

# DETERMINATION OF WATER RESOURCE CLASSES AND RESOURCE QUALITY OBJECTIVES FOR THE WATER RESOURCES IN THE MZIMVUBU CATCHMENT



## water & sanitation

Department:  
Water and Sanitation  
REPUBLIC OF SOUTH AFRICA

### BACKGROUND INFORMATION DOCUMENT (MAY 2017)

#### PURPOSE OF THIS DOCUMENT

The purpose of this document is to:

- Provide progress to date on the Classification of water resources and determination of Resource Quality Objectives (RQO) for the water resources in the Mzimvubu catchment.
- Present finalised spreadsheets of Resource Units, Integrated Units of Analysis and water quality information gathered from stakeholders.
- Present desktop and River Ecological Water Requirements, including EcoClassification results.
- Process of selecting and defining operational scenarios.

Project Steering Committee (PSC) members are encouraged to continue participating in the process by contributing information at meetings or by corresponding with the public participation office, the technical team or the DWS Project Manager at the addresses provided below.

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#### 1. BACKGROUND

The Directorate: Water Resource Classification of the Department of Water and Sanitation (DWS) initiated the study in August 2016 to determine the water resource classes and RQOs for the water resources in the Mzimvubu Catchment.

This document is intended to provide an overview of the process to date and does not replace the technical reports which are being made available as part of the study.

According to the Project Plan for the study (**Figure 1**), the team has completed Steps 1 and 2, and has submitted draft information for Step 3. Step 4 is also currently underway.

The PSC Meeting 2 will report on the following:

- Finalised spreadsheet of Resource Units, Integrated Units of Analysis and water quality information gathered from stakeholders
- River Ecological Water Requirements, including EcoClassification results
- Basic Human Needs assessment
- Systems Modelling and Operational scenarios

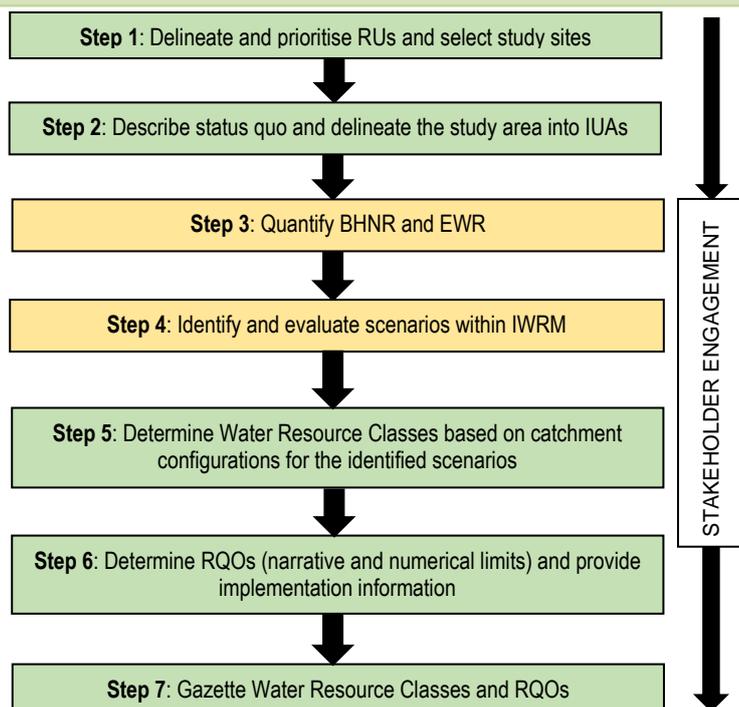


Figure 1: Project Plan for Mzimvubu Study

## 2. FINALIZED RESOURCE UNITS, INTEGRATED UNITS OF ANALYSIS AND WATER QUALITY INFORMATION

The water quality information provided has been sourced from stakeholders at the following meetings:

- ❖ Technical Task Group (TTG) Meeting: 30 January 2017, East London
- ❖ Upper Mzimvubu Catchment Information Meeting: 06 March 2017, Matatiele

One-on-one liaison with specific stakeholders identified as water quality specialists or practitioners who were not able to attend either of the above-mentioned meetings was undertaken as follows:

- ❖ Department of Economic Development and Environmental Affairs: T35 catchment
- ❖ DWS, Mthatha
- ❖ Alfred Nzo District Municipality: T31, T32, T33 catchments

Results will be presented at the PSC meeting in May 2017 according to the following headings:

- ❖ Finalized Resource Units (RUs) and Integrated Units of Analysis (IUAs)
- ❖ Confirmed water quality priority resource units
- ❖ Identified water quality role players/users and their locations within the RUs
- ❖ Identified driving users in terms of water quality
- ❖ Identified water quality variables that drive water quality state or requirements
- ❖ Any other information sourced from stakeholders

The spreadsheets will be updated throughout the study in preparation for RQOs as information becomes available, although the RUs and IUAs have been finalized through review (by the Project Management and Steering committees (PMC and PSC)) and approval by the DWS.

