Steenkoolspruit upstream of the confluence with the OLifants River	• Flow velocity very low. • *Azolla* (red fern) abundant. • High sediment • High algae.
Olifants_STE2	B11C	Steenkoolspruit	-26,1928.78; 29,1827.39	B11C-01449	The site is located on the upper Steenkoolspruit upstream of the confluence with the Dwars-in-die-Wegspruit	• Siltation • Organic pollution • Erosion • Trampling

Biological site	Quaternary catchment	River	Coordinates	Sub-reach	Site Location	Surrounding Impacts
Olifants_DWA2	B11D	Dwars-in-die-wegspruit	-26,2040.27; 29,1244.90	B11D-01467	The site is located on the Dwars-in-die-Wegspruit, upstream from the confluence with the Steenkoolspruit	• Low flows • Siltation • Organic pollution • Erosion impacts
Olifants_STE3	B11D	Steenkoolspruit	-26,1608.94; 29,1417.73	B11D-01366	The site is located on the Steenkoolspruit downstream of the confluence with the Dwars-in-die-Wegspruit	• Low flows • Sewage pollution • Over grazing • Trampling • Alien vegetation
Olifants_OLI1	B11L	Olifants	-25,3550.23; 29,1227.42	B11L-01024	The site is well located on the Olifants River below the confluences of the Klein Olifants and Klipspruit but above the Wilge confluence.	• Water quality impacts • Poorly treated sewage effluent • Alien vegetation • Sedimentation
Olifants_K-OLI1	B12B	Klein Olifants	-25,5305.62; 29,3758.39	B12B-01192	The site is located on the Klein-Olifants River upstream of Middleburg Dam.	• Erosion • Poorly treated sewage effluent • Siltation • Trampling
Olifants_K-OLI2	B12C	Klein Olifants	-25,4903.25; 29,3525.98	B12C-01153	The site is located on the Klein-Olifants River upstream of Middleburg Dam.	• Erosion • Water quality impacts • Poorly treated sewage effluent
OLIFANTS_BRO	B20D	Bronkhorstspruit	-25,5304.5; 28,4325.7	B20D-01146	The site is located on the Bronkhortspruit River.	• Moderate flows as a result of release from the dam • Floating debris • Sedimentation and organics observed. • Lots of algae and diatoms present (long stringy algae). • Upstream Bronkhorstspruit dam • High algae
Olifants_ELA2	B31A	Elands	-25,3430.04; 28,3435.79	B31A-00963	The site is located on the upper Elands River in the headwater of the catchment.	• Flow impacts • Silt • Sewage effluent • Alien vegetation
Olifants_GRO1	B41A	Grootspruit	-25.58372, 29.87910	B41A-01025	The site is located on the Grootspruit just before the confluence with the Steelpoort and the Langspruit.	• Agricultural activities • Cultivation • Grazing • Incised banks
OLI-LAN1	B41A	Langspruit	-25.592544, 29.898643	B41A-01047	The site is located on the Langspruit upstream with the confluence of the Grootspruit where it forms with Steelpoort River.	• Historical quarry upstream • Cultivation • Water abstraction • Grazing • Agricultural activities • Collapsed banks and erosion
Olifants_MAS1	B41C	Masala	-25,0827.6; 29,5459.4	B41C-00766	The site is located on the Masala River adjacent to a private lodge upstream of De Hoop Dam and the confluence of the Steelpoort River.	• Very low flows • Mining activities • Agricultural activities • Dry land cultivation • Informal settlements • Stream diversions and modifications
Olifants_KLI1	B41F	Klip	-24,5904.58; 29,5919.70	B41F-00699	The site is located in the lower Klip River prior to its confluence into the De Hoop Dam.	• Very low flows • Silt higher than expected • Some algae • Detritus • According to local information the DWS noted severe pollution from the mines during construction of De Hoop.
Olifants_STEP1	B41H	Steelpoort	-24,894400; 30.017083	B41H-00610	The site is located on the main stem of the Steelpoort River downstream of the De Hoop Dam.	• Very low flows • Silt • Agricultural activities

Biological site	Quaternary catchment	River	Coordinates	Sub-reach	Site Location	Surrounding Impacts
						• Impacts from grazing • Wood harvesting (wood crafters) • Mining activities • Exposed soils
Oliants_DWA1	B41H	Dwars	-245038.33; 30,0530.24	B41H-00640	The site is located in the Dwars River, upstream of the confluence of the Steelpoort River.	• Very low flow • Substrate has fine silt. • Detritus build up noted - linked to canopy cover. • Upstream flow modifications • Abstraction • Weirs present
Oliants_G-DWA1	B41G	Groot Dwars	-25,0539.99; 30,0720.72	B41G-00721	The site is located in the Groot Dwars River upstream of the Der Brochen Dam.	• Extensive mining activities • Grazing and cultivation activities
Olifants_MOH1	B71C	Mohlapitse	-24,0613.01; 30.0706.47	B71C-00292	The site is located on the Mahlapitse River downstream of the Wolkberg Wilderness Trail and Lekgalameetse Nature Reserve.	• Low flow • High silt present following rain • Wood harvesting • Cattle grazing
Olifants_MOH2	B71B	Mohlapitse	-24,1413.08; 30,0435.75	B71B-00335	The site is located on the Mohlapiste upstream from the confluence of the Olifants River (Site S10).	• Low flow observed. • Invasive vegetation within the riparian zone. • High sedimentation. • Water had a blue soapy feel and look to it. • Agricultural activities • Cattle grazing • Cultivation
Olifants_MOT1	B71E	Motse	-24,1852.46; 30,1023.34	B71E-00429	The site is located on the Motse River just upstream with the confluence of the Olifants River.	• Very low flows, mostly ephemeral • Water discoloured green with some silt present. • Informal settlement • Grazing and trampling • Cultivation • Wood harvesting
Olifants_TIM1	B73G	Timbavati	-24.119665, 31.632990	B73G-00339	The site is located on the Timbavati River within a protected reserve.	• Flow impacts • Water quality impacts
Olifants_OLI2	B73J	Olifants	-23.98734, 31.828179	B73J-00304	The site is located downstream of the Olifants and Letaba confluence and is the most downstream site of the greater catchment.	• Site is located within a protected area. • Located within the gorge downstream of the Olifants and Letaba catchment • Most downstream site of the greater catchment
Letaba Catchment						
Letaba_BRO2	B81A	Broederstroom	-23.9328, 29.94485	B81A-00270	The site is located in the Broederstroom, upstream of the Ebenezer Dam.	• Low flows • Plantations • Exposed soils
Letaba_POL1	B81B	Politsi	-23.7923, 30.11532	B81B-00240	The site is located in the Politsi River, upstream of the Tzaneen Dam.	• Low flows • Silt • Agricultural activities • Informal settlements • Wood harvesting (plantations) • Some sewerage from informal areas • Exposed soils
Letaba_G-LET4	B81C	Groot Letaba	-23.8395, 30.21627	B81F-00231	The site is located in the Groot Letaba just downstream of the town of Tzaneen, Tzaneen Dam and Yamorna Weir.	• Flow regime modified from Lake Tzaneen - low flows • Abstraction, weirs and dams • Fragmented river • Agricultural activities • Informal settlements • Sewerage and chemical pollution
Letaba_G-LET3	B81E	Groot Letaba	-23.735, 30.50999	B81F-00231	The site is located in the Groot Letaba, upstream from site Letaba_G-LET2	• Low flows - controlled • Fragmentation of river – weirs and dams • Abstractions • Agricultural activities • Impacts from grazing • Wood harvesting • Erosion

Biological site	Quaternary catchment	River	Coordinates	Sub-reach	Site Location	Surrounding Impacts
						• Exposed soils
Letaba_G-LET2	B81F	Groot Letaba	-23.6596, 30.63574	B82G-00135	The site is located in the Groot Letaba, upstream from the Hans Merensky Nature Reserve.	• Low flows • Fragmentation – weirs and dams • Agricultural activities • Rural activities • Wood harvesting • Removal of riparian vegetation • Erosion
Letaba_G-LET1	B81J	Groot Letaba	-23.652, 31.13173	B81J-00219	The site is located in the Groot Letaba upstream before the confluence with the Klien Letaba (becoming Letaba River).	• Very low flows • Silt • Agricultural activities • Impacts from grazing • Wood harvesting in the riparian zone • Fragmentation due to dams and weirs • Exposed soils • Abstraction • Return/runoff flows – agricultural and sewerage
Letaba_K-LET2	B82G	Klein Letaba	-23.281, 30.54316	B82G-00135	The site is located in the Klein Letaba directly downstream of the weir located near Hlaneki.	• Very low flows • Silt • Agricultural activities • Impacts from grazing • Wood harvesting (wood crafters) • Weir • Abstraction • Exposed soils, trampling and erosion
Letaba_NSA1	B82H	Nsama	-23.3488, 30.90899	B82H-00157	The site is located in the Nsama River, downstream of the Hudson Ntsanwisi Dam and before the confluence with the Klein Letaba.	• No flow during survey • Silt high • Agricultural activities • Impacts from grazing • Wood harvesting • Exposed soils • Trampling
Letaba_K-LET1	B82J	Klein Letaba	-23.6459, 31.14202	B82J-00201	The site is located in the lower section of the Klein Letaba River before the confluence with the Groot Letaba (becoming Letaba River).	• Abstraction • Exposed soils • Poor land-use practices • Poor infrastructure • Erosion and siltation
Letaba_LET1	B83A	Letaba	-23.6505, 31.14846	B83A-00220	The site is located in the Letaba River, just below the confluence of the Groot and Klein Letaba tributaries.	• Siltation limited – outside influence • Low flows related to excessive abstraction • Fragmentation – numerous dams and weirs • Exposed soils due to trampling – drought related
Letaba_TSE1	B83C	Tsende	-23.5361, 31.41703	B83B-00161	The site is located in the Tsende River, downstream of Pioneer Dam (Mopani Rest Camp) and upstream of the Mooiplaas picnic area (Tsendze Rustic Camp Site).	• Very low flows • Impoundment (Pioneer dam) upstream
Letaba_LET2	B83E	Letaba	-23.9422, 31.73159	B83E-00265	The site is located in the lower section of the Letaba River before it joins the Olifants River.	• Very low flows • Some siltation due to trampling in park – drought related • Abstraction outside park – dams and weirs
Shingwedzi catchment						
Shingwedzi_SHIS1	B90D	Shisha	-22.8689, 31.22339	B90D-00067	The site is located in the Shisha River which is predominantly within the Kruger National Park.	• No flow – pools only • Some silt • Site seasonal – part of large, flat catchment
Shingwedzi_MPH2	B90D	Mphongolo	-23.0238, 31.33415	B90D-00112	The site is located in the Mphongolo River, downstream of the confluence with the Phugwane and Shisha Rivers.	• Very low flows • Trampling • Some bank destabilisation
Shingwedzi_MPH1	B90B	Mphongolo	-22.8807, 30.96024	B90B-00082	The site is located in the Mphogolo River where the river enters the Kruger National Park.	• No flow • Silt • Agricultural activities (upstream) • Impacts from grazing(upstream) • Wood harvesting (upstream) • Exposed soils (upstream)

Biological site	Quaternary catchment	River	Coordinates	Sub-reach	Site Location	Surrounding Impacts
						• Sewerage (upstream)
Shingwedzi_PHU1	B90C	Phugwane	-22.9862, 30.92536	B90C-00106	The site is located in the Phugwane River where the river enters the Kruger National Park.	• No flow during survey • Silt • Agricultural activities • Impacts from grazing • Wood harvesting • Sewerage • Exposed soils
Shingwedzi_SHI2	B90F	Shingwedzi	-23.1417, 30.93512	B90F-00114	The site is located in the Shingwedzi River as it enters the Kruger National Park.	• Abstraction • Silt • Agricultural activities • Impacts from grazing • Wood harvesting (wood crafters) • Mining activities (old discarded mines) • Exposed soils • Sewerage
Shingwedzi_SHI3	B90G	Shingwedzi	-23.1724, 31.30491	B90G-00130	The site is located in the Shingwedzi River downstream of the geological feature exposed by the river (sandstone slab) know as Red Rocks. This site is above the confluence of the Mphongolo (including: Shisha and Phugwane).	• Very low flows • Some pollution from outside KNP

Table 3: Most impacted sites in the system

Most impacted sites		Poor Aquatic biota	Flow	Serious water quality issues	Reason
River	**Site name**				
Olifants	Olifants_EWR1	√	√	√	• Extensive coal mining • Acid mine drainage • Urbanisation • Return flows from Wastewater treatment works (WWTW) • Limited releases from Witbank Dam
Wilge	Olifants_EWR4	√	√	√	• Increased coal mining • Urbanisation • Increased return flows from WWTW
Klein-Olifants	Olifants_EWR3	√		√	• Extensive mining • Agriculture • Limited releases from Middelburg Dam • Untreated/poorly treated sewerage
Middle reaches of the Olifants from Flag Boshielo Dam to the border of KNP	Olifants_EW7	√	√	√	• Limited releases from Flag Boshielo Dam, De Hoop Dam and Blyderivierpoort Dam • Extensive agriculture • Erosion due to high cattle trampling and over grazing.
Lower Blyde River	Olifants_EWR12	√	√	√	• Extensive agricultural • Limited releases from Blyderivierpoort Dam
Olifants River in KNP	Olifants_EWR16	√	√		• PES D instead of a C • Can't provide the flows to support aquatic biota

Most impacted sites		Poor Aquatic biota	Flow	Serious water quality issues	Reason
River	Site name				
Groot Letaba	Letaba-EWR1	√	√	√	• Limited releases from upstream large dams • Extensive forestry • Urbanisation • Alien invasive vegetation in the riparian zone • Limited releases from Dap Naude, Ebenezer Dams
Letaba River in KNP	Letaba-EWR7	√	√	√	• Limited releases from upstream large dams • Nutrient enrichment • Extensive agriculture outside the KNP.
Shingwedzi River	SHI1	√	√	√	• Extensive use outside the KNP impacts the flows at this site • Ephemeral system

2.2 TARGET ECOLOGICAL WATER REQUIREMENTS

The EWRs for the TEC for all the EWR sites are given in **Table 4**. The EWR specifies the magnitude, duration and timing of specific flows and flow patterns that are considered to be the most important for maintaining the abiotic and biotic components of the TEC. EWRs are provided as the long-term mean percentages of the natural MAR (nMAR). The EWR flows constituted between 10 and 50 % of the nMAR for the rivers in the Olifants/Letaba System.

The quantification of the EWRs used the Desktop Reserve Model (DRM) (SPATSIM, version 2.12) and the results of the hydraulic modelling to calculate and evaluate the Ecological Water Requirements (quantity) for the REC and the final TEC at the EWR sites.

These EWR flow data were converted to hydraulic conditions at the rapid III EWR sites (i.e. depths and flow velocities at discharges measured in m^3/s) using a hydraulic model and evaluated by the ecologists. Where the modelled requirements were not adequate to provide the envisaged protection, the DRM was adjusted accordingly.

The following approaches were used:

- Verification of the drought and base flows (maintenance flows) using the DRM and hydraulic cross-sections;

- Specification of freshets and annual floods at the new rapid sites;
- Assessment of the freshets and annual floods specified during the previous preliminary Reserve studies, taking the release capacities of dams (where available) into consideration. These freshets were adjusted where required when higher than the release capacities of the dams;
- Assessment of the equal drought and base flows as specified at specific EWR sites for the Olifants catchment during the 2001 comprehensive study. Adjustments were made to these flow requirements, using the hydraulic cross-sections and habitat availability during drought periods.
- The quantified EWRs (RECs) were assessed, to evaluate the ecological responses to selected flow scenarios.
- Evaluation of ecological consequences and operational considerations based on the planning scenarios that considered the impact of the different ecological categories on the yield of the dams in the system;
- Adoption of the recommended scenario and defining the ecological specifications and monitoring requirements for maintenance of the Reserve for the rivers in the Olifants, Letaba and Shingwedzi catchments.

These final Ecological Reserve flow requirements for the TECs have been specified in the format of assurance tables and EWR rule curves. These curves specify the frequency of occurrence relationships of the defined maintenance and drought flow requirements for each month of the year. The tables thus specify the percent of time that defined flows should equal or exceed the flow regime required to satisfy the ecological Reserve.

The EWRs for the EWR sites are summarised below in **Table 4** for the Olifants, Letaba and Shingwedzi catchments respectively, as well as the TEC to be attained.

Table 4: Ecological Water Requirements and Target Ecological Category (TEC) for the EWR sites

EWR Site	River	Quaternary catchment	NMAR (Mm^3/a)	TEC	Total EWR as %NMAR	Maintenance Low flows as %NMAR	Drought Low flows as %NMAR	Freshets as %NMAR*
Olifants_ELA1	Upper Elands	B31C	31.08	C	20.87	10.61	4.93	10.26
Olifants_EWR1	Olifants	B11J	184.54	D	17.8	11.51	4.17	6.29
Olifants_EWR3	Klein Olifants	B12E	81.54	C/D	19.8	9.99	5.08	9.81
Olifants_EWR4	Lower Wilge	B20J	175.59	B	36.28	21.59	6.28	14.69
Olifants_WIL1	Upper Wilge	B20F	44.76	C	15.11	7.43	4.80	7.68
Olifants_EWR2	Olifants	B32A	500.63	B/C	29.83	23.11	6.10	6.72
OLI_EWR3	Kranspoortspruit	B32A	13.258	B	30.26	16.85	1.80	13.41
Olifants_SEL1	Selons	B32C	33.11	C	21.86	12.47	7.11	9.39
Olifants_EWR6	Lower Elands	B31G	60.32	D	10.48	7.30	3.29	3.18
Olifants_EWR5	Olifants	B32D	571.13	C	12.51	10.31	2.76	2.20
Olifants_EWR9	Steelpoort	B41H	137.5	C/D	23.33	15.16	6.66	8.18
Olifants_EWR10	Steelpoort	B41K	342.75	D	12.69	8.80	8.08	3.89
Olifants_EWR7	Olifants	B51G	736.94	D	9.89	8.78	1.72	1.12
Olifants_EWR8	Olifants	B71D	813.04	C/D	15.19	11.78	6.26	3.41
Olifants_SPE1	Spekboom	B42H	148.19	C	23.16	12.61	6.31	10.55
Olifants_EWR12	Lower Blyde	B60J	383.5	B	31.14	26.17	10.68	4.97
Olifants_EWR11	Olifants	B71J	1 321.92	C/D	12.81	9.86	6.26	2.94
Olifants_EWR13	Olifants	B72D	1762.1	C	23.23	18.14	7.99	5.09
Olifants_EWR14a	Upper Ga-Selati	B72H	52.2	C	27.53	20.48	0.00	7.05
Olifants_EWR14b	Lower Ga-Selati	B72K	72.74	D	19.45	12.65	0.00	6.81
Olifants_EWR16	Olifants	B73H	1 918.3	C	21.06	17.72	10.01	3.34

EWR Site	River	Quaternary catchment	NMAR (Mm^3/a)	TEC	Total EWR as %NMAR	Maintenance Low flows as %NMAR	Drought Low flows as %NMAR	Freshets as %NMAR*
Olifants_BLY1	Upper Blyde	B60B	164.45	B	46.08	35.96	12.16	10.12
SPK-EWR1	Spookspruit	B11H	9.322	C	30.12	14.82	7.87	15.29
DWA_EWR1	Dwars	B41H	26.1	B/C	31.24	23.40	8.78	7.84
OLI_EWR8	Ohrigstad	B60H	67.79	C	17.41	16.36	5.66	1.05
Letaba_EWR7	Letaba	B83D	646.28	C	17.34	13.88	4.91	3.46
Letaba_EWR2	Letsitele River	B81D	116.55	D	17.59	13.09	7.89	4.49
Letaba_EWR1	Great Letaba	B81B	99.85	C	24.76	17.58	9.56	7.18
Letaba_BRO1	Broederstroom	B81A	6.68	B/C	49.22	39.61	14.58	9.60
Shingwedzi_SHI1	Shingwedzi	B90H	86.42	B/C	22.50	6.41	0.00	16.09

* For release purposes, the freshets as specified in the EWR report should be used and not the summary as a % of the NMAR

3 ECOLOGICAL SPECIFICATIONS: DESCRIPTORS USED TO SPECIFY ECOLOGICAL CONDITION

Ecological specifications (Ecospecs) defined for drivers and responses serve as the ecological objectives that must be met. Specification of the ecological attributes and the driver components would provide an indication of the attainment of the TEC. The monitoring of these specifications and the drivers would determine how a resource is changing over time and whether the Reserve is being met. If not met, management intervention may be required to order to attain the desired ecological category. A brief description of each component

In Section 4, Ecospecs are provided for the following components (drivers and responses):

- Flow;
- Water Quality;
- Macroinvertebrates;
- Fish; and
- Habitat Integrity.

A brief description of the nature and content of the ecological specifications of these driver and response components is provided below.

3.1 FLOW

The flow ecological specifications are encompassed in the EWRs summarised in Section 2.2. The following descriptors of the flow characteristics are used to describe the EWRs in terms of ecological specifications:

- Total Mean Annual Maintenance and drought low flow volumes
- Monthly Mean Maintenance and drought low flows
- Monthly exceedance curves for the low flows (excluding freshets and floods)
- Monthly exceedance curves for the complete flow regime
- Duration, magnitude (in daily average peak), volume and timing of intra-annual floods.

The Reserve flow specifications (requirements) for the EWR sites in the study area is provided in Section 4.1 of this report. These have been determined based on the natural hydrology, the hydraulic characteristics of the site and the ecological specialist's interpretation of the habitat requirements of the biota. These have been defined as a set of Reserve assurance rules (frequency of occurrence tables of flow rates or volumes for different months of the year).

3.2 WATER QUALITY

The water quality Ecospecs of the Ecological Reserve include a range of selected variables that

provide baseline data that would provide an interpretation of biological responses and whether water quality as a driver is a problem. Monitoring and assessment of the physico-chemical data provides an understanding of the water quality impacts in the system, and an indication of whether the water quality contributes to the ecological category of the site. Water Quality Ecospecs are presented in Section 4.2 of this report.

The following water quality variables are included in the water quality Ecospecs either quantitatively or qualitatively:

- Physico-chemical: pH, Water temperature (°C), Dissolved oxygen (DO) in mg/L; Electrical conductivity (mS/m), Turbidity (NTU)
- Nutrients: Total Inorganic Nitrogen, ammonia, phosphate
- Major Ions: Calcium (Ca), magnesium (Mg), sodium (Na), sulphate (SO_4) and chloride (Cl)
- Chlorophyll a (Chl a) as periphyton algae (mg/m^2); Chlorophyll a as phytoplankton algae (µg/L)
- Toxicants: Metal ions (such as Al, Fe, Mn), pesticides, in-stream toxicity, fluoride (F).

3.3 MACROINVERTEBRATES

The descriptors for the macroinvertebrates were derived from DWAF (2008, 2007b) and Kleyhans and Louw (2006), and are based on a combination of target SASS5 scores and site-specific requirements for the presence of individual taxa. This approach was chosen because of the practicality of using existing biomonitoring practices, as well as the greater precision afforded by focusing on taxa with fairly well known habitat requirements.

The descriptors of the macroinverbrates are given below which is based on baseline and reference data:

- South African Scoring System Version 5 (SASS5) Scores;
- Average score per taxon (ASPT); and
- Biotopes/habitats.

3.4 FISH

The fish communities will be affected in several ways by flow regulation and water quality (drivers). These include both beneficial and adverse effects. Some species may increase in abundance in the rivers whereas others may be lost from a specific reach. In particular, flow plays a critical role in mediating relative abundances of native and non-native species, with low, constant flows benefiting invasive alien species. Water quality, as a driver, would impact on the health of the ecosystem, influencing the habitat and causing changes to the fish communities.

Baseline and reference data has been used as criteria to determine the species for the descriptors of the fish ecospecs.

3.5 HABITAT INTEGRITY

Fish communities, invertebrate and riparian assemblage will respond to habitat changes related to changes in water level and water quality. Conditions related to habitat integrity have been specified based on baseline data.

4 ECOLOGICAL SPECIFICATIONS AND MONITORING

4.1 Flow

The EWR requirements for all the EWR sites are included in the tables that follow below. A TEC is specified at all the key sites at which ecological consequences have been evaluated, however this is still under review. The associated rule and tab tables per site are included as Appendix A.

Table 5: EWR Requirements for Upper Elands: **Olifants_ELA1**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B31C**
River	Upper Elands
EWR Site Co-ordinates	S25.3031, E28.4631
Recommended Ecological Category	C
NMAR at EWR site	31.075
Total EWR	6.485 (20.87 %MAR)
Maintenance Low flows	3.296 (10.61 %MAR)
Drought Low flows	1.533 (4.93 %MAR)
Maintenance High flows	3.189 (10.26 %MAR)

Table 6: EWR Requirements for Lower Wilge: **Olifants_EWR4**

EWR Table: B TEC (flows in million m^3 per annum)

Quaternary Catchment	**B20J**
River	Lower Wilge
EWR Site Co-ordinates	S25.6196, E28.9991
Target Ecological Category	B
NMAR at EWR site	175.58
Total EWR	63.698 (36.28%MAR)
Maintenance Low flows	37.907 (21.59%MAR)
Drought Low flows	11.029 (6.28%MAR)
Maintenance High flows	25.790 (14.69 %MAR)

Table 7: EWR Requirements for the Upper Wilge: **Olifants_WIL1**

EWR Table: C REC (flows in million m^3 per annum)

Quaternary Catchment	**B20F**
River	Upper Wilge
EWR Site Co-ordinates	S25.8439, E28.8719
Recommended Ecological Category	C
NMAR at EWR site	44.755
Total EWR	6.763 (15.11 %MAR)
Maintenance Low flows	3.326 (7.43 %MAR)
Drought Low flows	2.151 (4.80 %MAR)
Maintenance High flows	3.437 (7.68 %MAR)

Table 8: EWR Requirements for the Olifants: **Olifants_EWR1**

EWR Table: D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B11J**
River	Olifants
EWR Site Co-ordinates	S25.7592, E29.3096
Target Ecological Category	D
NMAR at EWR site	184.53
Total EWR	32.845 (17.80 %MAR)
Maintenance Low flows	21.233 (11.51 %MAR)
Drought Low flows	7.704 (4.17 %MAR)
Maintenance High flows	11.612 (6.29 %MAR)

Table 9: EWR Requirements for the Klein Olifants: **Olifants_EWR3**

EWR Table: C/D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B12E**
River	Klein Olifants
EWR Site Co-ordinates	S25.6736, E29.342
Target Ecological Category	C/D
NMAR at EWR site	81.539

Quaternary Catchment	B12E
Total EWR	16.146 (19.80 %MAR)
Maintenance Low flows	8.145 (9.99 %MAR)
Drought Low flows	4.143 (5.08 %MAR)
Maintenance High flows	8.001 (9.81 %MAR)

Table 10: EWR Requirements for the Olifants: **Olifants_EWR2**

EWR Table: B/C TEC (flows in million m^3 per annum)

Quaternary Catchment	B32A
River	Olifants
EWR Site Co-ordinates	S25.4963, E29.2546
Target Ecological Category	B/C
NMAR at EWR site	500.63
Total EWR	149.364 (29.83 %MAR)
Maintenance Low flows	115.720 (23.11 %MAR)
Drought Low flows	30.564 (6.10 %MAR)
Maintenance High flows	33.644 (6.72 %MAR)

Table 11: EWR Requirements for the Kranspoortspruit: **OLI_EWR8**

EWR Table: B REC (flows in million m^3 per annum)

Quaternary Catchment	B32A
River	Kranspoortspruit
EWR Site Co-ordinates	S25.4377, E29.4756
Recommended Ecological Category	B
NMAR at EWR site	13.858
Total EWR	4.194 (30.26 %MAR)
Maintenance Low flows	2.335 (16.85 %MAR)
Drought Low flows	0.250 (1.80 %MAR)
Maintenance High flows	1.859 (13.41 %MAR)

Table 12: EWR Requirements for the Selons River: **Olifants_SEL1**

EWR Table: C REC (flows in million m^3 per annum)

Quaternary Catchment	**B32C**
River	Selons
EWR Site Co-ordinates	S25.3799, E29.4356
Recommended Ecological Category	C
NMAR at EWR site	33.109
Total EWR	7.237 (21.86 %MAR)
Maintenance Low flows	4.130 (12.47 %MAR)
Drought Low flows	2.356 (7.11 %MAR)
Maintenance High flows	3.107 (9.39 %MAR)

Table 13: EWR Requirements for the Olifants: **Olifants_EWR 8**

EWR Table: C/D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B71D**
River	Olifants
EWR Site Co-ordinates	S24.2399, E30.0825
Target Ecological Category	C/D
NMAR at EWR site	813.17
Total EWR	123.52 (15.19 %MAR)
Maintenance Low flows	95.791 (11.78 %MAR)
Drought Low flows	50.939 (6.26 %MAR)
Maintenance High flows	27.734 (3.41 %MAR)

Table 14: EWR Requirements for the Lower Spekboom River: **Olifants_SPE1**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B42H**
River	Lower Spekboom
EWR Site Co-ordinates	S24.6942, E30.3613
Target Ecological Category	C

NMAR at EWR site	148.19
Total EWR	34.316 (23.16 %MAR)
Maintenance Low flows	18.687 (12.61 %MAR)
Drought Low flows	9.346 (6.31 %MAR)
Maintenance High flows	15.630 (10.55 %MAR)

Table 15: EWR Requirements for the Upper Blyde: **Olifants_BLY1**

EWR Table: B TEC (flows in million m^3 per annum)

Quaternary Catchment	**B60B**
River	Upper Blyde
EWR Site Co-ordinates	S24.7344, E30.7783
Target Ecological Category	B
NMAR at EWR site	164.45
Total EWR	75.777 (46.08 %MAR)
Maintenance Low flows	59.129 (35.96 %MAR)
Drought Low flows	20.003 (12.16 %MAR)
Maintenance High flows	16.648 (10.12 %MAR)

Table 16: EWR Requirements for the Olifants: **Olifants_EWR11**

EWR Table: C/D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B71J**
River	Olifants
EWR Site Co-ordinates	S24.3076, E30.7857
Target Ecological Category	C/D
NMAR at EWR site	1 321.92
Total EWR	169.27 (12.81 %MAR)
Maintenance Low flows	130.388 (9.86 %MAR)
Drought Low flows	82.805 (6.26 %MAR)
Maintenance High flows	38.884 (2.94 %MAR)

Table 17: EWR Requirements for the Lower Blyde: **Olifants_EWR12**

EWR Table: B TEC (flows in million m^3 per annum)

Quaternary Catchment	**B60J**
River	Lower Blyde
EWR Site Co-ordinates	S24.4075, E30.8274
Target Ecological Category	B
NMAR at EWR site	383.27
Total EWR	119.394 (31.14 %MAR)
Maintenance Low flows	100.343 (26.17 %MAR)
Drought Low flows	40.967 (10.68 %MAR)
Maintenance High flows	19.051 (4.97 %MAR)

Table 18: EWR Requirements for the Olifants: **Olifants_EWR13**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B72D**
River	Olifants
EWR Site Co-ordinates	S24.1284, E31.0146
Recommended Ecological Category	C
NMAR at EWR site	1 762.1
Total EWR	409.396 (23.23 %MAR)
Maintenance Low flows	319.713 (18.14 %MAR)
Drought Low flows	140.811 (7.99 %MAR)
Maintenance High flows	89.683 (5.09 %MAR)

Table 19: EWR Requirements for the Olifants: **Olifants_EWR 16**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B73H**
River	Olifants
EWR Site Co-ordinates	S24.0494, E31.7318
Target Ecological Category	C
NMAR at EWR site	1 918.3
Total EWR	403.958 (21.06 %MAR)
Maintenance Low flows	339.962 (17.72 %MAR)

Quaternary Catchment	**B73H**
Drought Low flows	192.106 (10.01 %MAR)
Maintenance High flows	63.996 (3.34 %MAR)

Table 20: EWR Requirements for the Olifants: **Olifants_EWR5**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B32D**
River	Olifants
EWR Site Co-ordinates	S25.3040, E29.4220
Target Ecological Category	C
NMAR at EWR site	571.13
Total EWR	71.449 (12.51 %MAR)
Maintenance Low flows	58.886 (10.31 %MAR)
Drought Low flows	15.768 (2.76 %MAR)
Maintenance High flows	12.563 (2.20 %MAR)

Table 21: EWR Requirements for the Lower Elands: **Olifants_EWR6**

EWR Table: D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B31G**
River	Lower Elands
EWR Site Co-ordinates	S25.1160, E28.9565
Target Ecological Category	D
NMAR at EWR site	60.32
Total EWR	6.319 (10.48 %MAR)
Maintenance Low flows	4.401 (7.30 %MAR)
Drought Low flows	1.987 (3.29 %MAR)
Maintenance High flows	1.918 (3.18 %MAR)

Table 22: EWR Requirements for the Olifants: **Olifants_EWR7**

EWR Table: D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B51G**
River	Olifants
EWR Site Co-ordinates	S24.5289, E29.5464
Target Ecological Category	D
NMAR at EWR site	736.942
Total EWR	72.915 (9.89 %MAR)
Maintenance Low flows	64.673 (8.78 %MAR)
Drought Low flows	12.646 (1.72 %MAR)
Maintenance High flows	8.243 (1.12 %MAR)

Table 23: EWR Requirements for the Steelpoort: **Olifants_EWR9**

EWR Table: C/D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B41H**
River	Steelpoort
EWR Site Co-ordinates	S24.7750, E30.1650
Target Ecological Category	C/D
NMAR at EWR site	137.4
Total EWR	32.079 (23.33 %MAR)
Maintenance Low flows	20.838 (15.16 %MAR)
Drought Low flows	9.153 (6.66 %MAR)
Maintenance High flows	11.241 (8.18 %MAR)

Table 24: EWR Requirements for the Steelpoort: **Olifants_EWR10**

EWR Table: D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B41K**
River	Steelpoort
EWR Site Co-ordinates	S24.4965, E30.399
Target Ecological Category	D
NMAR at EWR site	342.7
Total EWR	43.503 (12.69 %MAR)
Maintenance Low flows	30.168 (8.80 %MAR)

Drought Low flows	27.696 (8.08 %MAR)
Maintenance High flows	13.336 (3.89 %MAR)

Table 25: EWR Requirements for the Upper Ga-Selati: **Olifants_EWR14a**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B42H**
River	Upper Ga-Selati
EWR Site Co-ordinates	S24.0012; E30.6823
Target Ecological Category	C
NMAR at EWR site	52.205
Total EWR	14.372 (27.53 %MAR)
Maintenance Low flows	10.692 (20.48 %MAR)
Drought Low flows	0.000 (0.00 %MAR)
Maintenance High flows	3.681 (7.05 %MAR)

Table 26: EWR Requirements for the Lower Ga-Selati: **Olifants_EWR14b**

EWR Table: D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B42K**
River	Lower Ga-Selati
EWR Site Co-ordinates	S24.0225; E31.146667
Target Ecological Category	D
NMAR at EWR site	72.74
Total EWR	14.15 (19.45 %MAR)
Maintenance Low flows	9.199 (12.65 %MAR)
Drought Low flows	0.000 (0.00 %MAR)
Maintenance High flows	4.951 (6.81 %MAR)

Table 27: EWR Requirements for the Spookspruit: **SPK_EWR1**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B60H**
River	Ohrigstad

Quaternary Catchment	**B60H**
EWR Site Co-ordinates	S25.8605; E29.4029
Target Ecological Category	C
NMAR at EWR site	9.322
Total EWR	2.808 (30.12 %MAR)
Maintenance Low flows	1.382 (14.82 %MAR)
Drought Low flows	0.733 (7.87 %MAR)
Maintenance High flows	1.426 (15.29 %MAR)

Table 28: EWR Requirements for the Ohrigstad River: **OLI_EWR8**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B60H**
River	Ohrigstad
EWR Site Co-ordinates	S24.5473, E30.73807
Target Ecological Category	C
NMAR at EWR site	67.685
Total EWR	11.785 (17.41 %MAR)
Maintenance Low flows	11.071 (16.36 %MAR)
Drought Low flows	3.833 (5.66 %MAR)
Maintenance High flows	0.714 (1.05 %MAR)

Table 29: EWR Requirements for the Dwars River: **DWA_EWR1**

EWR Table: B/C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B41H**
River	Dwars
EWR Site Co-ordinates	S24.8358, E30.08345
Target Ecological Category	B/C
NMAR at EWR site	26.067
Total EWR	8.144 (31.24 %MAR)

Quaternary Catchment	**B41H**
Maintenance Low flows	6.099 (23.40 %MAR)
Drought Low flows	2.289 (8.78 %MAR)
Maintenance High flows	2.044 (7.84 %MAR)

Table 30: EWR Requirements for the Letaba: **Letaba_EWR7**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B83D**
River	Letaba
EWR Site Co-ordinates	S23.8268, E31.5906
Target Ecological Category	C
NMAR at EWR site	646.28
Total EWR	112.049 (17.34 %MAR)
Maintenance Low flows	89.672 (13.88 %MAR)
Drought Low flows	31.748 (4.91 %MAR)
Maintenance High flows	22.378 (3.46 %MAR)

Table 31: EWR Requirements for the Letsitele: **Letaba_EWR2**

EWR Table: D TEC (flows in million m^3 per annum)

Quaternary Catchment	**B81D**
River	Letsitele
EWR Site Co-ordinates	S23.8932, E30.3576
Recommended Ecological Category	D
NMAR at EWR site	116.55
Total EWR	20.497 (17.59 %MAR)
Maintenance Low flows	15.262 (13.09 %MAR)
Drought Low flows	9.200 (7.89 %MAR)
Maintenance High flows	5.236 (4.49 %MAR)

Table 32: EWR Requirements for the Letsitele: **Letaba_EWR1**

EWR Table: C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B81B**

River	Groot Letaba
EWR Site Co-ordinates	S23. 9178, E30.0507
Target Ecological Category	C
NMAR at EWR site	99.85
Total EWR	24.721 (24.76 %MAR)
Maintenance Low flows	17.553 (17.58 %MAR)
Drought Low flows	9.550 (9.56 %MAR)
Maintenance High flows	7.168 (7.18 %MAR)

Table 33: EWR Requirements for the Broederstroom: **Letaba_BRO1**

EWR Table: B/C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B81A**
River	Broederstroom
EWR Site Co-ordinates	S23.8011, E29.9772
Recommended Ecological Category	B/C
NMAR at EWR site	6.617
Total EWR	3.257 (49.22 %MAR)
Maintenance Low flows	2.621 (39.61 %MAR)
Drought Low flows	0.965 (14.58 %MAR)
Maintenance High flows	0.636 (9.60 %MAR)

Table 34: EWR Requirements for the Shingwedzi: **Shingwedzi_SHI1**

EWR Table: B/C TEC (flows in million m^3 per annum)

Quaternary Catchment	**B90H**
River	Shingwedzi
EWR Site Co-ordinates	S23.1849, E31.5251
Target Ecological Category	B/C
NMAR at EWR site	86.424
Total EWR	19.449 (22.50 %MAR)
Maintenance Low flows	5.541 (6.41 %MAR)
Drought Low flows	0.000 (0.00 %MAR)
Maintenance High flows	13.909 (16.09 %MAR)

4.2 Water Quality

Water quality ecospecs have been set using PES, the TEC or a Resource quality objective (if available for the site), based on the strictest criteria that applies. In-stream water quality data was also assessed at EWR sites that included a water quality monitoring station in its vicinity.

Upper Elands: Olifants_ELA1

Olifants_ELA1 is located in the upper Elands River above Rust de Winter Dam in the nature reserve. The Elands River in this area flows through the Rust de Winter Dam to confluence with the Olifants some 100 kilometres downstream. Irrigatoin takes place just below the dam for approximately 20kms until it enters the Renosterkop Dam at Vaalbank. The closest water quality site is B3H013 located just below Rust de Winter Dam. Chemical water quality at site B3H013 is good with average total dissolved solids being 130 mg/L. The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 35: EWR Site: Upper Elands: Olifants_ELA1 - EcoSpecs relating to Physico-chemical data.

River: Upper Elands		**EWR : Olifants_ELA1**	Nearest WQ site (downstream Rust De Winter Dam) B3H013. No WQ site in vicinity of EWR site. In situ reading obtained during survey
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 15 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 30 mg/L	
	Na	The 95th percentile of the data must be ≤ 30 mg/L	
	Cl	The 95th percentile of the data must be ≤.20 mg/L	
	Ca	The 95th percentile of the data must be ≤ 32 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 6.5 – 8.4	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L.	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2.	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.75 mg/L	

Lower Wilge: Olifants_EWR4

Olifants _EWR4 is located on the Wilge River just below the confluence with the Saalklapspruit and the Osspruit. There are considerable agricultural activities in the area and this point (B2H015) is downstream of several mines and settlements, such as Phola. The chemical water quality at this point shows the impacts from these sources, with elevated TDS, calcium and sulphate. The TEC is B category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit, or the RQO that was applicable for the site.

Table 36: EWR Site: Lower Wilge: Olifants_EWR4: EcoSpecs relating to Physico-chemical data**.**

River: Lower Wilge		**EWR : Olifants_EWR4**	Downstream B2H015Q01 Wilge River at Zusterstroom
Water quality metrics		**ECOSPEC: TEC, PES and RQO**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 20 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 150 mg/L	
	Na	The 95th percentile of the data must be ≤ 20 mg/L	
	Cl	The 95th percentile of the data must be ≤ 30 mg/L	
	Ca	The 95th percentile of the data must be ≤ 70 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.75 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Aluminium	The 95th percentile of the data must be ≤ 62.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	
	Manganese	The 95th percentile of the data must be ≤ 99.0 µg/L	

Upper Wilge: Olifants_WIL1

This site is located on the Wilge River upstream of the confluence with the Bronkhorstspruit. Impacts include agricultural activities and the Kusile Power station. These impacts are evident in the elevated TDS and sulphates recorded at site B2H014.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 37: EWR Site: Upper Wilge: Olifants_WIL1 - EcoSpecs relating to Physico-chemical data

River: Upper Wilge		**EWR : Olifants_WIL1**	Downstream B2H014Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 30 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 80 mg/L	
	Na	The 95th percentile of the data must be ≤ 30mg/L	
	Cl	The 95th percentile of the data must be ≤ 20 mg/L	
	Ca	The 95th percentile of the data must be ≤ 32 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.058 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	

Olifants: Olifants_ EWR 1

Olifants_EWR1 is located on the Olifants downstream on the confluence with the main stem Olifants River. The closest water quality monitoring points are B11_188530 on the Olifants and B1H002 on the Spookspruit. The impacts at this point are severe and incude impacts from coal mines, poor functionining domestic wastewater treatment works and urban run-off. The impacts are clearly seen on the elevated TDS and sulphate (95 percentile of 635 mg/L and 195 mg/L respectively) and average orthophosphate levels of 1.1 mg/L in the Olifants; and TDS and sulphate (95 percentile of > 2 000 mg/L and 1 500 mg/L respectively) and calcium levels of 248 mg/L in the Spookspruit. The TEC is D category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 38: EWR Site: Olifants: Olifants_EWR1 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR1**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 70 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 250 mg/L	
	Na	The 95th percentile of the data must be ≤ 40 mg/L	
	Cl	The 95th percentile of the data must be ≤ 60 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.6 – 9.2	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	Nitrite &Nitrite	The 50th percentile of the data must be ≤ 3.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.091 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1 mg/L	

Klein Olifants: Olifants_EWR3

Site Olifants_EWR3 is located on the Klein Olifants River downstream of Middelburg and Doringpoort Dams, and downstream of the confluence with the Vaalbankspruit. The Vaalbankspruit flows through the Middelburg industrial area so the site will show impacts from the steel industries located there as well as urban run-off impacts from the town of Middelburg, and will also show impacts from the mines and agricultural activities that occur in the upper catchment of the Klein Olifants. Water quality sites in the vicinity include B12_188401 ands B12_188391, although the data is limited. Elevated levels of TDS (95 percentile: 662 mg/L and 600 mg/L) and sulphate (95 percentile: 266 mg/L and 360mg/L) respectively have been recorded.

The TEC is C/D category. The water quality ecospecs are based on the present state water quality for fluoride and the TEC the remaining parameters.

Table 39: EWR Site: Klein Olifants: Olifants_EWR3 - EcoSpecs relating to Physico-chemical data

River: Klein Olifants		**EWR : Olifants_EWR3**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: TEC and PES**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 150 mg/L	
	Na	The 95th percentile of the data must be ≤ 92.5 mg/L	
	Cl	The 95th percentile of the data must be ≤ 120 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.6 – 9.2	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 3.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.091 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	

Olifants: Olifants_EWR2

EWR site Olifants_EWR2 is located on the Olifants River downstream from the confluence of the Wilge and Klein-Olifants River just upstream of Loskop Dam. There are no water quality sites in this area, with the closest being B2H016 on the Wilge River just upstream of the confluence with the Oilfants. The chemical water quality at this point shows elevated TDS (95 percentile: 400 mg/L) and sulphate (95 percentile 213 mg/L). The water quality at Olifants _EWR2 is expected to be similar.

The TEC is B/C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit or a RQO that was applicable for the site (manganese).

Table 40: EWR Site: Olifants: Olifants_EWR2 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR2**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: TEC, PES and RQO**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 150 mg/L	
	Na	The 95th percentile of the data must be ≤ 40 mg/L	
	Cl	The 95th percentile of the data must be ≤ 60 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Aluminium	The 95th percentile of the data must be ≤ 62.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.5 mg/L	
	Manganese	The 95th percentile of the data must be ≤ 180 µg/L	

Kranspoortspruit: OLI_EWR3

The site is located on the Kraanspoortspruit which flows into the Loskop Dam. There are no water quality sites on this river. The impacts should be limited as there is very limited agriculture in the upper parts and the river flows through a natural habitat.

The TEC is B category. The water quality ecospecs are based on the TEC.

Table 41: EWR Site: Kranspoortspruit: OLI_EWR3 - EcoSpecs relating to Physico-chemical data

River: Kranspoortspruit		**EWR : Olifants_OLI_EWR3**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 30 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 80 mg/L	
	Na	The 95th percentile of the data must be ≤ 70mg/L	
	Cl	The 95th percentile of the data must be ≤.40 mg/L	
	Ca	The 95th percentile of the data must be ≤ 32 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.75 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.02 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 15µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 14.56 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	

Selons: Olifants_SEL1

EWR site Olifants _SEL1 is located on the Selons River in the Middle Olifants sub-catchment upstream of the confluence with the Olifants and includes the Bobbejaansdoom and the Kruis rivers. The impacts would be mainly from agriculture, with large natural areas in the catchment. Sampling point B32_191822 is located near this EWR site, however only EC and pH are monitored regularly. The 95th percentile for EC is 29.6mS/m, with a calculated TDS of 198 mg/L using a multiplication factor of 6.7.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit or a RQO that was applicable for the site.

Table 42: EWR Site: Selons: Olifants_SEL1 - EcoSpecs relating to Physico-chemical data

River: Selons		**EWR : Olifants_SEL1**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: PES, TEC and RQO**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 150 mg/L	
	Na	The 95th percentile of the data must be ≤ 92.5 mg/L	
	Cl	The 95th percentile of the data must be ≤.120 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.6 – 9.2	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.5 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.058 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/L	
	Aluminium	The 95th percentile of the data must be ≤ 0.15 mg/L	
	Manganese	The 95th percentile of the data must be ≤ 1.30 mg/L	
	Zinc	The 95th percentile of the data must be ≤ 36 µg/L.	

Olifants: Olifants_EWR 8

The site is located on the Olifants downstream of the Flag Boshielo Dam below the confluence with the Mohlapitse River in the Lower Olifants. The Olifants flows through numerous sprawling villages and would have impacts from tributaries flowing through areas of similar land-use. The closest monitoring point is B71_192537. Data is however limited and the current state shows the 95 percentile value for EC at 74 mS/m, which gives a calculated TDS vaue of 496 mg/L using a multiplication factor of 6.7. The 95 percentile value for sulphate is 82 mg/L and 50 percentile orthophosphate as 0.005 mg/L.

The TEC is C/D category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 43: EWR Site: Olifants: Olifants_EWR8 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR8**	No water quality site in vicinity of EWR site, however closest site is B71_192537
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 70 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 120 mg/L	
	Na	The 95th percentile of the data must be ≤ 80 mg/L	
	Cl	The 95th percentile of the data must be ≤ 75 mg/L	
	Ca	The 95th percentile of the data must be ≤ 40 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 75 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2°C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 3.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.058 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/L	

Spekboom: Olifants_SPE1

This EWR site is located on the lower Spekboom River in the Steelpoort sub-catchment below the confluence with the Waterval River. There are considerable areas of irrigation upstream of this point on the Waterval and below the confluence and large natural areas on the Spekboom upstream of the confluence. The closest monitoring point is B42_192622, however data is limited. The current state shows a 95 percentile EC value of 62 mS/m (calculated TDS of 415 mg/L) and a 50 percentile orthophosphate value of 0.022 mg/L. The pH is slightly elevated with a lower limit of 7.6 and an upper limit of 8.6.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit or a RQO that was applicable for the site (manganese).

Table 44: EWR Site: Spekboom: Olifants_SPE1 - EcoSpecs relating to Physico-chemical data

River: Lower Spekboom		**EWR : Olifants_SPE1**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 60 mg/L	
	Na	The 95th percentile of the data must be ≤ 40 mg/L	
	Cl	The 95th percentile of the data must be ≤ 60 mg/L	
	Ca	The 95th percentile of the data must be ≤ 40 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Aluminium	The 95th percentile of the data must be ≤ 150 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/L	
	Manganese	The 95th percentile of the data must be ≤ 1.3 mg/L	

Upper Bylde: Olifants_BLY1

This EWR site isloacted in the upper reaches of the Blyde River, upstream of the confluence with the Treur River and the Blyde River Canyon Reserve in the Steelpoort sub-catchment. In terms of water quality there should b eno major impacts on this stretch of river. Monitoring point B6H1 (B60_90489) is located on the Blyde River at Willemsoord. The chemical water quality at this point is very good and there is considerable data. The 95 percentile TDS value at this point is 170 mS/m, sulphate of 21 mg/L, chloride of 7 mg/L and orthophosphate of 0.01 mg/L.

The TEC is B category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 45: EWR Site: Upper Bylde: Olifants_BLY1 - EcoSpecs relating to Physico-chemical data

River: Upper Blyde		**EWR : Olifants_BLY1**	Downstream site B6H001Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 20 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 20 mg/L	
	Na	The 95th percentile of the data must be ≤ 10mg/L	
	Cl	The 95th percentile of the data must be ≤.20 mg/L	
	Ca	The 95th percentile of the data must be ≤ 32 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.5 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 15 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 14.56 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 15 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 9 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.75 mg/L	

Olifants: Olifants_EWR 11

EWR site Olifants_EWR11 is located on the Olifants River upstream from the confluence with the Blyde River. Major impacts in this area relate to run-off from sprawling villages and agricultural impacts. The chemical quality at monitoring point B7H9 (B71_90507) shows these impacts with a 95 percentile value for chloride of 99 mg/L, TDS of 561 mg/L, sulphate of 68 mg/L and 50 percentile value for orthophosphate of 0.02 mg/L.

The TEC is C/D category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 46: EWR Site: Olifants: Olifants_EWR11 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR11**	Downstream site B7H009Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 100 mg/L	
	Na	The 95th percentile of the data must be ≤ 80 mg/L	
	Cl	The 95th percentile of the data must be ≤ 75 mg/L	
	Ca	The 95th percentile of the data must be ≤ 40 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 70 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.091 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/L	

Lower Bylde: Olifants_EWR 12

This EWR site is located on the Blyde River just upstream of the confluence with the Olifants River. There are large areas of agricultural land and irrigation upstream of this site, as well as the Blyderivierspoort Dam. Monitoring point B6H4 (B60_90491) has extensive data and indicates 95 percentiles of TDS of 187 mg/L, EC of 26 mS/m, chloride of 8.6 mg/L, sulphate of 18 mg/L and orthophosphate (50 percentile) of 0.008 mg/L.