## 3. RIVER ECOLOGICAL WATER REQUIREMENTS

Draft Desktop EWR and River EWR reports have been prepared and submitted to the PMC for review. Once comments have been addressed, the second drafts will be submitted to the PSC for review. Results will be presented at the PSC meeting of May 2017.

To date the following actions and tasks relating to EWR assessments have been undertaken:

- ❖ River Resource Units and Management Resource Units (MRUS) have been identified;
- ❖ River EWR sites (key biophysical nodes) have been identified;
- ❖ River EWR surveys have been undertaken;
- ❖ Estuarine surveys have been undertaken (as part of the dam feasibility study in 2014);
- ❖ Hydraulic, hydrodynamic and biophysical data collated have been analysed; and
- ❖ Hydrological analyses for all biophysical nodes are complete.

There are 82 biophysical nodes that have been identified that require EWR determination. Due to the lack of data in some areas and the large size of the study area, ecological water requirements are processed at different sites and nodes. A priority determination process was used to identify those nodes or rivers which require detailed assessment and also provide information at which levels other nodes should be addressed. The results of this assessment were presented at the PSC meeting 1. The desktop biophysical nodes are those with a moderate and low priority and where desktop EWR estimates will suffice.

At the detailed level, EWRs have been undertaken at four EWRs/key biophysical nodes. The results from the EWR sites were extrapolated to 10 additional nodes. EWRs were determined at 68 desktop biophysical nodes using the appropriate desktop model.

### 3.1 EWR DETERMINATION AT DESKTOP BIOPHYSICAL NODES

The EWRs at 68 desktop biophysical nodes have been determined using a desktop model which estimates EWRs. The outputs are presented as flow duration tables called EWR rules for the Recommended Ecological Category (REC). Results will be presented during the PSC meeting of 9 May 2017 and will be summarised as part of an information pack that will be distributed to stakeholders at the upcoming PSC meeting.

### 3.2 DETAILED EWR DETERMINATION AT KEY BIOPHYSICAL NODES (EWR SITES)

The first step in determining EWRs is to apply the EcoClassification process. The role of the EcoClassification process is, amongst others, to define the various Ecological Categories (ECs) for which EWRs will be set. The EcoClassification process broadly consists of three steps:

**a) Determining and categorising the PES** (health or integrity) of various biophysical attributes of rivers compared to the natural (or close to natural) reference condition.

The ecological state of the river is described in terms of categories (A-F; where A = Natural, and F = critically modified) for each component (geomorphology, physico-chemistry, riparian vegetation, fish and macroinvertebrates). Integration of these components represents the Ecological Status or EcoStatus of a river at a particular biophysical node. The EcoStatus can therefore be defined as the totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna that require a supporting habitat structure. This ability relates directly to the capacity of the system to provide a variety of goods and services.

**b) Determining the Ecological Importance and Sensitivity (EIS)**

The EIS was calculated using DWS models. This approach estimates and classifies the EIS of the rivers in a catchment by considering a number of components surmised to be indicative of these characteristics. The following ecological aspects are considered as the basis for the estimation of EIS:

- ❖ The presence of rare and endangered species, unique species (i.e. endemic or isolated populations) and communities, intolerant species and species diversity, and
- ❖ Habitat diversity.

**c) Derive the Recommended Ecological Category (REC)**

The REC will be an improved category from the PES if the PES is lower than a B Ecological Category and if the EIS is High or Very High. The attainability of an improved category will also be considered.

The EcoClassification results are summarised in *Table 1* below.

EWR SITE	RIVER	PES	EIS	REC	COMMENT
MzimEWR1	Tsitsa	C	Moderate	C	The main causes are sedimentation due to catchment erosion, presence of alien predatory fish and vegetation, grazing pressure and wood removal.
MzimEWR2	Thina	C	Moderate	C	The main causes are sedimentation due to catchment erosion, presence of alien predatory fish and vegetation, grazing pressure and wood removal.
MzimEWR3	Kinira	C	Moderate	C	The main causes are sedimentation due to catchment erosion, presence of alien predatory fish and vegetation, grazing pressure and wood removal.
MzimEWR4	Mzimvubu	C	Moderate	C	The main causes are sedimentation due to catchment erosion, presence of alien predatory fish and vegetation, grazing pressure and wood removal.

*Table 1: EcoClassification results*

EWRs are then set for the REC as determined above, as well as for the PES if different from the REC. The key EWR sites assessed, following detailed methods, are situated in the Tsitsa, Thina, Kinira and Mzimvubu rivers. The EWRs have been determined following the Habitat Flow Stressor Response approach and all the tools that support this method. A summary of the results is included in **Table 2** below.

Note that results are provided for the PES and REC, and an alternative lower category.

Table 2: Summary of results as a percentage of the nMAR

Site	EcoStatus	nMAR (MCM <sup>1</sup> )	pMAR <sup>2</sup> (MCM)	% of nMAR	Low flows (MCM)	Low flows (%)	High flows (MCM)	High flows (%)	Total flows (MCM)	Total (%)
MzimEWR1	PES; REC: C	438.04	413.16	94.32	87.43	20	48.25	11	135.68	31
	D EC				67.66	15.4	42.16	9.6	109.82	25.1
MzimEWR2	PES; REC: C	404.51	393.23	97.21	89.24	22.1	32.41	8	121.65	30.1
	D EC				60.63	15	29.5	7.3	90.13	22.3
MzimEWR3	PES; REC: C	407.12	399.3	98.08	82.87	20.3	52.57	12.9	135.44	33.3
	D EC				63.83	15.7	45.83	11.3	109.66	26.9
MzimEWR4	PES; REC: C	2655.13	2532.21	95.37	331.16	12.5	301.3	11.3	632.46	23.8
	D EC				201.32	7.6	267.95	10.1	469.27	17.7

<sup>1</sup> Million Cubic Metres

<sup>2</sup> Present Day MAR

The confidence in the EcoClassification is Moderate to High which is acceptable for an Intermediate assessment. Furthermore, no further work on the EcoClassification is required as it will not influence the EWR determination. However, monitoring is essential to ensure that the ecological objectives in terms of the REC are achieved and the EC will therefore be verified during monitoring.

In general, the EWR requirements for low flows have a Moderate to High (MzimEWR 1) confidence. Additional biological surveys could improve the confidence but it is of more important to improve the confidence first of the hydraulics.

#### 4. BASIC HUMAN NEEDS

A draft Basic Human Needs report has been prepared and submitted to the PMC for review. Once comments have been addressed, the second draft will be submitted to the PSC. Results will be presented at the PSC meeting of May 2017.

The Basic Human Needs associated with all resources has been determined. To achieve this an analysis of the current demographic profile of the Mzimvubu River catchment was undertaken. The results of Census 2011 were used as the departure point, with population figures adjusted to a 2015 figure using the currently accepted population growth figures for the applicable districts within the catchment area. The data was matched with the profiles of reliance on water resources as provided by the Census 2011.

Those receiving water from a recognised formal water source and therefore not likely to be dependent on direct abstraction from rivers or groundwater, were excluded. Approximately 36.0% of the households are recorded as being serviced by a Regional Water Supply Scheme. The rest are deemed to be BHN dependant and are households who abstract directly from boreholes as Schedule 1 users, or from streams, springs, dams and pools, or make other arrangements for their water. BHN figures are shown on **Table 3** for both 25L per person per day, and 60L.

Table 3: BHN figures for the Mzimvubu catchment

Total population	1 045 215	Cubic metres per day	million m <sup>3</sup> /a
Population not serviced and allocated to BHNR	685 006		
BHNR 1: @ 25 L/p/d – excluding those on a formal scheme (surface water or borehole abstraction)		17 125	6 251
BHNR 1: @ 60 L/p/d – excluding those on a formal scheme (surface water or borehole abstraction)		41 100	15 002

## 5. OPERATIONAL SCENARIOS

During this step (Step 4 of the Project Plan; **Figure 1**) various scenarios will be evaluated and the consequences of these scenarios in terms of ecological, economic and Ecosystem Services will be presented to the stakeholders. Scenarios are different options for protection within each catchment. Once a scenario is accepted, it will lead to the formulation of the Water Resources Classes. These scenarios are referred to as **operational scenarios**, as they deal with different ways the river, estuaries and catchment can be operated and include changes to present operation and/or land use as well as future developments.