The TEC is B category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 47: EWR Site: Lower Bylde: Olifants_EWR12 - EcoSpecs relating to Physico-chemical data

River: Lower Blyde		**EWR : Olifants_EWR12**	Upstream site B6H004Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 15 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 20 mg/L	
	Na	The 95th percentile of the data must be ≤ 15mg/L	
	Cl	The 95th percentile of the data must be ≤ 20 mg/L	
	Ca	The 95th percentile of the data must be ≤ 32 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.5 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.020 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 15 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 14.56 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 15 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 19 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.5 mg/L	

Olifants: Olifants_EWR 13

The EWR site is located on the Olifants River 20km upstream from the Ga-Selati confluence, upstream of the Balule Nature Reserve Complex and Phalaborwa mining, industrial and wastewater treatment works impacts (Ga-Selati River). The Blyde River confluences with the Olifants approximately 8 kilometers upstream of this point. The upstream impacts are related to agriculture and diffuse sources from villages. The water quality monitorimg point B7H7 (B72_90503) is located just below the Makhutswi confluence with the Olifants. The site has extensive data for the period April 2005 to March 2016 and indicates 95 percentiles of TDS of 431 mg/L, EC of 60 mS/m, chloride of 51 mg/L, sulphate of 66 mg/L and orthophosphate (50 percentile) of 0.015 mg/L.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 48: EWR Site: Olifants: Olifants_EWR13 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR13**	Upstream site B7H007Q01
Water quality metrics		**ECOSPEC: PES and REC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 80 mg/L	
	Na	The 95th percentile of the data must be ≤ 92.5 mg/L	
	Cl	The 95th percentile of the data must be ≤.70 mg/L	
	Ca	The 95th percentile of the data must be ≤ 50 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Aluminium	The 95th percentile of the data must be ≤ 62.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	

Olifants: Olifants_EWR 16

This EWR site is located on the Olifants River, the furthest downstream EWR site in the system, approximately 6km upstream from the confluence with the Letaba River at the Olifants River Gorge (KNP Eastern border with Mozambique). It is below the confluence with the Timbavati River in the Park. The chemical water quality at water quality monitoring point B7H17 (B73_90515) for the period January 2006 to May 2016 shows the impacts from the Phalaborwa area with 95 percentile data for TDS of 490 mg/L, chloride 63 mg/L, sulphate 80 mg/L and a 50 percentile orthophosphate level of 0.017 mg/L.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 49: EWR Site: Olifants: Olifants_EWR16 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR16**	Downstream site B7H017Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 30 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 80 mg/L	
	Na	The 95th percentile of the data must be ≤ 70mg/L	
	Cl	The 95th percentile of the data must be ≤ 40 mg/L	
	Ca	The 95th percentile of the data must be ≤ 32 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 30 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 8.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.75 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.02 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	

Olifants: Olifants_EWR5

This EWR site is located on the Olifants River downstream from the confluence of the Selons River. The site is downstream of the Loskop Dam and the major impacts would be from the extensive irrigation in the area. There is no water quality monitoring site in this area. The closest point is B20_88595, however the data is extremely limited. The calculated TDS value from a 95 percentile EC value of 82.3 mS/m for the period July 2009 to December 2014) is 550 mg/L.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 50: EWR Site: Olifants: Olifants_EWR5 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR5**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 40 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 125 mg/L	
	Na	The 95th percentile of the data must be ≤ 60 mg/L	
	Cl	The 95th percentile of the data must be ≤ 60 mg/L	
	Ca	The 95th percentile of the data must be ≤ 40 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 75 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.058 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/L	

Lower Elands: Olifants_EWR6

This EWR site is located on the Elands River downstream of the Rhenosterkop Dam and Mkombo Nature Reserve. The only water quality monitoring with adequate data is B3R5 (B31-90466) on the Rhenosterkop Dam wall. 95 percentile data for the period January 2006 to April 2016 indicate the impacts from upstream agricultural activities with TDS at 371 mg/L, chloride at 51 mg/L and fluoride at 1.5 mg/L.

The TEC is D category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 51: EWR Site Lower Elands: Olifants_EWR6 - EcoSpecs relating to Physico-chemical data

River: Lower Elands		**EWR : Olifants_EWR6**	Downstream site B3R005Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 20 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 30 mg/L	
	Na	The 95th percentile of the data must be ≤ 80 mg/L	
	Cl	The 95th percentile of the data must be ≤.80 mg/L	
	Ca	The 95th percentile of the data must be ≤ 30 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.6 – 9.2	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 6.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 3.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.091 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 42 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2 mg/L	

Olifants: Olifants_EWR7

This EWR site is located on the Olifants River below Flag Bashielo Dam, upstream the confluence of the Ngwaritsi River, and just downstream of the non-perenial Nkumpi River. There are some gypsum and lime mines on an unnamed tributary that drains towards the Nkumpi River. Other impacts would be from run-off from the villages and limited agriculture. There are no water quality monitoring points in the area with recent data.

The TEC is D category. The water quality ecospecs are based on the South African water quality guidelines and the TEC whichever comprised the stricter limit.

Table 52: EWR Site Olifants: Olifants_EWR7 - EcoSpecs relating to Physico-chemical data

River: Olifants		**EWR : Olifants_EWR7**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 70 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 120 mg/L	
	Na	The 95th percentile of the data must be ≤ 80 mg/L	
	Cl	The 95th percentile of the data must be ≤ 75 mg/L	
	Ca	The 95th percentile of the data must be ≤ 40 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 75 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.0 – 10.0	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 5.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 3.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 42 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.2 mg/L	

Steelpoort: Olifants_EWR9

This EWR site is located in the middle reaches of Steelpoort River below the confluence of the Dwars (Steelpoort Park). The point is some 30 kms downstream of De Hoop Dam and the major impacts at this point will be the mines and industries on the Dwars River and in the Steelpoort Valley. The closest water quality monitoring point near this site is B41_1000009855, approximately 8 kms downstream. The data is however very limited. The 95 percentile TDS value calculated from the EC of 91.4 mS/m is 620 mg/L showing the impacts from the upstream activities.

The TEC is C/D category. The water quality ecospecs are based on the South African water quality guidelines and the TEC whichever comprised the stricter limit.

Table 53: EWR Site Steelpoort: Olifants_EWR9 - EcoSpecs relating to Physico-chemical data

River: Steelpoort		**EWR : Olifants_EWR9**	No water quality site in vicinity of EWR site (only 8km downstream)
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 70 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 250 mg/L	
	Na	The 95th percentile of the data must be ≤ 115 mg/L	
	Cl	The 95th percentile of the data must be ≤.175 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.0 – 10.0	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 5.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 3.52 mg/L	

Steelpoort: Olifants_EWR10

This EWR site is located on the lower reaches of the Steelpoort River towards the confluence of the Olifants River (Great Escarpment Mountains Ecoregion). The upstream impacts from this site include the mines and industries in the Steelpoort Valley, as well as impacts from urban development. There are also several villages along this stretch of river. Upstream site B4H11 (B41_90473) and downstream site B4H25 (B41_193091) have similar data with slight deterioration at the downstream site. For the period March 2012 to March 2016, the chemicals water quality has 95 percentile value for TDS: 378 mg/L, chloride 43 mg/L, orthophosphate 0.01 mg/L and sulphate 31 mg/L.

The TEC is D category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

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Table 54: EWR Site Lower Steelpoort: Olifants_EWR10 - EcoSpecs relating to Physico-chemical data

River: Lower Steelpoort		**EWR : Olifants_EWR10**	No water quality site in vicinity of EWR site use upstream site B4H011Q01 (B4H11)
Water quality metrics		**ECOSPEC: PES, RQO and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 40 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 50 mg/L	
	Na	The 95th percentile of the data must be ≤ 40 mg/L	
	Cl	The 95th percentile of the data must be ≤ 50 mg/L	
	Ca	The 95th percentile of the data must be ≤ 50 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 70 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.0 – 9.0	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 4.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.091 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 42 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.8 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	
	Aluminium	The 95th percentile of the data must be ≤ 62.5 µg/L	
	Zinc	The 95th percentile of the data must be ≤ 14.4 µg/L	
	Manganese	The 95th percentile of the data must be ≤ 0.68 mg/L	

Upper Ga-Selati: Olifants_EWR14a

This EWR site is located on the Upper Ga-Selati River. The main impacts would be from villages and limited agriculture. The closest monitoring point is B7H14 (B72_90511) which has a large data set indicating good chemical water quality at this point. For the period February 2006 to March 2016, the chemical water quality has 95 percentile value for TDS: 206 mg/L and orthophosphate of 0.006 mg/L.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 55: EWR Site Upper Ga-Selati: Olifants_EWR14a - EcoSpecs relating to Physico-chemical data

River: Upper Ga-Selati		**EWR : Olifants_EWR14a**	No water quality site in vicinity of EWR site. Closest site is B7H140Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 20 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 10 mg/L	
	Na	The 95th percentile of the data must be ≤ 15 mg/L	
	Cl	The 95th percentile of the data must be ≤.15 mg/L	
	Ca	The 95th percentile of the data must be ≤ 30 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 35 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 6.4 – 8.6	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.01 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	

Lower Ga-Selati: Olifants_EWR14b

This EWR site is located on the lower Ga-Selati River, near Foskor in the Lowveld Ecoregion, near the confluence with the Olifants River. The impacts from the area are from the mines and the discharge from the Phalaborwa wastewater treatment works. The severe impacts from this area are shown by the results of the 95 percentile data for the period January 2006 to May 2016 at water quality monitoring point B7H19 (B72_90518) just upstream of the EWR site - TDS: 1 989 mg/L, calcium: 124 mg/L, chloride: 274 mg/L, fluoride: 3.2 mg/L, magnesium: 164 mg/L, sodium: 247 mg/L, orthophosphate (50 percentile): 0.5 mg/L and sulphate: 730 mg/L.

The TEC is D category. The water quality ecospecs are based on TEC due to the poor present state quality.

Table 56: EWR Site Lower Ga-Selati: Olifants_EWR14b - EcoSpecs relating to Physico-chemical data

River: Lower Ga-Selati		**EWR : Olifants_EWR14b**	Upstream water quality site B7H19
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 70 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 250 mg/L	
	Na	The 95th percentile of the data must be ≤ 115 mg/L	
	Cl	The 95th percentile of the data must be ≤.175 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 85 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.0 – 10.0	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 5.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 4.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 42 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 1.0 mg/L	

Spookspruit: SPK_EWR1

This site is located on the Spookspruit at the R575, the main impacts at this point would the extensive upstream coal mines. The water quality data for the monitoring point located at the EWR site is limited to EC and pH, and some sulphate data. Monitoring point B1H2 downstream of the EWR site has an extensive data record and data for the period January 2006 to April 2016 is used. The 95 percentile data shows the sever impacts from the mine – TDS: 1 662 mg/L, calcium: 234 mg/L, magnesium: 259 mg/L and sulphate 1 567 mg/L.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 57: EWR Site Spookspruit: SPK_EWR1 - EcoSpecs relating to Physico-chemical data

River: Spookspruit		**EWR : SPK_EWR1**	No water quality site in vicinity of EWR site, but can use downstream site B1H200Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 250 mg/L	
	Na	The 95th percentile of the data must be ≤ 92.5 mg/L	
	Cl	The 95th percentile of the data must be ≤.120 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	

Dwars: DWA_EWR1

This EWR site is located on the Dwars River just above the confluence with the Steelpoort River. The main impacts will be from the upstream platinum mining. The monitoring site with adequate water quality data is B4H9 (B41_90471). The 95 percentile values for the period January 2006 to March 2016 are as follows: TDS: 414 mg/L and sulphate of 23 mg/L and 50 percentile for nitrate: 3.6 mg/L, which increases downstream towards the Steelpoort and is considerably higher than the nitrate concentrations detected in the Steelpoort River.

The TEC is B/C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 58: EWR Site Dwars River: DWA_EWR1 - EcoSpecs relating to Physico-chemical data

River: Dwars		**EWR : DWA_EWR1**	No water quality site in vicinity of EWR site, use water quality site B4H9
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 30 mg/L	
	Na	The 95th percentile of the data must be ≤ 25 mg/L	
	Cl	The 95th percentile of the data must be ≤ 20 mg/L	
	Ca	The 95th percentile of the data must be ≤ 45 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 7.0 – 8.7	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 µg/L	

Ohrigstad: OLI_EWR8

This EWR site is located in quaternary catchment B60H and is situated on the R532 road to Blyde River Canyon. The site falls within the Blyde Nature Reserve. No gauging weirs or water quality monitoring sites as are present in the vicinity of the selected site. There are few impacts and this is evidenced by the chemical water quality at a point upstream on the Ohrigstadt River (B60_1000009803) and at the monitoring point B6H14 (B60_90496) on the Blyde River. At these points 95 percentile values for TDS are 174 mg/L and 158 mg/L respectively.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 59: EWR Site Ohrigstad: OLI_EWR8 - EcoSpecs relating to Physico-chemical data

River: Ohrigstad		**EWR : OLI_EWR8**	No water quality site in vicinity of EWR site. Use upstream water quality site B60_1000009803
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 20 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 20 mg/L	
	Na	The 95th percentile of the data must be ≤ 15 mg/L	
	Cl	The 95th percentile of the data must be ≤ 15 mg/L	
	Ca	The 95th percentile of the data must be ≤ 25 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 6.4 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.5 mg/L	

Letaba: Letaba_EWR7

This EWR site is located on the Letaba River in the Kruger National Park just upstream of Letaba Rest Camp and the Engelhard Dam/weir. There are few upstream impacts. The water quality data at downstream monitoring site B8H18 (B83_90529) show high 95 percentile TDS values (413 mg/L) as well as elevated levels of chloride (81 mg/L) and sodium (66 mg/L). This is very likely due to the low flow conditions of the river and the concentration of the salts.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 60: EWR Site: Letaba: Letaba_EWR7- EcoSpecs relating to Physico-chemical data

River: Letaba		**EWR: Letaba EWR7**	Downstream site B8H018Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 50 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 30 mg/L	
	Na	The 95th percentile of the data must be ≤ 92.5 mg/L	
	Cl	The 95th percentile of the data must be ≤.120 mg/L	
	Ca	The 95th percentile of the data must be ≤ 80 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.058 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	

Letsitele: Letaba_EWR2

This EWR site is located on the Letsitele River just downstream gauging weir B8H010 and upstream the Letaba River confluence. The impacts at this site are mostly from urban run-off. This is evidenced by the water quality data at site B8H10 (B81_90526), upstream of the EWR site where the 95 percentile for TDS is 226 mg/L and ammonium concentrations of 0.86 mg/L, nitrate of 0.6 mg/L and orthophosphate of 0.05 mg/L which would lead to eutrophic conditions.

The TEC is D category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 61: EWR Site Letsitele: Letaba_EWR2 - EcoSpecs relating to Physico-chemical data

River: Letsitele		**EWR : Letaba EWR2**	Upstream site B8H010Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 15 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 20 mg/L	
	Na	The 95th percentile of the data must be ≤ 30 mg/L	
	Cl	The 95th percentile of the data must be ≤ 35 mg/L	
	Ca	The 95th percentile of the data must be ≤ 30 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 45 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 6.0 – 9.0	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 5.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 4.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.125 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 30 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 42 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 72.5 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 78.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	

Great Letaba: Letaba_EWR 1

The site is located on the Great Letaba River between Ebenezer and Tzaneen Dams in the upper foothills geozone. The major impacts in this are related to forestry and plantations. The chemical water water quality at this point (B8H14) is excellent with a 95 percentile EC of 10 mS/m and a TDS of 72 mg/L. All other parameters are equally low.

The TEC is C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 62: EWR Site: Great Letaba: Letaba_EWR1 - EcoSpecs relating to Physico-chemical data

River: Great Letaba		**EWR: Letaba EWR1**	Downstream site B8H014Q01
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 10 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 10 mg/L	
	Na	The 95th percentile of the data must be ≤ 15 mg/L	
	Cl	The 95th percentile of the data must be ≤.15 mg/L	
	Ca	The 95th percentile of the data must be ≤ 10 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 20 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 6.5 – 8.6	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 2.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 0.7 mg/L	

Broederstroom: Letaba_BRO1

The site is located in the upper catchment on the Broederstroom just upstream of Dap Naude Dam. The main impacts are from forestry and plantations. There are no water quality sites in this are but it is likely that the water quality is in a similar state as that at Letaba_EWR1.

The TEC is B/C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 63: EWR Site: Broederstroom: Letaba_BRO1 - EcoSpecs relating to Physico-chemical data

River: Broederstroom		**EWR : Letaba_BRO1**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 10 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 10 mg/L	
	Na	The 95th percentile of the data must be ≤ 15 mg/L	
	Cl	The 95th percentile of the data must be ≤15 mg/L	
	Ca	The 95th percentile of the data must be ≤ 10 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 20 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 6.5 – 8.6	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 1.0 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.025 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 20 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 21 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Aluminium	The 95th percentile of the data must be ≤ 62.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	

Shingwedzi: Shingwidzi_SHI1

This EWR site is located on the lower reaches of the Shingwidzi River before it enters Mozambique downstream of the Kanniedood Dam in the Kruger National Park. The wtaer quality impacts would be natural except for elevagted salts due to the non-perennial nature of the river.

The TEC is B/C category. The water quality ecospecs are based on the present state water quality and the TEC whichever comprised the stricter limit.

Table 64: EWR Site: Shingwedzi: Shingwidzi_SHI1 - EcoSpecs relating to Physico-chemical data

River: Shingwedzi		**EWR : Shingwidzi_SHI1**	No water quality site in vicinity of EWR site
Water quality metrics		**ECOSPEC: PES and TEC**	
Major Ions	Mg	The 95th percentile of the data must be ≤ 30 mg/L	
	SO_4	The 95th percentile of the data must be ≤ 80 mg/L	
	Na	The 95th percentile of the data must be ≤ 70 mg/L	
	Cl	The 95th percentile of the data must be ≤.40 mg/L	
	Ca	The 95th percentile of the data must be ≤ 60 mg/L	
Physical variables	EC	The 95th percentile of the data must be ≤ 55 mS/m	
	pH	The 5th and 95th percentiles of the data must range from 5.9 – 8.8	
	Temperature	Variation of 2^{o}C or 10% from background average temperature.	
	Dissolved oxygen	The 5th percentile of the data must be ≥ 7.0 mg/L	
	Turbidity	Vary (small amount) from natural turbidity range; minor silting of instream habitats acceptable.	
Nutrients	TIN	The 50th percentile of the data must be ≤ 0.75 mg/L	
	PO_4-P	The 50th percentile of the data must be ≤ 0.02 mg/L	
Response variables	Chl-a phytoplankton	The 50th percentile of the data must be ≤ 15 µg/L	
	Chl-a periphyton	The 50th percentile of the data must be ≤ 14.56 mg/m^2	
	Ammonia	The 95th percentile of the data must be ≤ 43.75 µg/L.	
	Atrazine	The 95th percentile of the data must be ≤ 48.75 µg/L	
	Aluminium	The 95th percentile of the data must be ≤ 62.5 µg/L	
	Fluoride	The 95th percentile of the data must be ≤ 2.5 mg/L	

4.3 Fish, Macroinvertebrates and Habitat Integrity

Ecological specifications for the EWR sites within the Olifants, Letaba and Shingwedzi catchment biotic responses components are provided in **Table 65** to **Table 84** below.

Ecological specifications for the biological sites within the Olifants, Letaba and Shingwedzi catchment biotic responses components are provided in **Table 85** to **Table 123** below.

The following approach was adopted for the biological ecospecs. The current or desired PES was used as the ecostatus that should be achieved. With regard to the fish (FRAI) and macroinvertebrates (MIRAI) the reference values (expected species for fish, SASS score, and expected number of families and ASPT for the macroinvertebrates) were used as the best possible scenario (PES A). From that the lowered values for the current or desired PES was calculated as a percentage of the expected values.

This was subsequently used with the frequency (FROC) of the species or families present to determine possible indicator species and families that should be present under the specific flow conditions listed in the ecospecs.

The ecospecs for the instream habitat and riparian zone was based on current impacts that can be considered as possible mitigation measures to improve the habitat to the desired state.

4.3.1 EWR Sites within the Olifants, Letaba and Shingwedzi Catchment

Refer to **Table 65** to **Table 123** for the ecological specifications from a biotic perspective for the Olifants, Letaba and Shingwedzi catchments.

Table 65: Ecological specifications for Upper Elands River: **Olifants_ELA1**

Fish		Special conditions	Aquatic Macroinvertebrates		Special conditions	Habitat Integrity	Special conditions
FRAI			**MIRAI**			**Habitat integrity: Instream**	Ensure overhanging vegetation, root wads and undercut banks inundated during low flow conditions.
No. of indigenous fish species that should be recorded	15	Flow dependant spp. must be recorded in FS habitat - 15 - 20 individuals per 20min electroshock effort	**SASS5 Score**	135-150 or better (220 = ref conditions)	Improve water quality - need to sample Tricorythidae and Hydropsycidae		
		Habitat must include root wads and undercut banks to ensure habitat sensitive spp. can occur - 2 - 4 specimens per 20 min effort.	**No. of Taxa**	62 expected		**Habitat integrity: Riparian**	Manage alien infestations
			ASPT	4.7-4.8 or better (7 = ref conditions)			

Considerations
Absence of flow dependent fish (e.g.: *Labeo cylindricus, L. molybdinus)* and the absence of fish which are habitat sensitive (e.g. *Marcusenius macrolepidotus*).
Absence of least sensitive aquatic macroinvertebrates however the site seems to be representative of those taxa (e.g. Simuliidae, Corixidae)
Fish migration link is fragmented due to small upstream weirs
Small stream thus sensitive to flow changes

Monitoring	**Frequency**

Chemical and *in situ* water quality should be monitored	Bi-annually
Diatom sampling	Every 2 years
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet season
Riparian VEGRAI should be Monitored	Every 5 years
The IHI should be conducted every 2 years	Every 2 years

Table 66: Ecological specifications for Lower Wilge River: **Olifants_EWR4**

Fish		**Special conditions**	**Aquatic Macroinvertebrates**		**Special conditions**	**Habitat Integrity**	**Special conditions**
FRAI			**MIRAI**			**Habitat integrity: Instream**	Flow needed for habitat diversity, including marginal vegetation as habitat.
No. of indigenous fish species that should be recorded	14	Flow sensitive and habitat sensitive spp. must be present - increase low flows	**SASS5 Score**	180-190 or better (220 = ref conditions)	Improve flow velocities to ensure suitable habitat for Tricorythidae and Aeshnidae		
		Sample 30+ CPRE, 30+ BMAR and 10 AURA per 20min electroshock effort	**No. of Taxa**	64 expected		**Habitat integrity: Riparian**	Manage cattle trampling

Considerations
As the Olifants system is already degraded, further degradation of the Wilge River needs to be prevented and aimed to be improved
Absence of flow dependent fish (e.g.: *Labeo cylindricus and L. molybdinus)*
Velocity sensitive aquatic macroinvertebrates and those specific to certain habitat availability (e.g. Trichorythidae, Leptophelbiidae)
High nutrient loads owing to considerable algal growth
Fish migration link between the Olifants system and upper Wilge River is important
Sensitive stream owing to the stream geomorphology and profile
The Wilge River brings higher flows and the natural cues into the highly regulated and fragmented Olifants system
The recon strategy (2011) also requires a category B for the Wilge

Monitoring	**Frequency**
Chemical and *in situ* water quality should be monitored	Bi-annually
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season

Riparian VEGRAI should be Monitored	Every 5 years
The IHI should be conducted	Annually
Ecological categories specified as per Resource Quality Objectives must be enforced	

Table 67: Ecological specifications for the Upper Wilge River**: Olifants_WIL1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Must improve WQ – concern about organic pollution (sewage). Must improve flows to get better habitat for biota.
No. of indigenous fish species that should be recorded	9 species expected	PES D Should collect 4-5 species in a 20min effort.		190+ expected		
			Lower erosion. Prevent further riparian zone destruction.	Expected 60+ families	**Habitat integrity: Riparian**	Lower erosion. Prevent further riparian zone destruction.
			ASPT	5.6-5.8		

Considerations
Upper reaches an important water source and biota habitat in the system.

Monitoring	**Frequency**
Chemical, microbial and in situ water quality should be monitored	Bi-annually
Turbidity and deposition	monitored monthly during the wet season and once during the dry season
Diatom samples should be taken	Minimum every 2 years
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season

Monitoring	**Frequency**
Riparian VEGRAI should be conducted	Every 5 years
The IHI should be conducted	Annually

Table 68: Ecological specifications for the Olifants River: **Olifants_EWR1**

Fish		**Special conditions**	**Aquatic Macroinvertebrates**		**Special conditions**	**Habitat Integrity**	**Special conditions**
FRAI			**MIRAI**			**Habitat integrity: Instream**	Flow needed for habitat diversity, including marginal vegetation as habitat.
No. of indigenous fish species that should be recorded	19 (20 - if eels are included)	In 20min electroshock, sample at least 10 BMAR, 30+ CPRE, 5 LCYL	**SASS5 Score**	125-135 or better (220 = ref conditions)	Improve flow velocities to ensure suitable habitat for Tricorythidae and Aeshnidae		
			No. of Taxa	62 expected		**Habitat integrity: Riparian**	Control alien invasives and stabilise banks
			ASPT	4.1-4.3 or better (7 = ref conditions)			

Considerations
Absence of flow dependent sensitive fish species, lack of habitat diversity and poor water quality (e.g.: *Labeobarbus marequensis, Labeo molybdinus, Labeo cylindricus and Petrocephalus wessels*i. *P. wesselsi* is habitat specific and thus absent from the site at the time of the survey. Alien invasive fish species namely *Micropterus salmoides* has an impact on the small fish species (e.g. *Enteromius (Barbus) anoplus, E. eutaenia*). The identified *Gambusia affinis* food source is eggs and thus further impacts on the indigenous fish populations by preying on their eggs. The presence of *Cyprinus carpio* further is competing for habitat between fish namely *Tilapia rendalli* and *Tilapia sparrmanii.*
Velocity sensitive aquatic macroinvertebrates, lack of habitat diversity and poor water quality (e.g: Perlidae and Heptegeniidae). Porifera were not identified owing to the siltation on the rocks.
High nutrient loads owing to considerable algal growth.