In preparation for the modelling of operational scenarios, meetings and liaison with DWS took place, and a discussion document was prepared by Colin Talanda and Pieter van Rooyen of WRP, the yield modellers for the study. The following pertinent points are extracted from this document and will be discussed further at the PSC meeting of May 2017.

Scenarios, in context of water resource management and planning, are plausible definitions (settings) of all the factors that influence the water balance and water quality in a catchment and the system as a whole. The scale (resolution) of the analysis requires the aggregation of land use effects and therefore individual and localised small scale developments will not significantly influence the classification of a water resource. The **operational scenarios** are based on **flow** and **water quality** related aspects and not on non-flow related aspects. Mitigation measures to address non-flow related aspects will be identified and will be addressed as part of the RQO process.

The proposed scenarios to be set up through the Water Resources Yield Model (WRYM) for the Mzimvubu system are summarised in **Table 4**. The Present Ecological State (PES) and the Recommended Ecological Category (REC) for the EWR river sites (current study) and the estuary (2014 dam feasibility study) can be summarised as follows:

- MzimEWR 1 (Tsitsa River) PES = C = REC
- MzimEWR 2 (Thina River) PES = C = REC
- MzimEWR 3 (Kinira River) PES = C = REC
- MzimEWR 4 (Mzimvubu River) PES = C = REC

The EWR sites are shown in **Figure 2**.

Scenario	SCENARIO VARIABLES						
	Update Water Demands	Ultimate Development Demands & Return Flows (2040)	Revive Irrigation (T33A-T33G)	EWR <sup>1</sup>	Mzimvubu Water Project <sup>5</sup>	New Municipal Dams / Abstractions	Port St Johns Proposed WWTW
<b>MZ1</b>	Yes	No	No	No	No	No	No
<b>MZ2</b>	Yes	Yes	Yes	No	Yes	Yes	No
<b>MZ3-1</b>	Yes	Yes	Yes	REC tot <sup>2</sup>	Yes	Yes	No
<b>MZ3-2</b>	Yes	Yes	Yes	REC low <sup>3</sup>	Yes	Yes	No
<b>MZ3-3</b>	Yes	Yes	Yes	REC Low <sup>4</sup>	Yes	Yes	No
<b>MZ4</b>	Yes	Yes	Yes	Based on MZ3 outcome	Yes	Yes	Yes
<b>MZ5</b>	Possible optimized scenario balancing protection and use, using MZ4 as a starting point						

Table 4: Summary of the proposed Mzimvubu Scenarios

1 Ecological Water Requirement

2 Recommended Ecological Category (Total Flows)

3 Recommended Ecological Category (Low Flows)

4 Recommended Ecological Category (Total Flows for January, February, March and Low Flows remaining months)

5 Mzimvubu Water Project: Ntabelanga & Lalini dams

A scenario currently under discussion, which will not be set up through the WRYM as it is a non-flow related scenario, is one related to rehabilitation and restoration of the Upper Mzimvubu Catchment. Liaison is underway with DEA's Natural Resource Management programme, the uMzimvubu Catchment Partnership Programme (UCPP), and the Ntabelanga Laleni Ecological Infrastructure Programme (NLEIP), to consider a water quality scenario, assessing changes in sedimentation and instream turbidity levels.