Monitoring	**Frequency**
Chemical and *in situ* water quality should be monitored.	Quarterly
Diatom samples should be taken	Every 2 years

Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored together with the IHI	Annually towards the end of the wet season
Riparian VEGRAI should be conducted	Every 3 years
The RQOs set for the EWR1 must be stringently enforced	

Table 69: Ecological specifications for the Klein Olifants River: **Olifants_EWR3**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Increased flows to flush system
No. of indigenous fish species that should be recorded	11	When sampling, should collect 5 BMAR, 5 CPRE and 5 LCYL in a 20min electro shock effort	**SASS5 Score**	125-135 or better (220 = ref conditions)		
			No. of Taxa	62 expected	**Habitat integrity: Riparian**	Increased flows to flush system
			ASPT	4.1-4.3 or better (7 = ref conditions)		

Considerations
Absence of flow dependent fish (e.g.: *Labeobarbus marequensis, Enteromius (Barbus) paludinosus,)*
Velocity sensitive aquatic macroinvertebrates, lack of habitat diversity and poor water quality (e.g: Perlidae and hydropsychidae).
Small stream thus sensitive to flow changes
Marginal and bank habitat requires improvement
High nutrient loads owing to considerable algal growth

Monitoring	**Frequency**
A task team urgently needs to address the issues surrounding the Steve Tshwete Waste Water Treatment Plant downstream of the EWR site.	
Stringent management measures for this reach and the broader Klein-Olifants should be revised and updated within the existing catchment management plan	
The proposed water quality RQOs for the nutrients are set for EWR3 should be stringently enforced	
Chemical and *in situ* water quality should be monitored quarterly downstream of the WWTW in addition to the monitoring at this EWR site	Annually

Diatom samples should be taken	Annually
Whole Effluent Toxicity (WET) testing should be conducted	Quarterly
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season
Riparian VEGRAI should be conducted	Every 5 years
The IHI should be conducted	Annually

Table 70: Ecological specifications for the Olifants River: **Olifants_EWR2**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve flow to increase marginal vegetation as habitat
No. of indigenous fish species that should be recorded	23 (including eel spp.)	Collect BMAR (30+), LCYL (20+) and CPRE (30+) / 20min shock effort	**SASS5 Score**	165-175 or better (220 = ref conditions)		
		Must capture 10 each of a least four (4) spp. of the expected small barbs	**No. of Taxa**	64 families expected	**Habitat integrity: Riparian**	Improve flow to increase marginal vegetation as habitat
			ASPT	5.5-5.7 or better (7 = ref conditions)		

Considerations
Absence of flow and flow depth dependent fish (e.g.: *Labeo rosae and Micralestes acutidens , Mesobola brevianalis and Marcusenius macrolepidotus)*
Velocity sensitive aquatic macroinvertebrates and those specific to certain habitat availability and require good water quality were absent (e.g. Hydropschidae and Heptogeniidae)
High nutrient loads owing to considerable algal growth and high siltation

Monitoring	**Frequency**
Chemical and *in situ* water quality should be monitored	Annually
Diatom samples should be taken	Annually
Whole Effluent Toxicity (WET) testing should be conducted	Quarterly
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season
Riparian VEGRAI should be conducted	Every 5 years
The IHI should be conducted	Annually

Table 71: Ecological specifications for the Kranspoortspruit: **OLI-EWR3**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	19	A high number of mining applications are in the process within the upper reaches of the Olifants system which may impact on the water quality and flow in the system. This needs to be managed		A high number of mining applications are in the process within the upper reaches of the Olifants system which may impact on the water quality and flow in the system. This needs to be managed	**Habitat integrity: Instream**	A high number of mining applications are in the process within the upper reaches of the Olifants system which may impact on the water quality and flow in the system. This needs to be managed.
		When sampling - 20min shock - sample AURA 5, BMAR 20+ and CPRE 15 - and at least 3 spp. of small barbs	**SASS5 Score**	185-190 or better (220 = ref conditions)	**Habitat integrity: Riparian**	Important to rehabilitate trampling and riparian vegetation.
			No. of Taxa	62 expected		
			ASPT	5.94-5.97 (7 = ref conditions)		

Considerations
Absence of flow dependent fish (e.g.: *Oreochromis mossambicus* and *Marcusenius macrolepidotus)*
Velocity sensitive aquatic macroinvertebrates (Heptageniidae and hydropsychidae). Their abundance has decreased due to lower flow depth and exposed habitats.

The system is an important refuge area for fish species within the Olifants system (3 of the reference species i.e. *Enteromius (Barbus) eutaenia, Labeobarbus marequensis and Chiloglanis pretoria*e are shallow, fast, deep dependent during all life cycles. The rare and unique *Petrocephalus wesselsi (to the system)*has been recorded previously)
Small stream thus sensitive to flow and quality changes

Monitoring	**Frequency**
Owing to limited upstream impacts, and the possible presence of the rare and endangered BLIN and unique BBIF the status of the river needs to be improved	
REMP sampling must be conducted every 2 years	Every 2 years

Table 72: Ecological specifications for the Selons River: **Olifants_SEL1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI		Improve habitat diversity - flows	**MIRAI**		**Habitat integrity: Instream**	Improve quality - lower algae loads
No. of indigenous fish species that should be recorded	12	In 20min electro sampling - sample 30+ BMAR, CPRE 15+, at least 2 spp. of small barbs and a Labeo spp.	**SASS5 Score**	141-149 or better (220 = ref conditions)		
			No. of Taxa	64 families expected	**Habitat integrity: Riparian**	Alien vegetation control and stabilising of banks.
			ASPT	4.52-4.58 (7 = ref conditions)		

Considerations
Absence of flow dependent fish (e.g.: *Labeo cylindricus, L. molybdinus and L. rosae)*
Velocity and water quality sensitive aquatic macroinvertebrates (Heptageniidae and hydropsychidae).
Fish migration link is fragmented due to weirs, impoundments and abstraction
Small stream thus sensitive to flow changes
The upstream Rooikraal Dam has no release capacity. Flow at site only from Kruis River

Monitoring	**Frequency**
REMP sampling must be conducted every 2 years	Every 2 years

Table 73: Ecological specifications for the Olifants River: **Olifants_ EWR8**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI		Improve flows to ensure habitat diversity	**MIRAI**		**Habitat integrity: Instream**	Improve water quality and flows
No. of indigenous fish species that should be recorded	27 (including 3 eel spp.)	In 20min electro sampling, must collect 4 small barb spp. and 2 Chiloglanis spp.	**SASS5 Score**	141-149 or better (220 = ref conditions)		
		Should expect to collect at least 2 Labeo spp. during electroshocking	**No. of Taxa**	64 families expected	**Habitat integrity: Riparian**	Improve water quality and flows
			ASPT	4.52-4.58 (7 = ref conditions)		

Considerations
Absence of flow depth and flow velocity dependent fish (e.g.: *Labeo rosae and L. ruddi and Chiloglanis swierstrai*). The later fish species prefers a sandy substrate which was not present owing to the smothering of algae and siltation.
Absence of flow dependent aquatic macroinvertbrates and biota requiring good water quality (e.g. Psephenidae)

Monitoring	Frequency
Owing to the proximity of this site, full comprehensive surveys should be conducted	Annually
Chemical and *in situ* water quality should be monitored	Quarterly
Diatom samples should be taken	Annually
The WET testing should be conducted	Quarterly
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season

Riparian VEGRAI should be conducted	Every 5 years
The IHI should be conducted	Annually
Stringent management measures for this reach should be revised and updated within the existing catchment management plan	
It is recommended that the system be flushed (freshetts)	

Table 74: Ecological specifications for the Lower Spekboom River: **Olifants_SPE1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve flows - need marginal vegetation as habitat. Lower nutrient inputs.
No. of indigenous fish species that should be recorded	17 (including 1 eel spp.)	Should collect 20+ CPRE, 15+ LCYL and 20+ LMOL in 20min electro sampling.	**SASS5 Score**	189-195 or better (240 = ref conditions)		
		In addition, get at least 3 small barbs	**No. of Taxa**	64 families expected	**Habitat integrity: Riparian**	Protect riparian zone along the reach
			ASPT	5.58-5.63 (7 = ref conditions)		

Considerations
Absence of habitat specific fish species (e.g.: *Opsaridium peringueyi, Enteromius (Barbus) neefi, E. paludinosus*. Although the habitat was there, it was exposed owing to the drought
Fish migration link from the Olifants system through the Steelpoort River, as the Spekboom River acts as a refugia.

Monitoring	**Frequency**
Due to the importance of the Spekboom River to the lower Steelpoort River, it is recommended that RHEM be conducted	Annually
Chemical, microbial and *in situ* water quality must be monitored	Quarterly
The site should be monitored to understand the health of the system and ensure the trajectory of change over time	
The instream monitoring should be in collaboration with the adjacent land use/s allocated water use license compliance monitoring program	

Table 75: Ecological specifications for the Upper Bylde River: **Olifants_BLY1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Lower erosion/silt from plantations. Lower overgrazing in the catchment. Control alien invasives. Rehabilitate river banks *i.e*. erosion.
No. of indigenous fish species that should be recorded	6 spp. expected	In 20min sampling - collect 15+ CPRE, 15+ BMAR and 3 AURA.	**SASS5 Score**	201-207 or better (240 = ref conditions)		
		Must collect 2 spp. of small barbs (BMOT, BNEE)	**No. of Taxa**	64 families expected	**Habitat integrity: Riparian**	Control alien invasives. Rehabilitate erosion of the river banks.
			ASPT	5.93-5.98 (7 = ref conditions)		

Considerations	
Absence of *Enteromius (Barbus) motebensis* owing to low water conditions and exposed marginal vegetation.	
Absence of fast flowing water, habitat and good water quality dependent aquatic macroinvertebrates (e.g. Psephenidae)	
High silt loads linked to upstream informal settlements and forestry which reduced the aquatic macroinvertebrate assemblages	
Sensitive stream owing to the stream geomorphology and profile	
Monitoring	**Frequency**
Due to the importance of the upper Blyde River in maintaining the good condition of the lower Blyde, it is recommended that RHEM be conducted	Annually
Chemical, *in situ* water quality and microbiological parameters should be monitored	Bi-annually
Index of habitat integrity (IHI) should be conducted	Annually
Land use activities should be managed to prevent degradation of the ecological health of the system and deterioration in water quality.	

Table 76: Ecological specifications for the Olifants River: **Olifants_ EWR11**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flushing to remove silt. Improve habitat i.e. marginal vegetation. Ensure sufficient SOOC available as habitat for the macro-invertebrates.
No. of indigenous fish species that should be recorded	29 expected including 3 eel spp.	To improve to C category must sample at least 25+ BMAR, 20+ CPRE and CPAR, 2 Labeo spp. in 20min electroshock sampling.	**SASS5 Score**	140-147 or better (220 = ref conditions)		
		Must collect at least 3 small barb spp. Must get habitat sensitive spp. *i.e.* MMAC, MBRE and PCAT	**No. of Taxa**	67 families expected	**Habitat integrity: Riparian**	Manage harvesting of vegetation in the riparian zone. Lower trampling and erosion.
			ASPT	4.55-4.7 or better (7 = ref conditions)		

Considerations
Absence of *Labeo rosae, Chiloglanis swierstrai, Micralestes acutidens* owing to low flow velocities, high turbidity and the substrate being covered in fine silt (poor water quality) .
Absence of fast flowing water, habitat and good water quality dependent aquatic macroinvertebrates (e.g. Perlidae and Hydrophysidae)
Fish migration link is fragmented due to weirs, impoundments and abstraction

Monitoring	**Frequency**
A full comprehensive monitoring programme for all drivers and response indicators to be implemented	
Chemical and *in situ* water quality should be monitored	Quarterly
Flow monitoring	
Diatom samples should be taken minimum	Annually
WET testing should be conducted quarterly until results are resolved	Quarterly

Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season
Riparian VEGRAI should be conducted	Every 5 years
IHI should be conducted	

Table 77: Ecological specifications for the Lower Blyde River: **Olifants_EWR12**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Return flows from agriculture, encroachment into the riparian zone must be controlled.
No. of indigenous fish species that should be recorded	27 spp. 2 eel spp.	In 20min electroshock should sample 30+ BMAR, 80+ CPRE, 30+ LCYL and 20+ MACU	**SASS5 Score**	202-207 or better (240 = ref conditions)		
		Must collect at least 2 small barb spp. and habitat sensitive spp. e.g. PCAT, MBRE and MMAC	**No. of Taxa**	71 expected	**Habitat integrity: Riparian**	Protect the riparian zone.
			ASPT	5.94-5.97 or better (7 = ref conditions)		

Considerations
Absence of *Opsaridium peringueyi, Petrocephalus wesselsi and Mesobola brevianalis* linked to limited flow velocities, habitat modification and siltation.
Aquatic macroinvertebrate assemblage abundance lower than normal owing to changes in water quality and limited flow velocities. Low flow velocities and flow depth dependent aquatic macroinvertebrates absent (e.g. Trichorythidae, Prospistomatidae)

Monitoring	Frequency
A full comprehensive monitoring programme for all drivers and response indicators to be implemented	
Chemical and *in situ* water quality should be monitored quarterly	Quarterly
Flow monitoring	
Diatom samples should be taken minimum annually	Annually
WET testing should be conducted	Quarterly
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season
VEGRAI should be conducted every 5 years	Every 5 years

IHI should be conducted annually	Annually

Table 78: Ecological specifications for the Olifants River: **Olifants_EWR13**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Vegetation degradation in catchment, erosion, silt build-up, needs flushing.
No. of indigenous fish species that should be recorded	33 spp. including 3 eel spp.	Should collect 30+ BMAR, 50+ CPRE, 20 CSWI, 20+ LCYL and 20+ LMOL in 20min electroshock effort.	**SASS5 Score**	174-179 or better (220 = ref conditions)		
		Must collect at least 4 small barbs - habitat related (marginal vegetation). Other spp. to collect include BIMB, GCAL, HVIT, PCAT, SINT	**No. of Taxa**	70 expected	**Habitat integrity: Riparian**	Manage developments into the riparian zone, erosion of the banks.
			ASPT	5.58-5.64 or better (7 = ref conditions)		

Considerations
Absence of flow dependent fish species (e.g. *Brycinus imberi, Labeo rosae, Chiloglanis swierstrai)*.
Absence of aquatic macro-invertebrates which are dependent on flow velocities (e.g. Perlidae, Psephenidae)
Low fish diversity a concern - flow and habitat related

Monitoring	**Frequency**
Chemical and in situ water quality should be monitored	Bi-annually
Diatom samples should be taken minimum	Every 2 years
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	annually during the wet season
Riparian VEGRAI should be conducted	Every 5 years
IHI should be conducted	Every 2 years

Table 79: Ecological specifications for the Olifants River: **Olifants_EWR16**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flow needed for habitat diversity, need marginal vegetation. Flush algae.
No. of indigenous fish species that should be recorded	36 spp. including 3 eel spp.	In 20min shock effort should collect: BMAR (80+), CPAR and CSWI (20+ each), LMOL and LCYL (15 each) and at least 4 small barb spp.	**SASS5 Score**	174-179 or better (220 = ref conditions)		
		In addition should get: PCAT, MBRE, MACU, GCAL and BIMB	**No. of Taxa**	64 expected	**Habitat integrity: Riparian**	Marginal vegetation.
			ASPT	5.58-5.64 or better (7 = ref conditions)		

Considerations
Wide channel and very dry period therefore the absence of flow dependent fish species (e.g. *Labeo congoro*, *Opsaridium peringueyi, Petrocephalus wesselsi)*.
Absence of aquatic macro-invertebrates which are dependent on flow velocities and those dependent on specific habitat availability (e.g. Perlidae, Psephenidae)
It is vital that this system within the Kruger National Park achieves the TEC status. In order to achieve this, the upper Olifants TECS need to be met and freshetts are implemented.

Monitoring	Frequency
A full comprehensive monitoring programme for all drivers and response indicators to be implemented	
Chemical and *in situ* water quality should be monitored	Quarterly
Flow monitoring at gauge B7H026	
Diatom samples should be conducted	Annually

WET testing should be conducted	Quarterly
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the wet and dry season
Riparian VEGRAI should be conducted	Every 5 years
IHI should be conducted	Annually
RQOs to be implemented and audited	

Table 80: Ecological specifications for the Letaba River: **Letaba_EWR7**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Poor habitat due to flow regulation - must improve. Need to maintain rare SIC habitat and marginal vegetation.
No. of indigenous fish species that should be recorded	30 spp. including 3 eel spp.	With improved flow and habitat must collect 20+ BMAR and 15+ CPRE in 20min shock effort.	**SASS5 Score**	Score 110 - expect 154 - 160 (or better) for Category C		
		As marginal vegetation improve, must get at least 3 small barb spp., MACU, SINT and GCAL	**No. of Taxa**	71 families expected	**Habitat integrity: Riparian**	Protect riparian zone and lower trampling and erosion. No increase in alien vegetation. Maintain viable populations of Matumi, leadwood, appleleaf, torchwood.
			ASPT	Score calculated at 5.3 - must be this or better.		

Considerations	
Absence of flow dependent and deep water in habitats were absent (e.g. Labeobarbus marequensis*, Labeo cylindricus, Oreochromis mossambicus and Hydrocynus vittatus*).	
Absence of flow related aquatic invertebrates (e.g. Perlidae, Heptageniidae, Oligoneuridae)	
Fish migration link is fragmented due to high number of impoundments and weirs with limited to no fishways.	
System is severely under stressed and thus will have no positive impact on the Olifants system	
Monitoring	**Frequency**
Owing to the proximity of this site, full comprehensive surveys should be conducted.	Annually
Chemical and *in situ* water quality should be monitored	Quarterly
Diatom sampling should be conducted	Annually
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the low flow conditions

Riparian VEGRAI should be conducted every 5 years	Every 5 years
The IHI should be conducted annually	Annually
Stringent management measures as per KNP protocols for this reach should be adhered to.	

Table 81: Ecological specifications for the Letsitele River: **Letaba_EWR2**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Alien invasive control needed, lower removal of riparian vegetation, stabilise river banks. Maintain the stones in current (SIC) and marginal vegetation
No. of indigenous fish species that should be recorded	19 spp. expected	In 20min shock effort must collect 20+ BMAR, 15+ CPRE.	**SASS5 Score**	86 recorded - currently in Class E, must improve to 115 or better.		
		Must collect 3 small barb spp., MMAC. Habitat and flow to improve to get LCYL and LMOL back in the reach	**No. of Taxa**	Expect 80+	**Habitat integrity: Riparian**	No increase in alien vegetation. Maintain viable populations of Matumi, leadwood, appleleaf.
			ASPT	Recorded 5.38 - must improve to 5.5.		

Considerations
High anthropogenic impacts and thus poor water quality resulted in the absence of *Micralestes acutidens, Mesobola brevianalis, Marcusenius macrolepidotus.*
Sensitive aquatic macroinverbrates absent owing to the poor water quality (e.g. Perlida, Ephemeriidae and Oligoneuridae)

Monitoring	**Frequency**
Owing to the proximity of this site, full comprehensive surveys should be conducted.	Annually
REMP protocols must be conducted annually	Annually
Organic and inorganic water quality and in situ water quality should be monitored	Quarterly
Diatom samples should be taken minimum	Annually
The WET testing should be conducted until results are resolved. As this river reach is an important water source for the locals, this is an important protocol.	Bi-annually

Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the low flow conditions
Riparian VEGRAI should be conducted	Every 5 years
The IHI should be conducted	Annually
Stringent management measures for this reach should be revised and updated within the existing catchment management plan	

Table 82: Ecological specifications for the Great Letaba River: **Letaba_EWR1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Monitor erosion of forestry. Rehabilitate riparian zone and remove alien vegetation. Maintain the stones in current (SIC) and marginal vegetation
No. of indigenous fish species that should be recorded	22 spp. expected including 2 eel spp.	Only 4 spp. collected - serious concern about this when comparing to the RQO set.	**SASS5 Score**	154-160 or better.		
			No. of Taxa		**Habitat integrity: Riparian**	Alien invasives and encroachment into the riparian zone.
			ASPT	5.2-5.4 or better		

Considerations
The presence of *Micropterus salmoides* is having an impact on the fish community.
Absence of aquatic macroinvertebrates which are dependent on flow velocities and good water quality (e.g. Perlidae, Prosopistomadiae)
Small stream thus sensitive to flow changes

Monitoring	Frequency
Owing to the proximity of this site, full comprehensive surveys should be conducted annually	Annually
Stringent management measures for this reach should be revised and updated within the existing catchment management plan	
Chemical and in situ water quality should be monitored	bi-annually
Diatom samples should be conducted	Annually
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the low flow conditions

Riparian VEGRAI should be conducted	Every 3 years
The IHI should be conducted	Annually

Table 83: Ecological specifications for the Broederstroom: **Letaba_BRO1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flow needed for habitat diversity, need marginal vegetation.
No. of indigenous fish species that should be recorded	Possibly 3 spp.	With presence and constant stocking of OMYK, no possibility of spp. to return.		With B/C score of 180 or better.		
			Marginal vegetation.	43 families expected	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	Should be 6 or more.		

Considerations
Although the alien invasive fish species have decimated the indigenous fish species population at this site, the habitat availability is still present for indigenous fish species to populate the site.
Small stream thus sensitive to flow changes

Monitoring	**Frequency**
Owing to the proximity of this site, full comprehensive surveys should be conducted.	Annually
Stringent management measures for this reach should be revised and updated within the existing catchment management plan	
In situ water quality should be monitored during the FRAI and MIRAI assessments	
Aquatic macroinvertebrates (MIRAI) should be monitored	Annually
The IHI should be conducted	Annually

Table 84: Ecological specifications for the Shingwidzi: **Shingwidzi_SHI1**

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flow improvement required
No. of indigenous fish species that should be recorded	26 spp. including 2 eel spp.	Must improve flow and habitat availability to get flow-dependant spp. into the system.	**SASS5 Score**	94 - improve to 142-146 (or better) (Expected 180)		
			No. of Taxa	64 families expected	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	Currently 5.22 - improve to 5.4 or better (6)		

Considerations
Absence of larger fish species and flow dependent fish (e.g.: *Labeobarbus marequensis, Enteromius (Barbus) paludinosus.*
Absence of flow and good water quality dependent aquatic macroinvertebrates (e.g. Perlidae, Philopotamidae)
Owing to no flow at the site, limited fish migration would occur and which further impacts on the fish community at the site
Sensitive stream owing to the stream geomorphology and profile

Monitoring	**Frequency**
Owing to the proximity of this site, full comprehensive surveys should be conducted annually	Annually
Stringent management measures as per KNP protocols for this reach should be adhered to	
Chemical and in situ water quality should be monitored annually	Annually
Diatom samples should be taken minimum annually	Annually
Fish (FRAI) and macroinvertebrates (MIRAI) should be monitored	Annually during the low flow conditions

Riparian VEGRAI should be conducted.	Every 5 years
The IHI should be conducted.	Annually

4.3.2 Biological Sites within the Olifants, Letaba and Shingwedzi Catchment

Table 85: Ecological specifications for the Steenkoolspruit: Olifants_STE1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve flows Need improved habitat for biota
No. of indigenous fish species that should be recorded	6-7 BANO BNEE BPAU BPOL CGAR PPHI TSPA (+ 3 exotics)	PES is D, Expect 4 species to be collected in 20 min sampling effort	**SASS5 Score**	Expected score of 60+		
			No. of Taxa	20+ taxa expected at the site	**Habitat integrity: Riparian**	Surrounding banks in a fair to good condition - Maintain
			ASPT	Expected value – 3.46 or higher		

Considerations
Improve flow velocities – ensure return flows of good quality

Monitoring	**Frequency**
Conduct a REMP	Annually
The instream monitoring should be in collaboration with the adjacent land use/s allocated water use licence compliance monitoring program.	

Table 86: Ecological specifications for the Bronkhorstspruit: Olifants_BRO1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve water quality- concern is the high organic pollution and algal growth
No. of indigenous fish species that should be recorded	Expected 6+ species	Current PES – C Should collect at least 5 species under normal flows, concern about the presence of BPOL	**SASS5 Score**	Expected score should improve to 120+		
			No. of Taxa	Expected – 25+	**Habitat integrity: Riparian**	Riparian in fair condition – need to remove alien vegetation and lower trampling of the river banks (cattle)
			ASPT	Expected – 4+		

Considerations
Must improve water quality – concern about high organic content related to sewage return flows.

Monitoring	**Frequency**
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season
Full chemical and *in situ* water quality is to be sampled	Quarterly
Diatom sampling	Quarterly

Table 87: Ecological specifications for the Timbavati: Olifants_TIM1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Need improved flow velocities to improve water quality
No. of indigenous fish species that should be recorded	20+ expected	PES B Only 2 sampled – should improve to 10+ under improved flow conditions. Need more sustained flow to revive the system.	**SASS5 Score**	Expected to be 150+		
			No. of Taxa	Expected – 25+ taxa	**Habitat integrity: Riparian**	In a good condition
			ASPT	Expected to be 4.9 or better		

Considerations
Must look at water quality outside the Kruger National Park – must lower the high organic content, possibly from lack of water purification management.

Monitoring	**Frequency**
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season
I*n situ* water quality is to be sampled	Quarterly

Table 88: Ecological specifications for the Steelpoort: OLI_GRO1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	Expected 6-8 species	PES – C Expected to sample 3-4 species, but MSAL a concern.	**SASS5 Score**	120+	**Habitat integrity: Instream**	Increased flows to remove sediment.
			No. of Taxa	30+ expected.	**Habitat integrity: Riparian**	Bank stabilisation Removal of exotics
			ASPT	5.0-5.1		

Considerations
Improved flow velocities to rejuvenate the in-stream habitat and improve water quality.

Monitoring	**Frequency**
This site must be continually monitored from a biological perspective in order to gain information for the RQO's	
Full REMP protocols should be conducted under better flow conditions during the wet season in order to establish a representative baseline for the Grootvlei catchment and its role in the upper Steelpoort catchment	
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Full chemical, microbial and in situ water quality is to be sampled	quarterly

Table 89: Ecological specifications for the Langspruit: Olifants_LAN1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Increased flows to remove silt.
No. of indigenous fish species that should be recorded	Expected 6-8 species	Need to sample 4 species and at least 30 small barbs in a 20min effort.	**SASS5 Score**	180+		
			No. of Taxa	Expected – 30+	**Habitat integrity: Riparian**	Stabilise bank Address erosion in the catchment Concern on water quality
			ASPT	6.4-6.6		

Considerations
All efforts must be made to ensure that alien fish do not occupy this system – concern of possible sources upstream. Must prevent infestation from sources downstream.

Monitoring	**Frequency**
This site must be continually monitored from a biological perspective in order to gain information for the RQO's	
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Full chemical, microbial and in situ water quality is to be sampled	quarterly

Table 90: Ecological specifications for the Masala: Olifants_MAS1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Some flows to improve instream habitat
No. of indigenous fish species that should be recorded	Expected 7-8 species	PES – C Expected to collect 4-5 species, including 3 small Barbs	**SASS5 Score**	180 – 190 expected		
			No. of Taxa	30+ expected	**Habitat integrity: Riparian**	Alien invasives eradication
			ASPT	Expected 5.8 – 5.9		

Considerations
Must improve land-use practices upstream (erosion) and lower possible sewage return flows

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season
Metal accumulation within the fish species to ensure that it is safe for human consumption	
RQOs to be implemented	

Table 91: Ecological specifications for the Klip: Olifants_KLI1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Sewage return flows, must rectify to lower algal growth. Increased flows to scour sediment buildup
No. of indigenous fish species that should be recorded	Expected 4-5 species	PES – B Must collect 3 species and 20 specimens per 20min effort	**SASS5 Score**	100+		
			No. of Taxa	20 expected	**Habitat integrity: Riparian**	Must lower trampling and vegetation removal
			ASPT	Expected to be 6.6		

Considerations
Must protect this river as a refuge of fish above the De Hoop Dam.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season
Continual management to protect the ecological status of this river reach, especially the management of the larger landscape due to the steepness of the site with the aim to avoid further erosion and trampling from local agricultural activities.	

Table 92: Ecological specifications for the Dwars: Olifants_DWA1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	18 species expected	PES - D Must collect 10 – 12 species	**SASS5 Score**	Expected 200+	**Habitat integrity: Instream**	Must improve water quality
			No. of Taxa	30+ expected	**Habitat integrity: Riparian**	Increased flows to remove silt. Monitor vegetation removal Lower trampling in the riparian zone
			ASPT	Expected 6-8-7		

Considerations
Must improve PES, as the Dwars River is an important refuge area for biota from the Steelpoort River.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status of this river reach, due to the river being an important refugia for the above mentioned fish species and planned upstream mining activities.	

Table 93: Ecological specifications for the Steenkoolspruit: Olifants_STE2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flow increase needed – siltation and organic pollution a concern
No. of indigenous fish species that should be recorded	3-4 expected	PES – C Must collect 2 species (10+ each) in sampling effort	**SASS5 Score**	Expected under good conditions to be 100+		
			No. of Taxa	Expect 25 families	**Habitat integrity: Riparian**	Lower erosion and trampling of surrounding land
			ASPT	Expected – 4.5 – 4.6		

Considerations
Refuge area in upper reaches of the system.

Monitoring	**Frequency**
Assess compliance to the conditions of the water use license criteria from surrounding land uses (current mining activities to the west of the sample site)	
The site should be monitored to understand the health of the system and ensure the trajectory of change over time	
The instream monitoring should be in collaboration with the adjacent land use/s allocated water use license compliance monitoring program.	

Table 94: Ecological specifications for the Dwars-in-die-wegspruit: Olifants_DWA2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flow increase needed – siltation and organic pollution a concern
No. of indigenous fish species that should be recorded	3-4 expected	PES – C Must collect 2 species (10+ each) in sampling effort	**SASS5 Score**	Expected under good conditions to be 100+		
			No. of Taxa	Expect 25 families	**Habitat integrity: Riparian**	Lower erosion and trampling of surrounding land
			ASPT	Expected – 4.5 – 4.6		

Considerations
Refuge area in upper reaches of the system.

Monitoring	**Frequency**
As the site was characterised by a deep pool, it hampered sampling effort and thus fish and aquatic macroinvertebrates could not be sampled. It is thus advised that this site is not surveyed owing to the poor site characteristics.	
Chemical and *in situ* water quality is to be sampled	Quarterly.
The instream monitoring should be in collaboration with the adjacent land use/s allocated water use license compliance monitoring program (i.e. current mining activities to the west of the sample site).	

Table 95: Ecological specifications for the Steenkoolspruit: Olifants_STE3

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Monitor sewage pollution Increased flows needed
No. of indigenous fish species that should be recorded	3-4 expected	PES – D	**SASS5 Score**	Expected under good conditions to be 100+		
			No. of Taxa	Expect 25 families	**Habitat integrity: Riparian**	Erosion, over grazing and trampling must be managed. Removal of alien invasive trees.
			ASPT	Expected – 4.5 – 4.6		

Considerations
Refuge area in upper reaches of the system.

Monitoring	**Frequency**
A different site should be identified to sample fish and macroinvertebrates.	
Chemical, bactrial and in situ water quality is to be sampled	Quarterly
The instream monitoring should be in collaboration with the adjacent land use/s allocated water use license compliance monitoring program (i.e. current and proposed future mining and power generation activities in the area).	

Table 96: Ecological specifications for the Olifants: Olifants_OLI1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Water Quality improvement required. Manage sewage pollution Increased flows needed to scour sediments
No. of indigenous fish species that should be recorded	11 – 13 species expected	PES – C Must collect 7-8 species under improved WQ conditions	**SASS5 Score**	120+ expected		
			No. of Taxa	50+ expected	**Habitat integrity: Riparian**	Alien invasive control must be done
			ASPT	5.8-6 expected		

Considerations
Important habitat for biota and vegetation above Loskop Dam.
Nutrient management must be considered in Olifants River and upstream into the Klipspruit

Monitoring	**Frequency**
Fish and macroinvertebrates should be sampled	Bi-annually
Full chemical and in situ water quality is to be sampled	Quarterly
Diatom sampling should be undertaken	Quarterly
Heavy metals arising from the Klipspruit must be monitored.	Quarterly

Table 97: Ecological specifications for the Klein-Olifants: Olifantsa_K_OLI1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve water quality Lower sewerage pollution Manage erosion and siltation
No. of indigenous fish species that should be recorded	5 expected	PES – D Must collect 3 species	**SASS5 Score**	140+		
			No. of Taxa	30+ expected	**Habitat integrity: Riparian**	Stabilise banks, lower trampling and erosion
			ASPT	4.9 - 5		

Considerations
Important section of the upper system with regard to biodiversity protection

Monitoring	**Frequency**
As site Olifants_K_OLI1 and Olifants_K_OLI2 are in close proximity to each other, and site Olifants_K_OLI2 is located in the upper reaches of Middleburg dam, it is recommended that a new site be selected on the Klein-Olifants to replace the two sites (Olifants_K_OLI1 and Olifants_K_OLI2) and provide a combined overview of upstream impacts from Klein-Olifants, Coetzerspruit, Bosmanspruit, Rietkuilsprit and Woes-Alleenspruit. This new site is proposed to be located at site co-ordinates -25.836943, 29.608087.	
Fish and macroinvertebrates should be sampled	Bi-annually
Full chemical, bacterial and *in situ* water quality is to be sampled	Quarterly
Diatom sampling should be undertaken	Quarterly

Table 98: Ecological specifications for the Klein-Olifants: Olifants_K_OLI2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve WQ Lower sewerage pollution Increased flows for scouring of sediments
No. of indigenous fish species that should be recorded	8-10 expected	PES – C Must collect 4-5 species during sampling efforts	**SASS5 Score**	120+		
			No. of Taxa	22+ families expected	**Habitat integrity: Riparian**	Manage erosion of river banks and the catchment
			ASPT	4.8+		

Considerations
Refugia and biodiversity importance above the impoundments in the system.

Monitoring	**Frequency**
As site Olifants_K_OLI1 and Olifants_K_OLI2 are in close proximity to each other, and site Olifants_K_OLI2 is located in the upper reaches of Middleburg dam, it is recommended that a new site be selected on the Klein-Olifants to replace the two sites (Olifants_K_OLI1 and Olifants_K_OLI2) and provide a combined overview of upstream impacts from Klein-Olifants, Coetzerspruit, Bosmanspruit, Rietkuilsprit and Woes-Alleenspruit. This new site is proposed to be located at site co-ordinates -25.836943, 29.608087.	
Fish and macroinvertebrates should be sampled	Bi-annually
Full chemical and *in situ* water quality is to be sampled	Quarterly
Diatom sampling should be undertaken	Quarterly

Table 99: Ecological specifications for the Elands: Olifants_ELA2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Must improve flows Need flushing of silt Must monitor and lower sewerage in the river
No. of indigenous fish species that should be recorded	Expected – 9 species	PES – C Must collect 4-5 species	**SASS5 Score**	Expect 160		
			No. of Taxa	Expected – 30 families	**Habitat integrity: Riparian**	Some riparian rehabilitation needed - aliens and bank stabilisation
			ASPT	Expect 6 – 6.2		

Considerations
Important sector above the impoundment for biodiversity protection

Monitoring	**Frequency**
Full chemical and in situ water quality is to be sampled	Quarterly
Diatom sampling should be undertaken	Quarterly

Table 100: Ecological specifications for the Groot Dwars: Olifants_G_DWA1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	WQ improvement needed Some siltation – control impacts in the catchment
No. of indigenous fish species that should be recorded	Expected - 2 species	PES – C Must collect both species	**SASS5 Score**	160		
			No. of Taxa	30+ expected	**Habitat integrity: Riparian**	In fair condition – must monitor removal of vegetation and trampling of river banks
			ASPT	6.0 expectd		

Considerations
Important sector above the Der Brochen impoundment.

Monitoring	**Frequency**
REMP protocols to be conducted	
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season
Full chemical and in situ water quality is to be sampled	Quarterly

Table 101: Ecological specifications for the Steelpoort: Olifants_STEP1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	Expected 18 species	PES – D Must sample 9 – 11 species	**SASS5 Score**	120+	**Habitat integrity: Instream**	Some solid waste dumping a concern
			No. of Taxa	Expected 25+	**Habitat integrity: Riparian**	Riparian vegetation modified. Bank eroded – trampling and vehicles
			ASPT	Expected 5.8 - 6		

Considerations
Important sector of the Steelpoort below De Hoop Dam

Monitoring	**Frequency**
REMP protocols to be conducted	
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season and dry season.
Full chemical, microbial and in situ water quality is to be sampled, taken careful note of temperature fluctuations.	Quarterly
Turbidity should be monitored (owing to the silt loads from the dam)	

Table 102: Ecological specifications for the Mohlapitse: Olifants_MOH1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Some solid waste
No. of indigenous fish species that should be recorded	20 species expected	PES – B Must collect 15+ species	**SASS5 Score**	180+		
			No. of Taxa	30+ families expected	**Habitat integrity: Riparian**	Stabilisation of road crossing to lower erosion risks
			ASPT	Expected – 7+		

Considerations
Critical refuge area of biota from the Olifants River – with some rare species present - AKAT

Monitoring	**Frequency**
Full REMP protocol	
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season and dry season
In situ water quality is to be sampled	Quarterly

Table 103: Ecological specifications for the Mohlapitse: Olifants_MOH2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve water quality Manage soil erosion in the catchment
No. of indigenous fish species that should be recorded	Expected – 22 species	PES – B In good conditions should collect 14 species	**SASS5 Score**	190+		
			No. of Taxa	30+ families expected	**Habitat integrity: Riparian**	Control alien invasive Manage riparian destruction, trampling and erosion
			ASPT	Expected – 6.5+		

Considerations
Important refuge area for biota from the Olifants River.

Monitoring	**Frequency**
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Full chemical, microbial and in situ water quality is to be sampled (based on the observed water having a cloudy blue colour at the time of the survey).	Quarterly

Table 104: Ecological specifications for the Motse: Olifants_MOT1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Manage sewage return-flows in the upstream sections. Monitor water quality from mining areas. Ensure illegal abstractions is halted.
No. of indigenous fish species that should be recorded			**SASS5 Score**			
			No. of Taxa		**Habitat integrity: Riparian**	Must get communities to improve land-use practices, high erosion and siltation a problem.
			ASPT			

Considerations
System is considered very seasonal/ephemeral – therefore limited habitat for fish and macroinvertebrates. Monitoring and management must be towards water quality and habitat integrity

Monitoring	**Frequency**
Full chemical, microbial and in situ water quality is to be sampled	Quarterly

Table 105: Ecological specifications for the Olifants: Olfants_OLI2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Must increase flow velocities to be able to get to PES B, improve water quality of water in the catchment.
No. of indigenous fish species that should be recorded	Expect 20+ species	PES B Must collect flow dependent and habitat dependent species – e.g. HVIT, LCON, LMOL, BMAR, CSWI, PCAT, MMAR	**SASS5 Score**	Expected 200+		
			No. of Taxa	45+ expected	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	Expected 6.8		

Considerations
This site in the KNP is expected to have a PES B. currently flows and impacts from the catchment is having severe detrimental impacts on the system and to rectify, the upstream recommendations as part of this report is critical and must be implemented.

Monitoring	**Frequency**
Aquatic macroinvertebrates should be sampled	Annually
Fish should be sampled	Every three years or should any changes or other indices are detected
Full chemical and in situ water quality is to be sampled	Annually
Diatom sampling should be undertaken	Annually

Table 106: Ecological specifications for the Letaba: Letaba_LET2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Increased flows needed. Monitor WQ outside KNP
No. of indigenous fish species that should be recorded	Expected 30, including 3 eel species (low probability)	PES C Expect do sample 12-15 species	**SASS5 Score**	Expected – 160+		
			No. of Taxa	30+ expected	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	6.6 – 6.8		

Considerations
As part of KNP mandate it is important to protect biodiversity of the system. Must improve water quality and quantity in the Letaba River.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical and *in situ* water quality should be conducted	Bi-annual
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season

Table 107: Ecological specifications for the Tsende: Letaba_TSE1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Maintain good flows
No. of indigenous fish species that should be recorded	Expect 4-6 species	PES B Expected to collect 4 species per survey	**SASS5 Score**	Expected – 150+		
			No. of Taxa	25+	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	6+		

Considerations
Important refugia as part of the Letaba River – this river in the park therefore critical as part of the biodiversity proctection.

Monitoring	**Frequency**
In situ water quality should be conducted with yearly chemical and microbial analysis – to determine any possible impacts from tourist facilities upstream.	
Aquatic macroinvertebrates should be sampled	Annually towards the end of the dry season.
Continual management to protect the ecological status of this river reach, due to the river being an important refugia for the above mentioned fish species and planned upstream mining activities.	

Table 108: Ecological specifications for the Letaba: Letaba_LET1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Must increase flows to conserve the system and biodiversity within the KNP. Must improve water quality from the catchment.
No. of indigenous fish species that should be recorded	20+ species expected	PES B Expected to collect 18+ species per survey, including flow dependent spp. LCON, HVIT	**SASS5 Score**	180+		
			No. of Taxa	35 expected	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	6.7+		

Considerations
This is an important system with regard to the mandate of the KNP to protect biodiversity.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Bi-annual
Fish and macroinvertebrates should be sampled	Annually during the wet season.
Continual management to protect the ecological status of this river reach, due to the river being an important refugia – cumulative impacts from the Letsitele, Nsama, Middle, Klein and Groot Letaba and to a smaller extent the Nwanedzi and Molototsi rivers.	

Table 109: Ecological specifications for the Klein Letaba: Letaba_K_LET1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Flow must improve to get the PES B as required. Must manage the WQ – especially return flows. Outside the KNP the erosion is a concern impacting on habitat availability – siltation.
No. of indigenous fish species that should be recorded	Expect 10-15 species in wet season conditions	PES B Must collect 8 species in the wet season.	**SASS5 Score**	Expect 150+ in PES B		
			No. of Taxa	20+ expected.	**Habitat integrity: Riparian**	Marginal vegetation as habitat must be maintained.
			ASPT	Expected to be 6.5+		

Considerations
This river is an important component of the Letaba River system and flow quantity and water quality is key in maintaining the habitat for biodiversity in the KNP.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Bi-annual
Aquatic macroinvertebrates and diatoms should be sampled. However, communication with the KNP game ranger must first be conducted to confirm there is flow at the site for the benefit of the sampling event.	Annually during the wet season
Continual management to protect the ecological status of this river reach, due to upstream impacts on the Letaba River system.	

Table 110: Ecological specifications for the Groot Letaba: Letaba_G_LET1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Water quality and quantity must improve – PES B downstream needed.
No. of indigenous fish species that should be recorded	Expected 25+ species.	PES C Must sample 15+ species under natural summer flows.	**SASS5 Score**	140+		
			No. of Taxa	Expect 40+	**Habitat integrity: Riparian**	Riparian vegetation removal a concern – erosion and siltation impact on instream habitat.
			ASPT	6.4+		

Considerations
This is the site just west of the KNP border and is considered an important sector of the river with regard to water input into the park. It is an important refugia for biota and part of the biodiversity conservation for the lower section of the Letaba River system – at the confluence with the Klein Letaba River.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Annually during the wet season or when there is flow at the site.
Continual management to protect the ecological status of this river reach, due to the upstream impacts on the system to ensure good quality water into the KNP and Mozambique.	

Table 111: Ecological specifications for the Nsama: Letaba_NSA1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Water quality and return flows must be improved.
No. of indigenous fish species that should be recorded	Expected – 15	PES B	**SASS5 Score**	160+		
			No. of Taxa	40+ families expected	**Habitat integrity: Riparian**	Erosion and trampling. Dumping of refuse – all types
			ASPT	6.8		

Considerations
An important tributary of the Klein Letaba River – needs to improve flows and water quality for the system downstream.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality	Annually during the wet season
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status – important tributary of the Klein Letaba River – will reflect the impacts from the catchment and therefore loads on the Letaba River system.	

Table 112: Ecological specifications for the Klein Letaba: Letaba_K_LET2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Water quality and quantity to be addressed.
No. of indigenous fish species that should be recorded	20+ species	PES D Need to collect 10+ species under improved flow conditions	**SASS5 Score**	140+		
			No. of Taxa	30+ expected	**Habitat integrity: Riparian**	Removal of natural vegetation. Alien invasive encroachment. Erosion and trampling.
			ASPT	5.8-6		

Considerations
An important sector of the river in the middle reaches of the system.

Monitoring	**Frequency**
REMP protocols should be conducted	Annually
Chemical, microbial and in situ water quality	Annually during the wet season and prior to the dry season
Fish and macroinvertebrates should be sampled.	Annually towards the end of the wet season
Continual management to protect the ecological status of this river reach.	

Table 113: Ecological specifications for the Groot Letaba: Letaba_G_LET2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Erosion and siltation. Poor water quality. Need increased sustained flows to flush the system and improve PES
No. of indigenous fish species that should be recorded	18+ species	PES D Expected to collect as least 14 species	**SASS5 Score**	140+		
			No. of Taxa	30+ families expected	**Habitat integrity: Riparian**	Riparian destruction and alien invasives a concern. Erosion and trampling – resulting the siltation.
			ASPT	5.8-6+		

Considerations
Because of the fragmented nature of the system, more sustained flows in needed to improve the overall condition of the river.

Monitoring	**Frequency**
Monitoring only to be conducted at site LET13. A biological survey is not necessary at site LET12 and LET13.	

Table 114: Ecological specifications for the Groot Letaba: Letaba_G_LET3

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Erosion and siltation. Poor water quality. Need increased sustained flows to flush the system and improve PES
No. of indigenous fish species that should be recorded	18+ species	PES D Expected to collect as least 14 species	**SASS5 Score**	140+		
			No. of Taxa	30+ families expected	**Habitat integrity: Riparian**	Riparian destruction and alien invasives a concern. Erosion and trampling – resulting the siltation.
			ASPT	5.8-6+		

Considerations
Because of the fragmented nature of the system, more sustained flows in needed to improve the overall condition of the river.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Annually towards the end of the dry season.
Continual management to protect the ecological status of this river – severe impacts related to fragmentation, pollution and abstraction.	

Table 115: Ecological specifications for the Groot Letaba: Letaba_G_LET4

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve WQ – concern about sewage pollution. Improve flow regime conditions.
No. of indigenous fish species that should be recorded	16+ species expected	PES D Must collect 10+ species under improved WQ and flow conditions.	**SASS5 Score**	175+ expected		
			No. of Taxa	40+ expected	**Habitat integrity: Riparian**	Concern about some riparian removal and alien invasive infestations – control latter.
			ASPT	6.5-6.8		

Considerations
Must improve PES. Important sector of the river below Lake Tzaneen.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Bi-annually towards the end of the dry and wet season
Continual management to protect/improve the ecological status of this river reach. Highly impacted and must improve EC to ensure good water quality downstream.	

Table 116: Ecological specifications for the Broederstroom: Letaba_BRO2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	6+ species expected	PES C Concern with the MSAL presence – indigenous fish under serious threat.	**SASS5 Score**	210+	**Habitat integrity: Instream**	Lower silt inputs from plantations
			No. of Taxa	40+ expected	**Habitat integrity: Riparian**	Alien vegetation eradication. Restore riparian zone with removal of plantations near river edge.
			ASPT	6.5-6.8+		

Considerations
This system is an important tributary of the Groot Letaba River – can contribute good quality and quantity water to the system – however the impacts of forestry are negative in this regard.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical and *in situ* water quality should be conducted	Bi-annual
Fish and macroinvertebrates should be sampled	Annually towards the end of the dry season.
Continual management to protect the ecological status of this river.	

Table 117: Ecological specifications for the Politsi: Letaba_POL1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Improve WQ and velocity. Lower silt inputs from forestry.
No. of indigenous fish species that should be recorded	8-10 expected	PES C Must collect at least 6 species under improved conditions	**SASS5 Score**	180+		
			No. of Taxa	35+	**Habitat integrity: Riparian**	Remove forestry on river banks. Rehabilitate the river banks and alien invasive vegetation.
			ASPT	6.8-7		

Considerations
This river is an important biota refuge and water supply to the Groot Letaba River.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and *in situ* water quality should be conducted	Bi-annual
Fish and macroinvertebrates should be sampled	Annually towards the end of the dry season
Continual management to protect the ecological status of this river.	

Table 118: Ecological specifications for the Shisha: Shingwedzi_SHIS1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	Mostly seasonal floodplain	Not sure if fish can be monitored.	**SASS5 Score**			
			No. of Taxa			
			ASPT			

Considerations
System very important supply of water to the Mphongolo River (Shingwedzi River system)

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
In situ water quality should be conducted	Annually in the wet season
Fish and macroinvertebrates should be sampled	Every 3 years towards the end of the wet season
Continual management to protect the ecological status of this river.	

Table 119: Ecological specifications for the Mphongolo: Shingwedzi_MPH2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	10-12 expected	PES A Must monitor in wet season, as system is seasonal – 4 – 6 species expected	**SASS5 Score**	120+	**Habitat integrity: Instream**	Concern about sewage pollution
			No. of Taxa	25+		
			ASPT	5.5+		

Considerations
This is an important tributary of the Shingwedzi River – critical water supply and biodiversity refuge.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and *in situ* water quality should be conducted	Annually during the wet season
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status of this river reach – impacts from outside the KNP must be monitored.	

Table 120: Ecological specifications for the Mphongolo: Shingwedzi_MPH1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	10-12 species expected	PES D 4-6 species in good flow conditions	**SASS5 Score**	120+	**Habitat integrity: Instream**	Must improve PES, as lower down PES must be A (Shi 3). Sewage pollution outside KNP a problem.
			No. of Taxa	25+		
			ASPT	5.5+		

Considerations
This is an important tributary of the Shingwedzi River – critical water supply and biodiversity refuge.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Annually during the wet season
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status of this river – severe impacts upstream.	

Table 121: Ecological specifications for the Phugwane: Shingwedzi_PHU1

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	24 species expected	PES C Expected to collect 12 species under improved flow conditions	**SASS5 Score**	120+	**Habitat integrity: Instream**	Increased flows Water quality – sewage in the system a concern (source outside KNP)
			No. of Taxa	25+		
			ASPT	3.9-4		

Considerations
This is an important tributary of the Shingwedzi River.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, microbial and in situ water quality should be conducted	Annually during the wet season
Fish, diatoms and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status of this river – impacts from outside KNP have negative results in lower Shingwedzi River.	

Table 122: Ecological specifications for the Shingwedzi: Shingwidzi_SHI2

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**		**Habitat integrity: Instream**	Water quality and sewage must improve. Rehabilitate old mines upstream – AMD into system.
No. of indigenous fish species that should be recorded	27 expected	PES C Expected to sample 12 – 15 species under improved flow conditions	**SASS5 Score**	120+		
			No. of Taxa	20+ expected	**Habitat integrity: Riparian**	Siltation due to poor land-use outside KNP
			ASPT	4 expected		

Considerations
The Shingwedzi, although seasonal, a critical water resource in the north of the country.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical, diatom, microbial and in situ water quality should be conducted	Annually during the wet season
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status of this river system – impacts carried through the KNP.	

Table 123: Ecological specifications for the Shingwedzi: Shingwidzi_SHI3

Fish		Special conditions	Aquatic Macroinvertebrates		Habitat Integrity	Special conditions
FRAI			**MIRAI**			
No. of indigenous fish species that should be recorded	28 expected	PES B Expect to collect 18-20 species under improved WQ and flow conditions	**SASS5 Score**	120+	**Habitat integrity: Instream**	Low flows limit habitat – improved flow will increase diversity.
			No. of Taxa	50 expected		
			ASPT	4.4-4.6		

Considerations
The Shingwedzi, although seasonal, a critical water resource in the north of the country.

Monitoring	**Frequency**
REMP protocols should be conducted	Annual
Chemical and *in situ* water quality should be conducted	Quarterly
Fish and macroinvertebrates should be sampled	Annually towards the end of the wet season.
Continual management to protect the ecological status of this river.	

5 GROUNDWATER SPECIFICATIONS

The assessment of the groundwater reserve in the Study Area is based on reviews of investigations and reviews done by independent research teams in the period between 2001 and 2013. In all cases the Olifants Riverand Letaba River Catchments were not addressed as one water management area, therefore, this assessment will focus on submitting a combined assessment of the groundwater reserve. The Shingwedzi River Catchment (TC B90) has not been studied in terms of any resource directed measures (RDM) assessment yet. The Tertiary Catchment (TC) B90 was therefore addressed on a desktop level assessment instead (as with the surface component).

The groundwater quality and quantity indices for the groundwater Reserve are included in Table 124 below. The table contains the basic dataset for the DWS GRDM Template, but is extended to include a groundwater quality index, a groundwater quality status/trend narrative, and a groundwater quantity directive/recommendation.

The groundwater Quality Index has been structured from an assessment of the quaternary groundwater quality National Groundwater Archive dataset, but unfortunately dates back to time when the climate in the study area was different, as well as the anthropogenic developments. It is therefore considered to be slightly more conservative (showing a fresher quality signature).

The groundwater Quality Status/trend narrative describes the time series component of the quaternary catchments groundwater quality. Of particular importance in this assessment is the long-term rising trends in TDS, NO_3–N, SO_4, and Mg for example. In this case the groundwater quality reserve should specify at least a Marginal water quality (DWAF *et al*, 1998), and further deterioration should not be allowed without very strict/implementable mitigation measures.

The groundwater Quantity Directive/Recommendation lists five levels of potential stresses on the groundwater component in the quaternary catchments, each with a specific guideline to address further groundwater allocations, i.e.

- Minimum Stress Index Level (Groundwater investigation limited to local water balance estimation and hydrocensus);
- Medium Stress Index Level (Groundwater investigation more detail in terms of hydrogeological conditions, hydrocensus, limited monitoring requirements, mapping of other abstractions and water balance);
- High Stress Index Level (High-level groundwater investigation, monitoring boreholes, specific license conditions, aquifer characterisation, recharge estimates, regional potential impacts and piezometric mapping);
- QC water balance assessment required (Current water balances for quaternary catchment does not match and Allocable groundwater is < 1 MCM/a)); and
- Groundwater allocation (or use) significantly over-allocated, means that use is potentially impacting on the Groundwater Component of the Reserve.

Ecological specifications of the groundwater resources are directly linked to these indexes, namely in the case of the groundwater component status of the reserve in a significantly over-allocated quaternary catchment, the water use is already impacting on the total reserve of the quaternary catchment and further allocations should be critically considered.