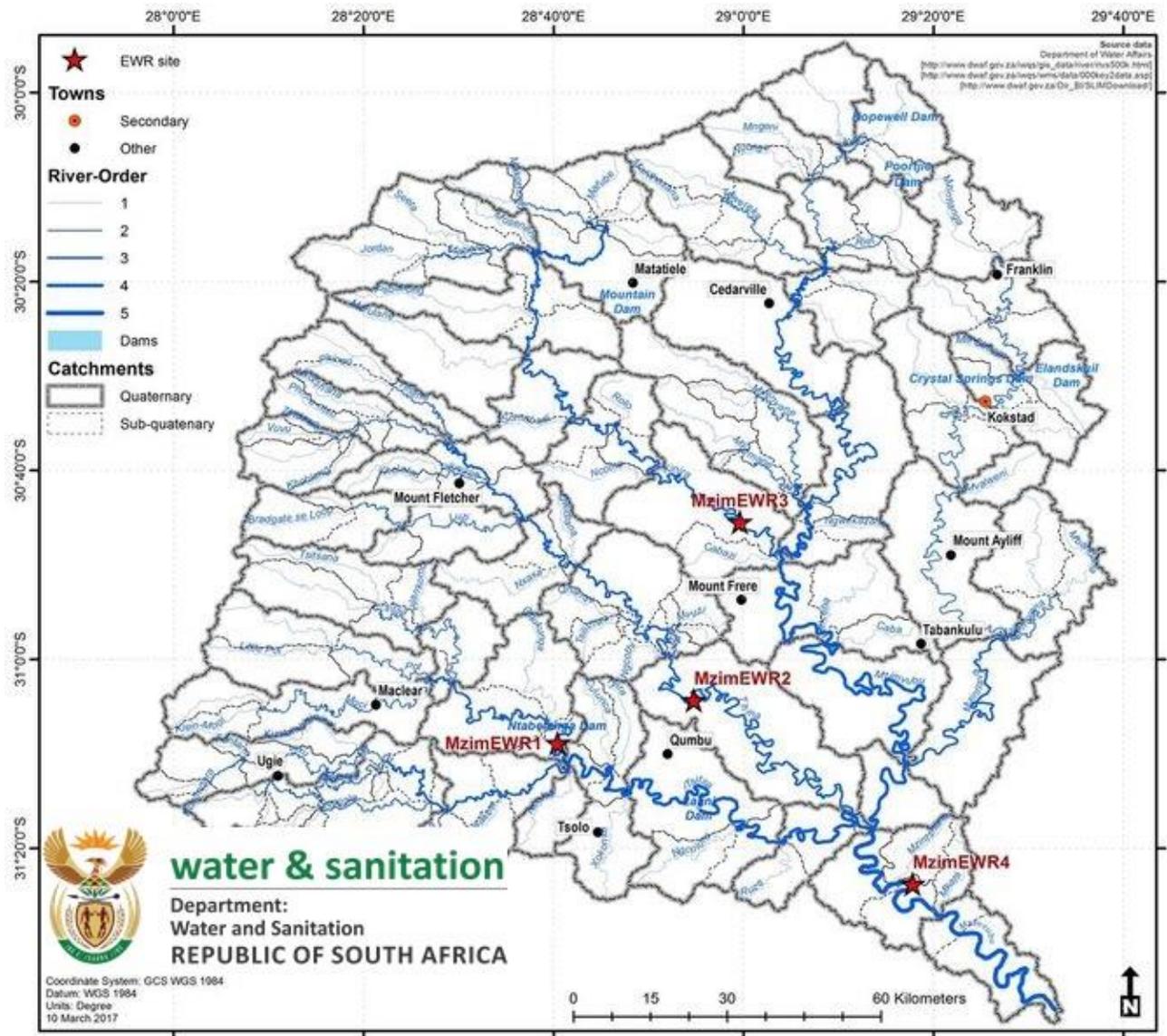


Figure 2: Position of the EWR sites

## 6. STAKEHOLDER ENGAGEMENT

Stakeholders will continue to be informed on progress of the study through a series of Background Information Documents prior to each PSC meeting and will be asked for their inputs on an ongoing basis.

More information on the project is available on <http://www.dwa.gov.za/rdm/WRCs/default.aspx>

## 7. LIST OF ACRONYMS

BHNR	Basic Human Needs Reserve	PMC	Project Management Committee
EC	Ecological Category	PSC	Project Steering Committee
EIS	Ecological Importance and Sensitivity	RU	Resource Units
EWR	Ecological Water Requirements	RQO	Resource Quality Objectives
IUA	Integrated Units of Analysis	REC	Recommended Ecological Category
MRU	Management Resource Units	TTG	Technical Task Group
NLEIP	Ntabelanga Laleni Ecological Infrastructure Partnership	UCCP	uMzimvubu Catchment Partnership Programme
PES	Present Ecological State	WRYM	Water Resources Yield Model



**THE DEPARTMENT OF WATER AND SANITATION  
AND THE STUDY TEAM  
WISHES TO THANK YOU FOR YOUR PARTICIPATION**