Table 124: Groundwater quantity and quality indices per quaternary catchment and Reserve

		INPUT	OUTPUT											
Catch-ment	**Area (km^2)**	**Rech to Aqf (WSM & SRK)**	**Gw Bf (WSM & SRK)**	BHN Reserve (Mm3/a)	Total Gwater Use (Mm3/a)	Total Gw Reserve (Mm3/a)	SI = Gw Use / Aqf Rech	(Mm3/a)	Quantity Index (GRDM)	Quality Index (Research Reports)	Allocable Gwater (Mm3/a)	Quantity Directive/ Recommendation i.t.o. New allocations.	Gw Quality Status/Trend i.t.o long-term sustainability	**Reserve (% of Recharge)**
		Ave	**Ave**		Calc'd		WSM2013	$Exigo_{2009}$	Ranked WSM	Ranked	Cal'd			
B11A	945	11.99	10.29	0.10	0.57	12.3	0.04	0.21	A-Unmodified	Good (Class One, 1)	2.98	Minimum Stress Index Level	Largely acceptable levels of TDS, NO_3-N and SO_4. Local impacts on water quality due to agriculture practices and livestock farming.	79.61
B11B	435	5.66	4.54	0.12	0.20	5.49	0.03	0.39	A-Unmodified	Good (Class One, 1)	1.32	Moderately Stress Index Level		80.26
B11C	385	5.65	4.00	0.04	4.37	4.89	0.77	0.21	C-Moderately modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level		85.64
B11D	551	9.23	5.40	0.18	2.34	6.68	0.31	0.33	B-Largely Natural	Marginal (Class Two, 2)	0.00	Moderately Stress Index Level		87.21
B11E	467	6.53	4.56	0.11	3.53	5.47	0.52	0.48	C-Moderately modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level		80.44
B11F	428	5.44	4.32	0.08	0.37	5.15	0.06	0.89	B-Largely Natural	Marginal (Class Two, 2)	1.08	Moderately Stress Index Level		79.97
B11G	368	4.58	3.73	0.07	0.10	4.49	0.02	0.41	A-Unmodified	Marginal (Class Two, 2)	1.17	Moderately Stress Index Level		80.04
B11H	246	3.40	2.50	0.04	0.46	3.01	0.12	0.23	B-Largely Natural	Marginal (Class Two, 2)	0.41	Highly stressed Index Level		79.63
B11J	269	4.49	5.39	0.45	1.88	1.88	0.06	0.15	B-Largely Natural	Marginal (Class Two, 2)	0.00	Highly stressed Index Level		85.45
B11K	378	6.50	7.33	0.03	0.22	7.62	0.02	0.92	B-Largely Natural	Marginal (Class Two, 2)	2.25	Minimum Stress Index Level		77.44
B11L	242	4.77	4.78	0.01	0.06	4.96	0.01	0.06	A-Unmodified	Marginal (Class Two, 2)	1.21	Moderately Stress Index Level		81.98
B12A	407	5.08	3.70	0.18	0.16	4.49	0.03	0.21	A-Unmodified	Good (Class One, 1)	0.26	Highly stressed Index Level		95.13
B12B	659	8.70	6.48	0.08	3.84	7.89	0.45	0.31	B-Largely Natural	Marginal (Class Two, 2)	0.00	Highly stressed Index Level		91.53
B12C	529	5.89	5.39	0.04	0.21	6.58	0.03	0.23	A-Unmodified	Marginal (Class Two, 2)	0.70	Highly stressed Index Level		91.39
B12D	362	4.63	3.91	0.98	0.24	5.7	0.05	0.92	E – Seriously modified	Marginal (Class Two, 2)	0.00	**QC water balance assessment required.**		110.47
B12E	436	10.06	8.94	0.04	0.45	9.19	0.04	0.05	A-Unmodified	Marginal (Class Two, 2)	2.21	Minimum Stress Index Level		79.98
B20A	574	12.35	7.00	0.48	20.57	9.84	2.00	1.00	F-Critically modified	Marginal (Class Two, 2)	0.00	**Groundwater allocation significant over-allocated**	In terms of TDS, nitrates and sulphates, water quality still within acceptable concentrations.	95.91
B20B	321	5.71	3.85	0.38	58.03	4.72	10.02	1.00	F-Critically modified	Marginal (Class Two, 2)	0.00	**Groundwater allocation significant over-allocated**		82.52
B20C	364	5.52	4.42	0.03	0.91	4.16	0.14	0.12	B-Largely Natural	Marginal (Class Two, 2)	1.59	Moderately Stress Index Level	Impacted by local activities: waste disposal sites and agricultural practises (B20A and -B)	63.71
B20D	480	9.27	5.70	0.26	1.43	5.56	0.17	0.11	B-Largely Natural	Marginal (Class Two, 2)	1.70	Moderately Stress Index Level		65.26
B20E	620	9.25	7.51	0.37	3.58	7.64	0.36	0.55	C-Moderately modified	Marginal (Class Two, 2)	0.00	Moderately Stress Index Level		77.88
B20F	504	9.25	6.00	0.05	0.80	5.76	0.09	0.07	B-Largely Natural	Marginal (Class Two, 2)	2.62	Minimum Stress Index Level		63.65
B20G	522	11.23	9.80	0.30	1.87	10.58	0.14	0.12	B-Largely Natural	Marginal (Class Two, 2)	1.04	Minimum Stress Index Level		80.46
B20H	563	9.63	10.41	0.36	1.77	11.39	0.13	0.36	B-Largely Natural	Marginal (Class Two, 2)	0.87	Minimum Stress Index Level		83.14
B20J	407	8.58	7.69	0.05	1.09	8.08	0.11	0.13	B-Largely Natural	Marginal (Class Two, 2)	1.14	Minimum Stress Index Level		80.56
B31A	387	5.26	3.46	0.04	4.81	3.81	0.79	0.55	C-Moderately modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level	Dissolved solids within acceptable limits	62.56
B31B	385	7.48	3.05	0.19	1.22	3.64	0.22	0.29	B-Largely Natural	Marginal (Class Two, 2)	0.71	Moderately Stress Index Level	Dissolved solids within acceptable limits	65.47
B31C	373	7.19	2.51	0.00	0.82	2.75	0.16	0.07	B-Largely Natural	Marginal (Class Two, 2)	1.59	Minimum Stress Index Level	Dissolved solids within acceptable limits	53.50
B31D	557	8.89	3.68	0.42	1.96	4.48	0.26	0.32	B-Largely Natural	Marginal (Class Two, 2)	1.16	Minimum Stress Index Level	Salinity & nitrates elevated areas	59.10
B31E	1382	28.04	0.00	0.14	9.24	0.14	1.11	0.09	C-Moderately modified	Good (Class One, 1)	0.00	Highly stressed Index Level	Local nitrate hot spots.	1.68
B31F	638	5.89	0.00	0.43	2.31	0.43	0.63	0.52	C-Moderately modified	Marginal (Class Two, 2)	0.95	Moderately Stress Index Level	Local nitrate hot spots.	11.65
B31G	433	5.98	1.97	0.31	1.42	1.71	0.30	0.42	B-Largely Natural	Marginal (Class Two, 2)	1.59	Minimum Stress Index Level	Salinity & nitrates elevated areas	36.62
B31H	612	6.58	2.61	1.64	4.36	3.6	0.64	0.26	C-Moderately modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level	Dissolved solids within acceptable limits	52.55
B31J	1380	17.80	0.00	0.10	30.84	0.1	3.93	0.10	E – Seriously modified	Marginal (Class Two, 2)	0.00	**Groundwater allocation significant over-allocated**	Elevated NO_3-N, Mg and SO_4 (rising trend) levels	1.28
B32A	801	18.24	15.73	0.05	0.54	16.31	0.03	0.07	A-Unmodified	Good (Class One, 1)	4.36	Minimum Stress Index Level	Dissolved solids within acceptable limits	77.01
B32B	614	11.06	10.27	0.04	0.25	9.74	0.02	0.12	A-Unmodified	Good (Class One, 1)	3.59	Minimum Stress Index Level		72.69
B32C	303	3.62	2.80	0.01	3.47	1.1	1.09	0.28	E – Seriously modified	Good (Class One, 1)	0.00	Highly stressed Index Level		34.48
B32D	521	6.99	2.47	0.07	3.14	3.22	0.63	0.07	C-Moderately modified	Good (Class One, 1)	0.00	Highly stressed Index Level	In terms of TDS, nitrates and sulphates, water quality still within acceptable concentrations.	65.05
B32E	203	2.74	1.24	0.01	0.19	1.6	0.08	0.08	A-Unmodified	Good (Class One, 1)	0.67	Minimum Stress Index Level	Dissolved solids within acceptable limits	65.84
B32F	667	4.27	1.71	0.34	4.30	1.05	1.16	0.43	D - Largely modified	Good (Class One, 1)	0.00	Highly stressed Index Level		28.30

		INPUT	OUTPUT											
Catch-ment	**Area (km^2)**	**Rech to Aqf (WSM & SRK)**	**Gw Bf (WSM & SRK)**	BHN Reserve (Mm3/a)	Total Gwater Use (Mm3/a)	Total Gw Reserve (Mm3/a)	SI = Gw Use / Aqf Rech	(Mm3/a)	Quantity Index (GRDM)	Quality Index (Research Reports)	Allocable Gwater (Mm3/a)	Quantity Directive/ Recommendation i.t.o. New allocations.	Gw Quality Status/Trend i.t.o long-term sustainability	**Reserve (% of Recharge)**
		Ave	**Ave**		Calc'd		WSM2013	$Exigo_{2009}$	Ranked WSM	Ranked	Cal'd			
B32G	968	11.99	4.11	1.83	5.85	3.18	0.66	0.57	C-Moderately modified	Good (Class One, 1)	0.07	Moderately Stress Index Level	Salinity & nitrates elevated areas	35.77
B32H	694	11.81	5.10	0.06	2.90	5.83	0.28	0.16	B-Largely Natural	Good (Class One, 1)	1.49	Minimum Stress Index Level	Dissolved solids within acceptable limits	57.10
B32J	323	1.97	0.03	0.44	1.01	0.44	0.86	0.79	C-Moderately modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level		37.61
B41A	765	13.36	13.57	0.14	0.06	14.93	0.00	0.32	A-Unmodified	Good (Class One, 1)	3.47	**QC water balance assessment required.**		81.67
B41B	778	15.09	13.56	0.04	1.23	15	0.07	0.14	A-Unmodified	Good (Class One, 1)	2.45	Minimum Stress Index Level		81.04
B41C	302	4.57	5.20	0.02	0.54	5.81	0.08	1.00	C-Moderately modified	Good (Class One, 1)	0.90	Minimum Stress Index Level		80.81
B41D	403	5.60	3.82	0.09	1.72	2.7	0.35	0.12	B-Largely Natural	Good (Class One, 1)	0.59	Minimum Stress Index Level		54.33
B41E	237	3.98	0.02	0.23	0.11	0.23	0.09	0.17	A-Unmodified	Marginal (Class Two, 2)	0.83	Minimum Stress Index Level	Local nitrate hot spots.	19.66
B41F	380	9.04	8.96	0.01	0.00	10	0.00	0.05	A-Unmodified	Marginal (Class Two, 2)	1.03	Minimum Stress Index Level	Not impacted, head waters area. Long-term quality stable trends.	91.91
B41G	442	9.06	9.41	0.01	0.38	10.35	0.03	0.41	A-Unmodified	Marginal (Class Two, 2)	0.88	Minimum Stress Index Level		90.71
B41H	410	5.07	0.05	0.35	0.16	0.35	0.06	0.34	A-Unmodified	Marginal (Class Two, 2)	2.06	Minimum Stress Index Level		13.62
B41J	691	7.59	0.10	0.41	0.64	0.41	0.15	0.45	A-Unmodified	Marginal (Class Two, 2)	3.26	Minimum Stress Index Level		9.51
B41K	635	5.27	0.12	0.47	1.99	0.47	0.56	0.34	B-Largely Natural		1.07	Minimum Stress Index Level		13.31
B42A	319	6.25	12.61	0.02	3.46	9.83	0.33	0.24	B-Largely Natural	Good (Class One, 1)	0.00	Minimum Stress Index Level	Dissolved solids within acceptable limits	92.39
B42B	214	7.55	9.54	0.17	0.06	6.45	0.01	0.15	A-Unmodified	Good (Class One, 1)	1.29	Minimum Stress Index Level	Potential impact from local mines (TDS & SO_4)	84.31
B42C	164	3.05	1.98	0.00	0.00	2.57	0.00	0.11	C-Moderately modified	Marginal (Class Two, 2)	0.28	Minimum Stress Index Level	Local nitrate hot spots. (Unfortunately limited time series dataset)	96.62
B42D	155	4.98	8.58	0.00	0.00	5.72	0.00	0.07	A-Unmodified	Marginal (Class Two, 2)	0.99	Minimum Stress Index Level		90.36
B42E	221	2.26	1.62	0.01	0.22	2	0.11	0.23	A-Unmodified	Marginal (Class Two, 2)	0.00	Minimum Stress Index Level		98.04
B42F	279	5.96	10.49	0.01	0.22	8.56	0.02	0.17	A-Unmodified	Marginal (Class Two, 2)	0.67	Minimum Stress Index Level		91.16
B42G	327	3.57	2.86	0.01	3.26	3.6	0.84	0.21	B-Largely Natural	Marginal (Class Two, 2)	0.00	**QC water balance assessment required.**		93.26
B42H	412	7.83	0.05	0.07	0.99	0.07	0.43	0.07	B-Largely Natural	Marginal (Class Two, 2)	1.25	Minimum Stress Index Level		3.03
B51A	312	2.49	0.04	0.40	0.08	0.40	0.04	0.69	B-Largely Natural	Marginal (Class Two, 2)	1.76	Moderately Stress Index Level	Local nitrate hot spots.	17.86
B51B	591	6.16	0.05	0.46	0.33	0.46	0.07	0.30	A-Unmodified	Marginal (Class Two, 2)	4.03	Minimum Stress Index Level	Local nitrate hot spots.	9.54
B51C	638	5.58	0.04	0.45	0.22	0.45	0.05	0.30	A-Unmodified	Marginal (Class Two, 2)	3.85	Minimum Stress Index Level	Local nitrate hot spots.	9.96
B51E	2927	22.24	0.00	0.34	8.56	0.34	1.36	0.41	D - Largely modified	Good (Class One, 1)	0.00	**QC water balance assessment required.**	Salinity & nitrates elevated areas	5.39
B51F	395	3.79	0.04	0.01	3.02	0.01	1.11	0.12	D - Largely modified	Marginal (Class Two, 2)	0.00	**QC water balance assessment required.**	Local nitrate hot spots.	0.37
B51G	591	5.02	0.04	0.97	12.43	0.97	3.28	0.70	F-Critically modified	Good (Class One, 1)	0.00	**Groundwater allocation significant over-allocated**	Salinity & nitrates elevated areas	25.59
B51H	717	10.86	0.07	0.98	0.57	0.98	0.12	0.31	A-Unmodified	Marginal (Class Two, 2)	3.35	Minimum Stress Index Level	Local nitrate hot spots.	20.00
B52A	566	6.27	0.01	0.48	0.28	0.48	0.11	0.36	A-Unmodified	Good (Class One, 1)	1.82	Minimum Stress Index Level	Salinity & nitrates elevated areas	18.60
B52B	633	7.37	0.06	1.07	2.08	1.07	0.29	0.64	B-Largely Natural	Good (Class One, 1)	3.94	Minimum Stress Index Level	Local nitrate hot spots.	15.09
B52C	200	1.60	0.00	0.16	0.22	0.16	0.23	0.43	B-Largely Natural	Good (Class One, 1)	0.58	Minimum Stress Index Level	Local nitrate hot spots.	16.67
B52D	341	4.30	0.01	0.73	1.19	0.73	0.57	0.43	C-Moderately modified	Good (Class One, 1)	0.17	Moderately Stress Index Level	Salinity & nitrates elevated areas	34.93
B52E	451	6.52	0.03	0.34	0.51	0.34	0.11	0.28	B-Largely Natural	Good (Class One, 1)	3.81	Minimum Stress Index Level	Local nitrate hot spots.	7.30
B52F	118	1.26	0.00	0.09	0.47	0.09	0.81	0.27	C-Moderately modified	Good (Class One, 1)	0.02	Moderately Stress Index Level	Local nitrate hot spots.	15.52
B52G	291	3.73	0.00	0.22	0.84	0.22	0.62	0.29	C-Moderately modified	Good (Class One, 1)	0.29	Minimum Stress Index Level	Salinity & nitrates elevated areas	16.30
B52H	563	4.28	0.14	0.66	0.77	0.66	0.23	0.65	B-Largely Natural	Good (Class One, 1)	1.95	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	19.53
B52J	395	6.91	0.03	0.22	0.14	0.22	0.07	0.22	C-Moderately modified	Good (Class One, 1)	1.73	**QC water balance assessment required.**	Local elevated Salinity & nitrates levels.	10.53
B60A	209	11.69	29.79	0.02	0.13	11.48	0.01	0.06	A-Unmodified	Ideal (Class Zero, 0)	2.23	**QC water balance assessment required.**	Local elevated Salinity & nitrates levels.	88.79
B60B	302	17.79	37.05	0.01	0.00	17.19	0.00	0.02	A-Unmodified	Marginal (Class Two, 2)	3.83	**QC water balance assessment required.**	Local elevated Salinity & nitrates levels.	85.01
B60C	94	3.08	13.68	0.00	0.00	4.93	0.00	0.09	A-Unmodified	Marginal (Class Two, 2)	0.97	**QC water balance assessment required.**	Local elevated Salinity & nitrates levels.	92.50
B60D	244	12.62	17.29	0.15	0.00	14.15	0.00	0.18	A-Unmodified	Marginal (Class Two, 2)	2.52	**QC water balance assessment required.**	Local elevated Salinity & nitrates levels.	88.55
B60E	83	1.52	3.61	0.00	0.00	0.76	0.00	0.05	A-Unmodified	Ideal (Class Zero, 0)	1.00	**QC water balance assessment required.**	Not impacted, head waters area.	43.93

		INPUT	OUTPUT											
Catch-ment	**Area (km^2)**	**Rech to Aqf (WSM & SRK)**	**Gw Bf (WSM & SRK)**	BHN Reserve (Mm3/a)	Total Gwater Use (Mm3/a)	Total Gw Reserve (Mm3/a)	SI = Gw Use / Aqf Rech	(Mm3/a)	Quantity Index (GRDM)	Quality Index (Research Reports)	Allocable Gwater (Mm3/a)	Quantity Directive/ Recommendation i.t.o. New allocations.	Gw Quality Status/Trend i.t.o long-term sustainability	**Reserve (% of Recharge)**
		Ave	**Ave**		Calc'd		WSM2013	$Exigo_{2009}$	Ranked WSM	Ranked	Cal'd			
B60F	399	6.61	4.94	0.01	2.71	5.44	0.35	0.21	B-Largely Natural	Ideal (Class Zero, 0)	0.00	Minimum Stress Index Level	Not impacted, head waters area.	70.83
B60G	448	6.00	2.51	0.03	3.71	1.35	0.82	0.11	C-Moderately modified	Ideal (Class Zero, 0)	0.00	Minimum Stress Index Level	Not impacted, head waters area.	29.87
B60H	385	9.44	5.26	0.14	5.34	6.29	0.70	0.18	D - Largely modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level	Local elevated Salinity & nitrates levels.	82.98
B60J	676	11.34	19.66	0.05	1.37	6.51	0.10	0.12	A-Unmodified	Marginal (Class Two, 2)	5.21	**QC water balance assessment required.**	Local nitrate hot spots.	49.89
B71A	298	8.49	0.08	0.03	0.23	0.03	0.07	0.06	A-Unmodified	Good (Class One, 1)	3.11	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	0.89
B71B	274	4.75	0.02	0.07	0.19	0.07	0.09	0.11	A-Unmodified	Good (Class One, 1)	1.85	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	3.32
B71C	263	6.36	9.35	0.03	0.00	2.2	0.00	0.06	A-Unmodified	Marginal (Class Two, 2)	3.78	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	37.48
B71D	227	3.00	4.45	0.10	0.22	2.08	0.05	0.44	A-Unmodified	Marginal (Class Two, 2)	1.77	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	51.61
B71E	782	5.20	0.15	0.80	1.55	0.8	0.25	0.90	B-Largely Natural	Marginal (Class Two, 2)	3.90	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	12.80
B71F	541	17.12	15.63	0.07	0.03	9.18	0.00	0.05	A-Unmodified	Marginal (Class Two, 2)	3.84	Minimum Stress Index Level	Local elevated Salinity & nitrates levels.	72.40
B71G	245	6.10	7.64	0.13	0.22	4.1	0.03	0.18	A-Unmodified	Marginal (Class Two, 2)	2.87	Moderately Stress Index Level	Local elevated Salinity & nitrates levels.	59.08
B71H	330	2.02	0.00	0.20	2.52	0.2	1.62	0.43	C-Moderately modified	Marginal (Class Two, 2)	0.00	Highly stressed Index Level	Salinity & nitrates hot spots, rising.	12.82
B71J	79	0.33	0.00	0.01	0.00	0.01	0.00	0.26	A-Unmodified	Marginal (Class Two, 2)	0.17	Highly stressed Index Level	Salinity & nitrates hot spots, rising.	5.56
B72A	534	10.41	14.22	0.54	3.01	9.18	0.24	0.33	B-Largely Natural	Good (Class One, 1) & Marginal (Class Two, 2)	0.56	Minimum Stress Index Level	TDS and SO4 are largely at acceptable levels, although salinity and nitrate hot spots are present.	73.26
B72B	332	2.20	0.00	0.00	0.06	0	0.04	0.07	A-Unmodified		1.31	Minimum Stress Index Level		0.00
B72C	335	2.88	0.00	0.05	0.07	0.05	0.04	0.11	A-Unmodified		1.76	Minimum Stress Index Level		2.66
B72D	922	7.63	0.00	0.01	4.49	0.01	0.69	0.13	B-Largely Natural		2.04	Moderately Stress Index Level		0.15
B72E	320	5.65	8.81	0.45	0.90	5.35	0.11	0.87	B-Largely Natural		2.48	**QC water balance assessment required.**		62.65
B72F	81	2.29	2.71	0.00	0.00	1.3	0.00	0.02	A-Unmodified		1.07	Moderately Stress Index Level		57.27
B72G	48	0.34	0.00	0.01	0.43	0.01	3.58	0.13	E – Seriously modified		0.00	Highly stressed Index Level		8.33
B72H	386	2.60	0.00	0.01	0.92	0.01	0.47	0.17	B-Largely Natural		1.01	**QC water balance assessment required.**		0.52
B72J	537	2.77	0.00	0.03	0.16	0.03	0.05	0.16	A-Unmodified	Marginal (Class Two, 2)	2.72	Minimum Stress Index Level	Marginal (Class Two, 2)	1.03
B72K	966	7.09	0.00	0.52	0.61	0.52	0.18	0.38	A-Unmodified	Marginal (Class Two, 2)	2.32	Minimum Stress Index Level	High salinity (Phalaborwa - B72K) & nitrate.	15.07
B73A	165	2.48	6.33	0.00	0.00	1.29	0.00	0.61	A-Unmodified	Good (Class One, 1) & Marginal (Class Two, 2)	1.04	**QC water balance assessment required.**	TDS and SO4 are largely at acceptable levels, although salinity and nitrate hot spots are present. In QC's B73G, -F, -H & -J are potential elevated/rising nitrate areas.	58.64
B73B	688	3.36	0.00	0.01	2.75	0.01	1.26	0.26	C – Moderately modified		0.00	Moderately Stress Index Level		0.46
B73C	880	7.18	0.00	0.65	1.01	0.65	0.32	0.09	A-Unmodified		1.53	Minimum Stress Index Level		20.38
B73D	687	4.87	0.00	0.00	1.20	0	0.51	0.11	B-Largely Natural		1.14	Minimum Stress Index Level		0.00
B73E	431	3.03	0.00	0.00	0.35	0	0.14	1.00	B-Largely Natural		2.16	Minimum Stress Index Level		0.00
B73F	507	6.66	0.00	0.00	0.00	0	0.00	0.02	A-Unmodified		3.37	Minimum Stress Index Level		0.00
B73G	733	9.88	0.00	0.00	0.00	0	0.00	0.07	A-Unmodified		4.31	Minimum Stress Index Level		0.00
B73H	302	1.95	0.00	0.00	0.00	0	0.00	0.03	A-Unmodified		1.50	Minimum Stress Index Level		0.00
B73J	255	1.81	0.00	0.00	0.00	0	0.00	0.69	A-Unmodified		1.55	Minimum Stress Index Level		0.00
B81A	169	10.34	7.57	0.00	0.15	7.57	0.01	0.01	A-Unmodified	Ideal (Class Zero, 0)	10.19	Minimum Stress Index Level	Not impacted, head waters area.	73.21
B81B	481	20.32	1.12	0.00	2.64	1.12	0.13	0.13	B-Largely Natural	Ideal (Class Zero, 0)	17.68	Minimum Stress Index Level	Salinity & nitrates hot spots, rising.	5.51
B81C	208	16.27	10.54	0.00	5.47	10.54	0.34	0.34	C – Moderately modified	Ideal (Class Zero, 0)	10.80	Moderately Stress Index Level	Not impacted, head waters area.	64.78
B81D	479	12.84	1.59	3.00	4.13	4.59	0.32	0.32	C-Moderately modified	Ideal (Class Zero, 0)	8.71	Moderately Stress Index Level	Marginal (Class Two, 2)	35.75
B81E	665	18.20	0.04	0.59	15.75	0.63	0.87	0.87	D-Largely modified	Ideal (Class Zero, 0)	2.45	**Groundwater allocation significant over-allocated**	Local salinity & nitrate hot spots.	3.46
B81F	1200	18.47	0.06	0.00	7.94	0.06	0.43	0.43	D - Largely modified	Marginal (Class Two, 2)	10.53	Highly stressed Index Level	Salinity & nitrates hot spots, rising.	0.32
B81G	512	12.58	0.13	0.00	5.06	0.13	0.40	0.40	D – Largely modified	Good (Class One, 1)	7.52	Highly stressed Index Level	Salinity & nitrates hot spots, rising.	1.03
B81H	668	8.80	0.01	0.00	2.62	0.01	0.30	0.30	C – Moderately modified	Marginal (Class Two, 2)	6.18	Moderately Stress Index Level	Salinity & nitrates elevated areas	0.11

		INPUT	OUTPUT											
Catch-ment	**Area (km^2)**	**Rech to Aqf (WSM & SRK)**	**Gw Bf (WSM & SRK)**	BHN Reserve (Mm3/a)	Total Gwater Use (Mm3/a)	Total Gw Reserve (Mm3/a)	SI = Gw Use / Aqf Rech	(Mm3/a)	Quantity Index (GRDM)	Quality Index (Research Reports)	Allocable Gwater (Mm3/a)	Quantity Directive/ Recommendation i.t.o. New allocations.	Gw Quality Status/Trend i.t.o long-term sustainability	**Reserve (% of Recharge)**
		Ave	**Ave**		Calc'd		WSM2013	$Exigo_{2009}$	Ranked WSM	Ranked	Cal'd			
B81J	567	6.34	0.00	0.00	0.00	0	0.00	0.00	A - Unmodified	Marginal (Class Two, 2)	6.34	Minimum Stress Index Level	Salinity & nitrates elevated areas	0.00
B82A	467	11.36	6.45	1.45	2.93	7.9	0.26	0.26	B - Largely natural	Good (Class One, 1)	8.43	Moderately Stress Index Level	Local nitrate hot spots.	69.54
B82B	406	9.50	5.47	0.00	14.50	5.47	1.53	1.53	F-Critically modified	Ideal (Class Zero, 0)	0.00	**Groundwater allocation significant over-allocated**	Local nitrate hot spots.	57.58
B82C	300	7.14	3.27	0.00	13.00	3.27	1.82	1.82	F-Critically modified	Marginal (Class Two, 2)	5.83	**Groundwater allocation significant over-allocated**	Salinity & nitrates elevated areas	45.80
B82D	632	10.35	4.76	4.00	4.52	8.76	0.44	0.44	D-Largely modified	Ideal (Class Zero, 0)	0.00	Moderately Stress Index Level	Not impacted, head waters area.	84.64
B82E	423	8.05	0.21	0.00	1.45	0.21	0.18	0.18	C – Moderately modified	Good (Class One, 1)	6.60	Highly stressed Index Level	Salinity & nitrates hot spots, rising.	2.61
B82F	760	14.30	1.00	0.00	1.43	1	0.10	0.10	B - Largely natural	Good (Class One, 1)	12.87	Minimum Stress Index Level	Salinity & nitrates hot spots, rising.	6.99
B82G	920	10.75	0.01	0.00	0.06	0.01	0.01	0.06	B - Largely natural	Poor (Class Three, 3)	10.15	Minimum Stress Index Level	**Significant nitrate pollution (Giyani)**	0.09
B82J	749	9.27	0.01	0.00	0.00	0.01	0.00	0.00	A – Unmodified	Marginal (Class Two, 2)	9.27	Minimum Stress Index Level	**Nitrates hot spots, rising.**	0.11
B82H	794	8.36	0.01	0.00	0.16	0.01	0.02	0.02	A – Unmodified	Marginal (Class Two, 2)	8.36	Minimum Stress Index Level	**Significant nitrate pollution**	0.12
B83A	1250	11.77	0.01	0.00	0.00	0.01	0.00	0.00	A – Unmodified	Ideal (Class Zero, 0)	11.77	Minimum Stress Index Level	Not impacted, head waters area.	0.08
B83B	439	5.71	0.00	0.00	0.00	0	0.00	0.00	A – Unmodified	Ideal (Class Zero, 0)	5.71	Minimum Stress Index Level	Not impacted, head waters area.	0.00
B83C	596	7.70	0.01	0.00	0.00	0.01	0.00	0.00	A – Unmodified	Ideal (Class Zero, 0)	7.70	Minimum Stress Index Level	Not impacted, head waters area.	0.13
B83D	784	7.88	0.00	0.00	0.00	0	0.00	0.00	A – Unmodified	Ideal (Class Zero, 0)	7.88	Minimum Stress Index Level	Not impacted, head waters area.	0.00
B83E	312	3.11	0.00	0.00	0.00	0	0.00	0.00	A – Unmodified	Ideal (Class Zero, 0)	3.11	Minimum Stress Index Level	Not impacted, head waters area.	0.00
			0.00											
B90A	692	5.01	0.00	0.08	0.02	0.08	0.00	0.00	A – Unmodified	Good (Class One, 1)	4.93	Minimum Stress Index Level	Not impacted, head waters area.	1.64
B90B	753	5.87	0.00	0.53	0.53	0.53	0.09	0.09	A – Unmodified	Good (Class One, 1)	5.34	Minimum Stress Index Level	Local elevated salts (Na, Cl & TAL)	9.03
B90C	534	4.36	0.00	0.40	0.40	0.40	0.09	0.09	A – Unmodified	Good (Class One, 1)	3.96	Minimum Stress Index Level	Not impacted, head waters area.	9.17
B90D	446	3.14	0.00	0.03	0.00	0.03	0.00	0.00	A – Unmodified	Good (Class One, 1)	3.11	Minimum Stress Index Level	Local elevated salts (Na, Cl & TAL)	1.08
B90E	473	2.94	0.00	0.03	0.00	0.03	0.00	0.00	A – Unmodified	Good (Class One, 1)	2.91	Minimum Stress Index Level	Local elevated salts (Na, Cl & TAL)	1.12
B90F	818	7.99	0.00	0.53	0.53	0.53	0.07	0.07	A – Unmodified	Marginal (Class Two, 2)	7.46	Minimum Stress Index Level	Local elevated salts and nitrates.	6.63
B90G	697	8.89	0.00	0.10	0.10	0.10	0.01	0.01	A – Unmodified	Marginal (Class Two, 2)	8.79	Minimum Stress Index Level	Local elevated salts and nitrates.	1.12
B90H	887	7.53	0.00	0.20	0.20	0.20	0.03	0.03	A – Unmodified	Marginal (Class Two, 2)	7.33	Minimum Stress Index Level	Local elevated salts and nitrates.	2.66

Please note

Quantity Index description based on the estimation of the so-called aquifer Stress Index (i.e. Use/Rech, groundwater use divided by the local recharge), A (<0.05), B (0.05-0.20), C (0.20-0.40), D (0.40-0.65), E (0.65-0.95) and F(>0.95).....MAX should be a C. All SI's >C needs water balance assessments and categorised hydrogeological investigations for new water use applications (viz. Quantity Directive as a guideline).

Quality Index description based on the DWAF et al, 1998 Domestic water quality classification and the available water quality data – which unfortunately is based on a quaternary level and outdated as well. This is just a narrative of the water quality status.

Quantity Directive describes the actual activity required to allow additional water allocations and is based on the *Quantity Index*, *Allocable Groundwater and Recharge (% of Recharge).* The following criteria has been adopted as a guideline for future groundwater investigations to support water use license conditions:

- Minimum Stress Index Level (Groundwater investigation limited to local water balance estimation and hydrocensus)
- Medium Stress Index Level (Groundwater investigation more detail in terms of hydrogeological conditions, hydrocensus, limited monitoring requirements, mapping of other abstractions and water balance);
- High Stress Index Level (High-level groundwater investigation, monitoring boreholes, specific license conditions, aquifer characterisation, recharge estimates, regional potential impacts and piezometric mapping)
- QC water balance assessment required (Current water balances for quaternary catchment does not match and Allocable groundwater is < 1 MCM/a)); and
- Groundwater allocation (or use) significantly over-allocated, means that use is potentially impacting on the Groundwater Component of the Reserve.

Gw Quality Status/Trend i.t.o. long-term sustainability describes specific groundwater quality signatures and should help as an indicator of management measure to address these water quality trends. Some of the trends are regional impacts, i.e. the elevated nitrate (NO_3–N) values in irrigated areas (Springbok Flats) and rural villages in the upper/middle Olifants and upper Letaba regions.

Quaternary catchments shaded with Blue is mainly dolomite water areas (with a grouping of dolomite compartment units)

		INPUT	OUTPUT											
Catch-ment	**Area (km^2)**	**Rech to Aqf (WSM & SRK)**	**Gw Bf (WSM & SRK)**	BHN Reserve (Mm3/a)	Total Gwater Use (Mm3/a)	Total Gw Reserve (Mm3/a)	SI = Gw Use / Aqf Rech	(Mm3/a)	Quantity Index (GRDM)	Quality Index (Research Reports)	Allocable Gwater (Mm3/a)	Quantity Directive/ Recommendation i.t.o. New allocations.	Gw Quality Status/Trend i.t.o long-term sustainability	**Reserve (% of Recharge)**
		Ave	**Ave**		Calc'd		WSM2013	$Exigo_{2009}$	Ranked WSM	Ranked	Cal'd			

6 WETLAND SPECIFICATIONS

Refer to Table 125 which shows the selected priority wetlands within the Olifants, Letaba and Shingwedzi catchments and the motivation thereof. Table 126 illustrates the ecological specifications for each priority wetland and associated monitoring requirements. Both tables include the Integrated Unit of Analysis (IUA), Quaternary Catchment, Wetland ID, Wetland Name, Wetland Type, Present Ecological State (PES) Category, Ecological Importance and Sensitivity (EIS) Category for each priority wetland.

Table 125: List of the priority wetlands in the Olifants, Letaba and Shingwedzi catchments and the motivation

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
1	B11E	Oli_1.1	Blesbokspruit wetland	Floodplain	E/F (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). It has also been flagged for protection through the NFEPA process (Nel *et al*., 2011 and Mbona *et al*., 2015). The wetland is well placed to provide a water quality and flood protection function but is threatened by headward erosion. Wetland has been prioritized to ensure that water quality enhancement and biodiversity maintenance functions are not impaired. Parts of the wetland have been undermined. Possible risk of water quality deterioration.
1	B11E	Oli_1.2	Rietspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). It has also been flagged for protection through the NFEPA process (Nel *et al*., 2011 and Mbona *et al*., 2015). The system provides a corridor for species movement in a mining altered landscape, with otters utilising the area. The wetland is also well placed to provide a water quality and flood protection function. Wetland attributes have therefore been prioritized to help ensure that key services identified are maintained. Preventing incision is regarded as critical for maintaining habitat attributes.
1	B11D	Oli_1.3	Kriel wetland	Channelled valley bottom	C/D (Mbona et al. 2015)	Moderate	Identified as a priority wetland in DWS (2014). The wetland is located directly downstream of mining operations and power stations in the catchment upstream of Witbank Dam. Livestock watering is also important downstream but can be jeopardized by poor water quality. While being well placed to provide an important water quality enhancement function, the wetland is affected by headward erosion that is affecting the system's ability to perform these functions.
1	B11F	Oli_1.4	Klipoortjiespruit wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). It has been flagged for protection through the NFEPA process (Nel *et al*., 2011 and Mbona *et al*., 2015) and is one of the more intact unchannelled valley bottom wetlands remaining in the upper Olifants River catchment. Extensive existing mining activities as well as future proposed mining activities in the upstream catchment leave this wetland well-placed to play an important role in water quality maintenance.
1	B11B	Oli_1.5	Koringspruit wetland	Channelled valley bottom (section of unchannelled valley bottom)	D (Mbona et al. 2015)		Identified as a priority wetland in DWS (2014). This wetland is located within a mining landscape upstream of the Witbank dam. Most wetlands in the area have been affected by mining operations and channel incision that has affected their functional value. This wetland includes a section of unchannelled valley bottom habitat important for water quality enhancement but is threatened by headward erosion.
1	B11K	Oli_1.6	Klipspruit wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High (B1 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This extensive unchannelled valley bottom wetland is located directly downstream of Witbank Town and receives water from old mines, urban areas and waste water treatment works. Given the sites location downstream of these impacts and upstream of Loskop dam and other areas used for recreational activities, the wetland clearly provides a critical water quality enhancement function.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
1	B12A	Oli_1.7	Klein-Olifants tributary	Channelled valley bottom; Hillslope seepage	D (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014) and a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015). This wetland, though moderately modified and somewhat incised, is likely to be a representative wetland of this wetland vegetation group. The wetland also falls within an area where wetlands have been flagged as important for crane conservation. Maintenance of wetland vegetation and associated wetland habitat for cranes is therefore regarded as a priority.
1	B12B	Oli_1.8	Matla wetland	Channelled valley bottom	C (Mbona et al. 2015)		Identified as a priority wetland in DWS (2014) and a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015). This wetland is located in the upper catchment and is largely intact and is therefore a useful intact example of wetlands within this wetland vegetation group. The wetland also falls within an area where wetlands have been flagged as important for crane conservation. Maintenance of wetland vegetation and associated wetland habitat for cranes and other wetland-dependant biota is therefore regarded as a priority.
1	B12B	Oli_1.9	Woes-alleenspruit wetland	Unchannelled valley bottom	C (Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014) and a wetland FEPA by Mbona *et al*. (2015). The wetland is located in the Middleburg Dam catchment and directly downstream of extensive coal mining operations. It is therefore well placed to provide a water quality enhancement function.
1	B12B	Oli_1.10	Bosmanspruit wetland	Unchannelled valley bottom	C (Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014) . This unchannelled valley bottom wetland is located in the Middleburg Dam catchment and directly adjacent to extensive coal mining operations. It is therefore well placed to provide a water quality enhancement function.
1	B12C	Oli_1.11	Kopermyn wetland	Unchannelled valley bottom; Channelled valley bottom Hillslope seepage	C (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). This is a large example of reasonably intact valley bottom wetland downstream of mining operations with further mining anticipated in the catchment (high mining potential). The wetland provides useful habitat for wildlife and provides a range of regulating and supporting services important for downstream users. Middelburg Dam is located only several kilometres downstream of the wetland.
1	B11C	Oli_1.12	Debeerspruit/Pieke spruit floodplain	Floodplain	A/B (Mbona et al. 2015)	High	Identified as a wetland FEPA (Mbona *et al*., 2015). This is a good representative example of a floodplain type wetland within the Upper Olifants River Catchment. The system is extensive and in relatively good condition. This system is important for flood attenuation and biodiversity support. The system is potentially at risk from future mining applications.
1	B11A	Oli_1.13	Viskuile floodplain complex	Floodplain	C (Mbona et al. 2015)	High to Very High	The Viskuile floodplain complex is a largely intact wetland system located in the upper catchment of the Olifants River. It is considered a good example of this wetland type within this wetland vegetation group. The wetland provides important habitat for wildlife and provides a range of regulating and supporting services important for downstream users. Existing and future mining activities within the wetland catchment indicate that the

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
							wetland complex is well placed to provide a water quality enhancement function. A large population of *Crinum bulbispernum* occurs within the floodplain.
1	B11C	Oli_1.14	Steenkoolspruit floodplain	Floodplain	D (Mbona et al. 2015)	High	Identified as a wetland FEPA (Mbona *et al*., 2015). This is a good representative example of a floodplain type wetland within the Upper Olifants River catchment. The system is extensive and in relatively good condition. This system is important for flood attenuation and biodiversity support. The system is potentially at risk from future mining applications.
2	B20C	Oli_2.1	Elandsvlei pans	Pan/depression; Hillslope seepage	C (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). This cluster of pans was identified as an area of exceptional biodiversity importance as part of the NFEPA process (Nel *et al*., 2011 and Mbona *et al*., 2015). They have also been highlighted as providing important habitat for African Grass Owls (*Tyto capensis*) within a largely transformed catchment. The pans are also utilised recreationally for bird watching purposes.
2	B20B	Oli_2.2	Koffiespruit tributary	Channelled valley bottom	A/B (Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This wetland is largely intact and is likely to be a representative wetland of this wetland vegetation group. Maintaining vegetation characteristics is regarded as most important from a biodiversity perspective.
2	B20A	Oli_2.3	Delmas wetland	Channelled valley bottom	D (Mbona et al. 2015)	Moderate	Identified as a priority wetland in DWS (2014). This wetland is located in an urban context and downstream of a waste water treatment works and old waste disposal facilities. Management of the waste water treatment works is reportedly problematic with a blue drop score of 18% obtained in 2011. The wetland is therefore well placed to improve poor water quality and reduce potential negative health effects for local communities. This function is however threatened by channel incision.
2	B20A	Oli_2.4	Bronkhorstspruit tributary	Unchannelled valley bottom; Channelled valley bottom Hillslope seepage	C (Mbona et al. 2015)	High	This large, extensive unchannelled valley bottom wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) provides important habitat for the African Grass Owl (*Tyto capensis*). Given the agricultural context and anticipated expansion of future mining operations, the wetland is also well placed to improve water quality. This is also the headwaters of the Bronkhorstspruit. The wetland is located in a groundwater stressed catchment (see Groundwater Report).
2	B20E	Oli_2.5	Wilge tributary	Floodplain; Channelled valley bottom	A/B to C (Mbona et al. 2015)	Moderate to High	Identified as a priority wetland in DWS (2014). A portion of the wetland system has also been identified as a FEPA by Mbona *et al*. (2015). This is one of few largely intact valley bottom wetlands that remain in the upper Wilge River catchment. The wetland system is also located within a priority mining and power generation area and is therefore well placed to reduce water quality impacts to the Wilge River.
2	B20G	Oli_2.6	Zaalklap wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High	Identified as a priority wetland in DWS (2014). This naturally unchannelled valley bottom has been flagged as a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) based on its importance for biodiversity maintenance. The wetland supports healthy populations of Marsh Owls whilst the reed beds are used for roosting by large numbers of Cattle Egrets. Given the wetlands location directly downstream of existing coal mining operations and

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
							likely future mining operations, the wetland is also well placed to improve water quality for downstream users. Rehabilitation efforts have already been successfully undertaken on parts of the wetland to improve the functionality of the system.
2	B20G	Oli_2.7	Saalboomspruit/ Saalklapspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This naturally unchannelled valley bottom has been flagged as a wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) and is known to support unusually large populations of African Snipe (*Gallinago nigripennis*). Given the wetlands location directly downstream of coal mining operations and the Phola waste water treatment works, it is also well placed to improve water quality for downstream users.
2	B20E	Oli_2.8	Upper Wilge River Floodplain	Floodplain	D (Mbona et al. 2015)	High (B2 Olifants PESEIS 2011)	This floodplain wetlands forms part of the Upper Wilge River system and has been identified by Mbona *et al*. (2015) as a wetland FEPA. The system is extensive and is considered important for flood attenuation and biodiversity support. The system is potentially at risk from future mining applications.
3	B12E	Oli_3.1	Klein-Olifants tributary	Floodplain; Channelled valley bottom; Hillslope seepage	A/B to C (Mbona et al. 2015)		Identified as a priority wetland in DWS (2014). This wetland FEPA (Nel *et al*., 2011 and Mbona *et al*., 2015) is largely intact and is a useful example of this wetland vegetation group. The wetland also falls within an area prioritized for crane conservation. Maintenance of wetland vegetation and associated wetland habitat is therefore regarded as a priority.
4	B31A	Oli_4.1	Elands tributary wetland	Channelled valley bottom; Hillslope seepage	C (Nel et al., 2011)		Identified as a priority wetland in DWS (2014). Despite being moderately modified, this large wetland has been identified as a wetland FEPA (Nel *et al*., 2011) supporting crane populations. Maintenance of appropriate habitat attributes is therefore regarded as important.
5	B51C	Oli_5.1	Makotswane	Channelled valley bottom; Hillslope seepage	C	Very High	This wetland is a good representative example of a granitic peatland. The wetland is likely to provide flow regulatory services in the catchment. Associated hillslopes comprise deep sand which helps to maintain water quality and feed the valleybottom systems and associated streams. This flow regulation service is an important function in this relatively arid region. Likely to provide important water quality enhancement function which may help to buffer the poor water quality in this section of the Olifants River. Peat related to what appear to be artesian springs occurs in this system. Appears to be a good example of the unique granitic peatlands that occur in this region. Giant bullfrog has been recorded in the wetlands of the area.
6	B41A	Oli_6.1	Lakenvlei wetland complex	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B (Mbona et al. 2015)	Very High	The Lakenvlei wetland complex has been identified as a wetland FEPA (Mbona *et al*., 2015) and is one of the largest, pristine peat wetlands in Mpumalanga. The wetland supports important populations of threatened bird species including the Grey Crowned Crane (EN), Wattled Crane (CR) and White-winged Flufftail (CR). Some rehabilitation has taken place on sections of the wetland. It is also expected to be important for the

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
							supply of high quality water.
6	B41B	Oli_6.2	Welgevonden wetland	Channelled valley bottom; Hillslope seepage	A/B (Nel et al., 2011)	High to Very High	Identified as a priority wetland in DWS (2014). This FEPA wetland system (Nel *et al*., 2011) is located in the upper reaches of the catchment and forms part of a priority wetland cluster. The wetland is important for biodiversity conservation as it contains areas of peat and supports important crane populations.
6	B41F	Oli_6.3	Draaikraal wetland 1	Channelled valley bottom	C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014). This large FEPA (Nel *et al*., 2011) wetland system , located within an agricultural context, is important for biodiversity conservation as it contains areas of peat and supports important crane populations. The site has been historically targeted for rehabilitation by WFWetlands.
6	B41F	Oli_6.4	Draaikraal wetland 2	Channelled valley bottom	A/B to C (Nel et al., 2011)	High to Very High	Identified as a priority wetland in DWS (2014). This FEPA (Nel *et al*., 2011) wetland system contains peat and supports threatened crane populations. The wetland is still in good condition despite surrounding agricultural land-use pressures.
6	B41F	Oli_6.5	Draaikraal wetland 3	Hillslope seepage	A/B (Nel et al., 2011)		Identified as a priority wetland in DWS (2014). This large unchannelled peatland has been identified as a wetland FEPA (Nel *et al*., 2011) and supports breeding populations of cranes. Wetland rehabilitation was previously implemented in this wetland to address impacts of historical drainage.
6	B41F	Oli_6.8	Verloren Valei	Comprises a mosaic of hillslope seepage wetlands and channelled and unchannelled valley bottom wetlands	A/B (Nel et al., 2011)	Very High	Verloren Valei has been listed as a Wetland of International Importance in terms of the Convention on Wetlands of International Importance (Ramsar, 1971). Verloren Valei Nature Reserve is a Provincial Nature Reserve which was proclaimed in 1983. This is the only Ramsar Wetland within the Olifants River Catchment. The wetland complex is known to support important populations of threatened bird species including the Grey Crowned Crane (EN), Wattled Crane (CR) and Blue Crane (VU). It is a botanically diverse system supporting numerous conservation important plant species.
6	B41A	Oli_6.9	Belfast wetland complex	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B to C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	Portions of this wetland complex were identified as a priority wetland in DWS (2014). Part of this wetland complex is located in an urban setting and directly upstream of Belfast dam which is used to supply Belfast town with potable water. Upstream mining activities together with overflow from the waste water treatment works pose a threat to water quality. This wetland has therefore been prioritized based on its water quality enhancement functions. Peat may occur in this system.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
9	B60F	Oli_9.1	Krankloofpsruit wetland	Channelled valley bottom	C (Nel et al., 2011)		Identified as a priority wetland in DWS (2014). Although not identified as a wetland FEPA, this is an unusually large unchannelled valley bottom wetland located in the upper reaches of this IUA. Despite significant impacts, the wetland was prioritized due to its role in ameliorating impacts from agricultural activities.
9	B60H	Oli_9.2	Ohrigstad wetland	Channelled valley bottom	C (Nel et al., 2011)	Likely to be High to Very High (B4 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014), and identified as a wetland FEPA (Nel *et al*., 2011), this floodplain system has been heavily degraded by subsistence cultivation. Few wetlands are located in this IUA however, and given the anticipated water quality impacts associated with agricultural use upstream, this wetland was prioritized for water quality enhancement. This wetland is located a short distance upstream of the Blyde River Dam.
10	B71G	Oli_10.1	Tufa waterfall	Tufa waterfall	B	Very High	One of only two known active tufa waterfalls within the Olifants River Catchment. Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent discharge of groundwater out of dolomitic aquifers. The tufa waterfall is an important cultural site that appears to be extensively utilised for this purpose. It is also a tourist attraction in the area. .
13	B60C	Oli_13.1	Treur wetland	Hillslope seepage	C (Nel et al., 2011)	Likely to be Very High (B4 Olifants PESEIS 2011)	Identified as a priority wetland in DWS (2014), and identified as a wetland FEPA (Nel *et al*., 2011). This is an important peatland system. The associated stream supports the endemic Treur River Barb (*Barbus treurensis*) which has an extremely limited distribution. The wetland and associated biota are threatened by existing forestry.
13	B60D	Oli_13.2	Kadishi waterfall	Tufa waterfall	A/B	Very High	One of only two known active tufa waterfalls within the Olifants River Catchment. Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent discharge of groundwater out of dolomitic aquifers. The tufa waterfall is an important tourism attraction within the Blyde/Mohlatse River Canyon Nature Reserve.
1	B81A	Let_1.1	Stanford wetland	Floodplain	D	Moderate	A large floodplain wetland located within an afforested area upstream of Stanford Lake and within the Ebenezer Dam catchment. The wetland is well placed to provide water quality enhancement and flow maintenance functions. Afforestation has impacted on the current state of the system through decreased flow and alien vegetation encroachment.
1	B81B	Let_1.2	Tzaneen Dam wetland	Unchannelled valley bottom; Channelled valley bottom	D/E	Moderate	This unchannelled valley bottom wetland is located upstream of Tzaneen Dam within an afforested area. It is therefore well placed to provide a water quality enhancement and flow maintenance function. Afforestation has impacted on the current state of the system through decreased flow and alien vegetation encroachment.
2	B81D	Let_2.1	Thabina wetland	Channelled valley bottom	C	High	A large channelled valley bottom wetland within a densely populated rural area. The wetland is important from a direct use perspective with cultivation along and within its

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
							margins, collection of natural resources and collection of water observed. The location of the wetland within a densely populated area without formal sewage or sanitation systems makes it likely that the wetland plays a very important role in water quality maintenance.
9	B82G	Let_9.1	Baleni hot spring	Spring	B	Very High	This is one of only a few remaining undeveloped hot springs in the Olifants/Letaba System. The spring maintains a water temperature of around 42 degrees and supports a peat dome. Flow from the spring also supports small pools of water within the adjacent Klein-Letaba River. These pools were observed to support fish. The spring is understood to be of spiritual significance, and is also used by local women for salt harvesting. Salt harvesting is undertaken during the winter dry season when salt crystals form due to evaporation of water. Being a spring, groundwater abstraction could potentially pose a high risk to the system.
12	B83C	Let_12.1	Nshawu	Unchannelled valley bottom; Channelled valley bottom	C	High	The Nshawu vlei is a well-known Kruger National Park wetland system and FEPA wetland (Nel *et al*., 2011). The system is currently heavily utilised by game and has a number of dams/excavations along its length. Headcutting and erosion has been identified as a risk to the system. Groundwater abstraction for water points in and around the wetland pose a potential risk to the condition of the system.
12	B83D	Let_12.2	Manyeleti/Makhadzi wetland	Unchannelled valley bottom	A	High	A large unchannelled valley bottom wetland in the Kruger National Park displaying seasonal to permanent saturation in some places. Found to be a wetter system than most of the other valley bottom wetlands in the area (and therefore unique) supporting numerous deeper pools of open water occupied by hippos. As is the case for most of these valley bottom wetlands, plant species diversity is likely fairly low, though a high diversity of faunal and avifaunal species are expected to be supported by the wetland.
-	B90B	Shi_1	Malahlapanga	Spring	E	High	This spring mire occurs within the boundaries of the Kruger National Park. The spring is geo-thermal in nature and supports several peat domes. The system is currently heavily impacted by trampling, overgrazing and to some extent runoff from a management road. This has resulted in erosion and lack of vegetation cover in and around the springs and wetland. Desiccation of the peat domes is likely the result of changes in groundwater (Grootjans *et al*., 2010).
-	B90D	Shi_2	Mafiyeni	Spring	C	Very High	This spring mire occurs within the boundaries of the Kruger National Park. The spring is geo-thermal in nature and supports one large and little-disturbed cupola/dome plus a few smaller highly mineralised and desiccated domes (Grootjans *et al*., 2010). The system has been somewhat impacted by trampling and overgrazing. This has resulted in reduced vegetation cover in and around the springs and wetland. Desiccation of the peat domes is likely the result of changes in groundwater (Grootjans *et al*., 2010).

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	Motivation
-	B90A	Shi_3	Shisha tributary	Unchannelled valley bottom	A/B	Moderate	This is a large, seasonally saturated unchannelled valley bottom wetland located in the northern Kruger National Park which was flagged by Park Rangers as one of the largest and intact systems within the northern Kruger National Park. It is considered a good representative example of an unchannelled valley bottom wetland within the Lowveld Region of the Olifants River Catchment. Numerous locally rare antelope species utilise these wetlands within the Kruger National Park.
-	B90H	Shi_4	Dzombo	Channelled valley bottom	B	High	A channelled valley bottom wetland located within the Kruger National Park. The wetland supports a higher species and habitat diversity than most of the surrounding valley bottom wetlands and includes large stands of *Hyphaene coriacea*. Some impacts due to erosion and historical placement of water points are evident, while numerous road and track crossings also occur.

Table 126: Wetland ecological specifications and monitoring requirements for the selected priority wetlands

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
1	B11E	Oli_1.1	Blesbokspruit wetland	Floodplain	E/F (Mbona et al. 2015)	High	C	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. **Protection, Maintenance and Management Requirements**: It is essential to improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Rehabilitation measures should be implemented in this system to improve its current state. Existing vegetation types and structure must be improved.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.
1	B11E	Oli_1.2	Rietspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al. 2015)	High	C	**Motivation**: Elevated flows are needed to inundate channelled sections of the wetland thereby providing the wetting regime required for supporting the vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on wetting for their life cycles. Increased channel incision threatens water retention within the wetland. Diffuse water distribution is required to optimise water quality enhancement functions. **Protection, Maintenance and Management Requirements**: It is essential to improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								improved within natural seasonal variability. Rehabilitation measures should be implemented in this system to improve its current state.	
1	B11D	Oli_1.3	Kriel wetland	Channelled valley bottom	C/D (Mbona et al. 2015)	Moderate	C	**Motivation**: Erosion and channel incision threaten to undermine the water quality enhancement functions of the wetland. Diffuse water distribution is required to optimise water quality enhancement functions. **Protection, Maintenance and Management Requirements**: Existing flow distribution and retention patterns must be improved. Rehabilitation is required in order to prevent further loss in water quality enhancement functions. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.
1	B11F	Oli_1.4	Klipoortjiespruit wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High	C	**Motivation**: Diffuse water distribution is required to optimise water quality enhancement functions. **Protection, Maintenance and Management Requirements**: It is essential to maintain the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Unchannelled nature of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
1	B11B	Oli_1.5	Koringspruit	Channelled	D	Moderate	C	**Motivation**:	PES to be verified and EIS and REC to be determined.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
			wetland	valley bottom (section of unchannelled valley bottom)	(Mbona et al. 2015)	(desktop)		Erosion and channel incision threaten to undermine the water quality enhancement functions of the wetland. Diffuse water distribution is required to optimise water quality enhancement functions. **Protection, Maintenance and Management Requirements**: Existing flow distribution and retention patterns must be improved. The unchannelled section of the wetland must be maintained in an unchannelled state. Rehabilitation is required in order to prevent channelization of the remaining unchannelled reach and further loss of wetland function. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.
1	B11K	Oli_1.6	Klipspruit wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	High (B1 Olifants PESEIS 2011)	C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. **Protection, Maintenance and Management Requirements**: The unchannelled nature of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
1	B12A	Oli_1.7	Klein-Olifants tributary	Channelled valley bottom; Hillslope	D (Mbona et al.	High	C	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
				seepage	2015)			Lateral flow inputs are important to wet the valley bottom margins thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles **Protection, Maintenance and Management Requirements**: Existing flow distribution and retention patterns must be maintained or improved. Rehabilitation should be implemented to secure existing functions and values. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Lateral flow inputs from hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. Desktop mapping of hillslope seepage wetlands contributing to the wetland system should be undertaken as part of the monitoring requirements. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.
1	B12B	Oli_1.8	Matla wetland	Channelled valley bottom	C (Mbona et al. 2015)	Moderate (desktop)	C	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Lateral flow inputs are important to wet the wetland margins thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles **Protection, Maintenance and Management Requirements**: Existing flow distribution and retention patterns must be maintained or improved.	PES to be verified and the EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Rehabilitation should be implemented to secure existing functions and values. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Lateral flow inputs from hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. Desktop mapping of hillslope seepage wetlands contributing to the wetland system. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.
1	B12B	Oli_1.9	Woes-alleenspruit wetland	Unchannelled valley bottom	C (Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
1	B12B	Oli_1.10	Bosmanspruit wetland	Unchannelled valley bottom	C (Mbona et al. 2015)	Moderate to High (B1 Olifants PESEIS 2011)	C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
1	B12C	Oli_1.11	Kopermyn wetland	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	C (Mbona et al. 2015)	High	B/C	**Motivation**: Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Interflow is considered the key driver of the extensive hillslope seepage wetlands forming part of this wetland complex **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Rehabilitation should be implemented to secure existing functions and values. Interflow driving hillslope seepage wetlands and lateral flow inputs from these hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. Desktop mapping of hillslope seepage wetlands contributing to the wetland system. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented
1	B11C	Oli_1.12	Debeerspruit/Piekespruit floodplain	Floodplain	A/B (Mbona et al. 2015)	High	A/B	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Protection, Maintenance and Management Requirements: Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. It is essential to maintain or improve the existing flow distribution and retention patterns in the system in order to maintain the current PES category and High EIS. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
1	B11A	Oli_1.13	Viskuile floodplain complex	Floodplain	C (Mbona et al. 2015)	High to Very High	A/B to B/C	**Motivation**: High flows are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs also play an important role in wetting the floodplain verges, especially during lower rainfall years. Maintaining the unchannelled characteristic of parts of the systems as well as the vegetation structure of the system is essential for water quality enhancement. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. It is essential to maintain or improve the existing flow distribution and retention patterns in the system in order to maintain the current PES category and High EIS. Lateral flow inputs from hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	
1	B11C	Oli_1.14	Steenkoolspruit floodplain	Floodplain	D (Mbona et al. 2015)	High	C	**Motivation**: Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs are also likely to play an important role in wetting the floodplain verges, especially during lower rainfall years. **Protection, Maintenance and Management Requirements**: Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								It is essential to maintain or improve the existing flow distribution and retention patterns in the system in order to maintain the current PES category and High EIS. Lateral flow inputs from hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	
2	B20C	Oli_2.1	Elandsvlei pans	Pan/depression; Hillslope seepage	C (Mbona et al. 2015)	High	B	**Motivation**: Water inputs are important in shaping habitat characteristics of pan systems. Water quality is an important driver of pan biodiversity. Vegetation type and structure of the pan wetlands and associated hillslope seepage wetlands are important to support the African Grass Owls and other avifaunal species frequenting the pans. **Protection, Maintenance and Management Requirements**: No increase in cultivation or habitat transformation within the pan catchments should be permitted. Water quality impacts to the pan system must be restricted to ensure that the water and sediment chemistry remain within an acceptable normal range (anion and cation concentration to pan volume relationship) for this particular water chemistry pan type. Lateral flow inputs from the catchment and hillslope seepage wetlands must be protected through the application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Desktop mapping of landuse within the pan catchments. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. An African Grass Owl monitoring strategy should be developed and implemented in conjunction with a local conservation authority or NGO. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented
2	B20B	Oli_2.2	Koffiespruit tributary	Unchannelled valley bottom	A/B (Mbona	Moderate to High	A/B	**Motivation**: Maintaining the unchannelled characteristic and vegetation	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
					et al. 2015)	(B2 Olifants PESEIS 2011)		structure of the system is essential to secure the biodiversity maintenance function performed by the wetland. **Protection, Maintenance and Management Requirements**: It is essential to maintain the existing flow distribution and retention patterns in the system in order to maintain the current PES category. Unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Rehabilitation should be implemented to secure existing functions and values.	dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented
2	B20A	Oli_2.3	Delmas wetland	Unchannelled valley bottom	D (Mbona et al. 2015)	Moderate	C	**Motivation**: Drains and erosion threaten the mostly unchannelled nature of this wetland, as do increased flow from stormwater and waste water treatment works inputs. Maintaining the unchannelled characteristic and vegetation structure of the system is essential for water quality enhancement. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Any application resulting in an increase in hardened surfaces should be accompanied by a detailed stormwater management plan including details attenuation of storm flows.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Rehabilitation should be implemented to secure existing functions and values.	
2	B20A	Oli_2.4	Bronkhorstspruit tributary	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	C (Mbona et al. 2015)	High	B	**Motivation**: Elevated flows are needed to inundate the channelled section of the wetland thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles. Maintaining the unchannelled characteristic of sections of the wetland and maintaining the vegetation structure of the system is essential to secure the biodiversity maintenance and water quality maintenance functions performed by the wetland. **Protection, Maintenance and Management Requirements**: Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. The overall biodiversity and viable populations of Red Data bird species must be maintained.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. An African Grass Owl monitoring strategy should be developed and implemented in conjunction with a local conservation authority or NGO.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
2	B20E	Oli_2.5	Wilge tributary	Floodplain; Channelled valley bottom	A/B to C (Mbona et al. 2015)	Moderate to High	B/C	**Motivation**: Elevated flows are needed to inundate the wetland thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs are also likely to play an important role in wetting the floodplain verges, especially during lower rainfall years. Diffuse water distribution is required to optimise water quality enhancement functions. **Protection, Maintenance and Management Requirements**: Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. It is essential to maintain or improve the existing flow distribution and retention patterns in the system in order to maintain the current PES category and High EIS. Lateral flow inputs from hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply. Rehabilitation should be implemented to secure existing functions and values.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented
2	B20G	Oli_2.6	Zaalklap wetland	Unchannelled valley bottom	D (Mbona	High	C	**Motivation**: Maintaining the unchannelled characteristic and vegetation	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
					et al. 2015)			structure of the system is essential for water quality enhancement. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. DWS to liaise with the relevant authority (DEA, WfWetlands, CSIR) with regards to existing monitoring initiatives within the wetland
2	B20G	Oli_2.7	Saalboomspruit wetland	Unchannelled valley bottom; Channelled valley bottom	D (Mbona et al. 2015)	Moderate to High (B2 Olifants PESEIS 2011)	C	**Motivation**: Diffuse flows are important for maintaining habitat diversity and water quality enhancement functions. Historic drainage has impacted negatively on the wetland with headcut advancement threatening to cause further loss in functional values. **Protection, Maintenance and Management Requirements**: Rehabilitation is required to halt headcut advancement and improve both habitat and water quality enhancement values. It is essential to secure or improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented
2	B20E	Oli_2.8	Upper Wilge	Floodplain	D	High	C	**Motivation**:	Compile an accurate desktop wetland basemap for the system prior

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
			River floodplain		(Mbona et al. 2015)	(B2 Olifants PESEIS 2011)		Floods are needed to inundate the floodplain thereby providing the wetting regime required for supporting the floodplain vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on flooding for their life cycles. Lateral flow inputs are also likely to play an important role in wetting the floodplain verges, especially during lower rainfall years. **Protection, Maintenance and Management Requirements**: Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Any application for development including mining likely to impact this system, besides going through the normal licensing processes, should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. It is essential to maintain or improve the existing flow distribution and retention patterns in the system in order to maintain the current PES category and High EIS. Lateral flow inputs from hillslope seepage wetlands must be protected through application of hydrological buffers determined via hydro-pedological assessments undertaken as part of EIA and/or WUL applications, and strict licensing conditions including monitoring of the systems should apply.	to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
3	B12E	Oli_3.1	Klein-Olifants tributary	Unchannelled valley bottom; Channelled valley bottom; Hillslope seepage	A/B to C (Mbona et al. 2015)	High (desktop)	B	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
4	B31A	Oli_4.1	Elands tributary wetland	Channelled valley bottom; Hillslope seepage	C (Nel et al., 2011)	High (desktop)	B/C	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. Lateral flow inputs are important to wet the valley bottom margins thereby providing the wetting regime required for supporting the wetland vegetation, particularly the facultative hydrophytic grasses, sedges and forbs that are dependent on seasonal saturation for their life cycles. Interflow is the key driver of hillslope seepage wetlands. **Protection, Maintenance and Management Requirements**: Existing flow distribution and retention patterns must be maintained or improved. Rehabilitation should be implemented to secure existing functions and values. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Interflow supporting hillslope seepage wetlands and lateral flow inputs from hillslope seepage wetlands must be protected through application of suitable to these seepage wetlands. Buffers to be determined via detailed wetland assessments as part of EIA and/or WUL applications, and	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. Desktop mapping of hillslope seepage wetlands contributing to the wetland system. A rehabilitation monitoring program should be implemented as part of the rehabilitation interventions once implemented.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								strict licensing conditions including monitoring of the systems should apply. No increase in cultivation or habitat transformation within the hillslope seepage wetlands should be permitted.	
5	B51C	Oli_5.1	Makotswane	Channelled valley bottom Hillslope seepage	C	Very High	B	**Motivation**: This wetland is likely to provide an important flow regulatory and water quality enhancement function which may help to buffer the poor water quality in the section of the Olifants River that this wetland feeds. **Protection, Maintenance and Management Requirements**: Targeted wetland management actions and rehabilitation interventions should be implemented to safeguard and improve the wetland structure and functioning and associated peat and artesian springs. Any applications for groundwater use and/or abstraction in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A Giant Bullfrog monitoring strategy should be developed and implemented in conjunction with a local conservation authority or NGO. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat.
6	B41A	Oli_6.1	Lakenvlei wetland complex	Unchannelled valley bottom Channelled valley bottom Hillslope seepage	A/B (Mbona et al. 2015)	Very High	A/B	**Motivation**: A constant baseflow should be maintained to ensure that the main valley bottom system is permanently inundated and side arms to the wetland remain permanently saturated. These flows will ensure that most of the marginal and instream vegetation remains inundated throughout the summer growing season and that the rooting zone is saturated throughout the year. This is a requirement for enabling	A wetland monitoring strategy/plan should be developed and implemented in conjunction with a local conservation authority or NGO. This should include monitoring of peat, Red Data bird species and key peat forming vegetation species. Desktop mapping of all dams in the system. Repeat every 3 years.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								perennial obligate hydrophytes to complete their life cycle and reproduce. This is also a requirement for maintaining peat and supporting crane breeding habitat. **Protection, Maintenance and Management Requirements**: Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Besides going through the normal licensing processes, any such application should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC. The overall biodiversity and viable populations of Red Data bird species must be maintained. No new dams should be constructed in the system without following detailed authorisation process. No increase in cultivation or habitat transformation within the hillslope seepage wetlands should be permitted.	
6	B41B	Oli_6.2	Welgevonden wetland	Channelled valley bottom Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	A/B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. **Protection, Maintenance and Management Requirements**: Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply.	PES, EIS and REC to be verified. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								The overall biodiversity and viable populations of Red Data bird species must be maintained. No new dams should be constructed in the system without following a detailed authorisation process.	Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.3	Draaikraal wetland 1	Channelled valley bottom	C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. **Protection, Maintenance and Management Requirements**: Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. The overall biodiversity and viable populations of Red Data bird species must be maintained. No new dams should be constructed in the system without following detailed authorisation process.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.4	Draaikraal wetland 2	Channelled valley bottom	A/B to C (Nel et al., 2011)	High to Very High (desktop)	A/B to B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. **Protection, Maintenance and Management Requirements**: Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								perspective, and strict licensing conditions including monitoring of the system should apply. The overall biodiversity and viable populations of Red Data bird species must be maintained. No new dams should be constructed in the system without following detailed authorisation process.	At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.5	Draaikraal wetland 3	Hillslope seepage	A/B (Nel et al., 2011)	High to Very High (desktop)	A/B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. **Protection, Maintenance and Management Requirements**: Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. The overall biodiversity and viable populations of Red Data bird species must be maintained. No new dams should be constructed in the system without following detailed authorisation process.	PES, EIS and REC to be verified. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A crane monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
6	B41F	Oli_6.8	Verloren Valei	Comprises a mosaic of hillslope	A/B (Nel et	Very High	A	**Motivation**: Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined.	DWS to liaise with the Mpumalanga Parks Board in terms of existing monitoring initiatives relevant to the wetlands at least every 3 years to assess whether or not the REC or BAS is being

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
				seepage wetlands and channelled and unchannelled valley bottom wetlands	al., 2011)			**Protection, Maintenance and Management Requirements**: The conservation measures and management practices as per the Ramsar Information Sheet (RIS) (https://rsis.ramsar.org/RISapp/files/RISrep/ZA1110RIS.pdf) for Verloren Valei Nature Reserve must be implemented and maintained together with any additional management plans/actions that have subsequently been implemented by the Mpumalanga Parks Board.	maintained.
6	B41A	Oli_6.9	Belfast wetland complex	Unchannelled valley bottom Channelled valley bottom Hillslope seepage	A/B to C (Nel et al., 2011)	High to Very High (B4 Olifants PESEIS 2011)	B to A/B	**Motivation**: This wetland was prioritized for water quality enhancement. Maintaining the flow distribution and retention patterns and vegetation structure of the system is essential to maintain the water quality enhancement function. **Protection, Maintenance and Management Requirements**: It is essential to improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Besides going through the normal licensing processes, any such application should also include as a minimum an Intermediate Level Wetland Reserve which includes flow modelling (surface and groundwater including interflow) of scenarios to establish the potential impact in terms of achieving the REC.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
9	B60F	Oli_9.1	Krankloofpsruit wetland	Channelled valley bottom	C (Nel et al., 2011)	Moderate (desktop)	C	**Motivation**: This wetland was prioritized for water quality enhancement. Maintaining the flow distribution and retention patterns and vegetation structure of the system is essential to maintain the water quality enhancement function. **Protection, Maintenance and Management Requirements**: It is essential to improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
9	B60H	Oli_9.2	Ohrigstad wetland	Channelled valley bottom	C (Nel et al., 2011)	Likely to be High to Very High (B4 Olifants PESEIS 2011)	B	**Motivation**: This wetland was prioritized for water quality enhancement. Maintaining the flow distribution and retention patterns and vegetation structure of the system is essential to maintain the water quality enhancement function. **Protection, Maintenance and Management Requirements**: It is essential to improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Unchannelled nature of sections of the wetland must be maintained.	PES, EIS and REC to be verified. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	achieving the Ecospecs, considering this in the context of achieving the REC.
10	B71G	Oli_10.1	Tufa waterfall	Tufa waterfall	B	Very High	A/B	**Motivation**: Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent permanent discharge of groundwater out of dolomitic aquifers. **Protection, Maintenance and Management Requirements**: Any applications for groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Maintenance of water inputs to the wetland is critical for peat formation and to prevent oxidation. Site specific management measures should be developed in consultation with the local community to ensure the continued protection of this system.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.
13	B60C	Oli_13.1	Treur wetland	Hillslope seepage	C (Nel et al., 2011)	Likely to be Very High (B4 Olifants PESEIS 2011)	A/B	**Motivation**: Maintenance of permanent water inputs to the wetland is critical for peat formation and to prevent oxidation. Maintenance of vegetation types and structure is required to ensure that existing biodiversity values are not undermined. **Protection, Maintenance and Management Requirements**: Any applications for development, abstraction or groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. A viable populations of the Treur River Barb fish species should be maintained. No increase in afforestation or other surface water reduction activities within the wetland catchment.	PES to be verified and EIS and REC to be determined. Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. Desktop mapping of catchment landuse focussing on extent of afforestation. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
									Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A Treur River Barb monitoring programme should be developed and implemented in conjunction with an NGO/conservation authority to monitor crane populations.
13	B60D	Oli_13.2	Kadishi waterfall	Tufa waterfall	A/B	Very High	A/B	**Motivation**: Tufa is formed where carbonate minerals precipitate out of ambient temperature water and thus represent permanent discharge of groundwater out of dolomitic aquifers. **Protection, Maintenance and Management Requirements**: Any applications for groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Maintenance of water inputs to the wetland is critical for peat formation and to prevent oxidation. Site specific management measures should be developed in consultation with the relevant conservation authority (Blyde/Motlatse River Canyon Nature Reserve).	A wetland monitoring strategy/plan should be developed and implemented in conjunction with the relevant conservation authority (Blyde/Motlatse River Canyon Nature Reserve).
1	B81A	Let_1.1	Stanford wetland	Floodplain	D	Moderate	C	**Motivation**: This wetland is likely to provide important water quality enhancement and flow maintenance functions in the Ebenezer Dam catchment. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								Targeted wetland management actions and rehabilitation interventions should be implemented to improve the wetland structure and functioning. This must address in particular afforestation related rehabilitation measures.	Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the targeted wetland management actions and rehabilitation interventions once implemented.
1	B81B	Let_1.2	Tzaneen Dam wetland	Unchannelled valley bottom Channelled valley bottom	D/E	Moderate	C/D	**Motivation**: This wetland is likely to provide important water quality enhancement and flow maintenance functions. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Targeted wetland management actions and rehabilitation interventions should be implemented to improve the wetland structure and functioning. This must address in particular afforestation related rehabilitation measures.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. A rehabilitation monitoring program should be implemented as part of the targeted wetland management actions and rehabilitation interventions once implemented.
2	B81D	Let_2.1	Thabina wetland	Channelled valley bottom	C	High	B	**Motivation**: This wetland is likely to provide an important flow regulatory and water quality enhancement function. The wetland is important form a direct human use perspective. **Protection, Maintenance and Management Requirements**: The unchannelled nature of sections of the wetland must be maintained. Existing vegetation types and structure must be maintained or improved within natural seasonal variability. Targeted wetland management actions and rehabilitation	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of channelization and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								interventions should be investigated and implemented if required to improve the wetland structure and functioning. Site specific management measures should be developed in consultation with the local community to ensure the maintenance and controlled utilisation of the wetland.	
9	B82G	Let_9.1	Baleni hot spring	Spring	B	Very High	A/B	**Motivation**: A culturally important site and one of only a few remaining undeveloped thermal hot springs in the catchment. This is a peatland with high ecological importance. Maintaining permanent flow in the system is essential for its maintenance and the protection of the peat. **Protection, Maintenance and Management Requirements**: Any applications for groundwater use in the area will need to consider the impacts on this system, both from an EIA and WUL perspective, and strict licensing conditions including monitoring of the system should apply. Maintenance of water inputs to the wetland is critical for peat formation and to prevent oxidation. Site specific management measures should be developed in consultation with the local community to ensure the continued protection of this system.	Compile an accurate desktop wetland basemap for the system prior to the start of monitoring and map the extent of erosion and dominant vegetation types in the system using the most recent available remote imagery. At the same time undertake a rapid PES assessment of the wetland and take fixed point photographs of key features from the closest access point/s. Repeat the above every 3 years and assess and report on achieving the Ecospecs, considering this in the context of achieving the REC. Undertake a baseline peat survey to determine extent, distribution and depth of peat in the system as well as humification. Repeat the survey every 10 years to determine changes and degradation related to peat.
12	B83C	Let_12.1	Nshawu	Unchannelled valley bottom Channelled valley bottom	C	High	B	**Motivation**: Being one of the largest wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. Opportunities exist to improve the current state of the system through management interventions. **Protection, Maintenance and Management Requirements**: It is essential to improve the existing flow distribution and retention patterns in the system in order to improve the current PES category and maintain the High EIS. Targeted wetland management actions and rehabilitation interventions should be implemented to improve the wetland	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								structure and functioning. This must address in particular the channelization that has developed in the system.	
12	B83D	Let_12.2	Manyeleti/Makhadzi wetland	Unchannelled valley bottom	A	High	A	**Motivation**: Being one of the larger wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. The current state of the system should be maintained. **Protection, Maintenance and Management Requirements**: It is essential to maintain the existing flow distribution and retention patterns in the system in order to maintain the current PES category and maintain the High EIS. No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process. Groundwater abstraction in the immediate vicinity of the wetland should be strictly controlled.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks.
-	B90B	Shi_1	Malahlapanga	Spring	E	High	C/D	**Motivation**: Being one of only a few thermal hot springs containing peat in the Kruger National Park, this wetland has important ecological value. Opportunities exist to improve the current state of the system through management interventions. **Protection, Maintenance and Management Requirements**: Targeted wetland management actions and rehabilitation interventions should be implemented to try to improve the wetland structure and functioning. Maintenance of water inputs to the wetland is critical for peat formation and to prevent oxidation.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
-	B90D	Shi_2	Mafiyeni	Spring	C	Very High	A/B	**Motivation**: Being one of only a few thermal hot springs containing peat in the Kruger National Park, this wetland has important ecological value. Opportunities exist to improve the current state of the system through management interventions. **Protection, Maintenance and Management Requirements**: Targeted wetland management actions and rehabilitation interventions should be implemented to try to improve the wetland structure and functioning. Maintenance of water inputs to the wetland is critical for peat formation and to prevent oxidation.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks.
-	B90A	Shi_3	Shisha tributary	Unchannelled valley bottom	A/B	Moderate	A/B	**Motivation**: Being one of the larger wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. The current state of the system should be maintained. **Protection, Maintenance and Management Requirements**: It is essential to maintain the existing flow distribution and retention patterns in the system in order to maintain the current PES category and maintain the High EIS. No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks.
-	B90H	Shi_4	Dzombo	Channelled valley bottom	B	High	B	**Motivation**: Being one of the larger wetlands in the Kruger National Park, this wetland has important biodiversity and functional value. Opportunities exist to improve the current state of the system through management interventions. **Protection, Maintenance and Management Requirements**: It is essential to maintain the existing flow distribution and retention patterns in the system in order to maintain the current PES category and maintain the High EIS.	A wetland monitoring strategy/plan should be developed and implemented in conjunction with SANParks.

IUA	Quaternary Catchment	Wetland ID	Wetland Name	Wetland Type	PES	EIS	REC	Ecological Specifications	Monitoring Requirements
								No new activities that could lead to flow concentration should be allowed in the system without following a detailed authorisation process.	

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APPENDIX A

RULE AND EWR TABLES

RULE AND EWR TABLES INCLUDE AS ELECTRONIC FILES