Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments

Project Steering Committee (PSC) meeting no. 2
Background Information Document (BID)
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PURPOSE OF THIS DOCUMENT

The purpose of this background information document (BID) is to inform stakeholders about this study that will determine Water Resource Classes and Resource Quality Objectives (RQOs) for significant water resources in the Usutu to Mhlathuze Catchments.

This BID contains the following:

- A brief overview of the Water Resource Classification System;
- An overview of the study area;
- An indication of where we are in the study process;
- The outcomes of the Ecological Water Requirements (EWRs) for rivers, wetlands and the groundwater component.

This document specifically provides a summary of the results of **Task 3** of the study.

Through this process water resources within the catchments will be classified in accordance with the Water Resource Classification System and RQOs will be determined.

Stakeholders are invited to participate in the process by contributing information at meetings and workshops, or by corresponding with the stakeholder engagement office or the technical team at the addresses provided below.

Stakeholder Engagement Office
Anelle Lötter
Cell: 082 804 5890
Email: anelle@jaws.co.za

Technical Enquiries
Caryn Seago / Dr Patsy Scherman /
Tel: 012 346-3496 (Caryn)
Cell: 082 323 3998 (Caryn) /
082 503 6070 (Patsy)
Email: cayns@wrp.co.za /
patsy@itsnet.co.za

BACKGROUND

The National Water Act,1998 (Act No. 36 of 1998), (NWA) is founded on the principle that National Government has overall responsibility for and authority over water resource management for the benefit of the public. It also requires that the nation's water resources be protected, used, developed, conserved, managed and controlled in an equitable, efficient and sustainable manner.

In order to achieve this objective, Chapter 3 of the National Water Act, 1998 (Act 36 of 1998) provides for the protection of water resources through the determination of Resource Directed Measures (RDM).

The Chief Directorate: Water Ecosystems Management of the Department of Water and Sanitation (DWS) is responsible for the determination of RDM which includes the classification of water resources, determination of the Resource Quality Objectives (RQOs) and the Reserve in terms of the Water Resource Classification System (WRCS). These protection measures aim to ensure that a balance is sought between the need to protect and sustain water resources on one hand and the need to develop and use them on the other.

The DWS is progressively determining water resources classes; Reserve and RQOs for all river systems in South Africa to ensure their protection and sustainable use, with the Usutu to Mhlathuze Catchments being among one of the current systems to be classified and RQOs determined.

This study is managed by a Project Management Committee (PMC) (consisting of relevant DWS representatives and the Professional Service Provider).

The PSC is represented by various sectors of society and meets on a regular basis to steer this study towards the acceptable scientific direction. Members of the PSC provide feedback to the constitutions / organisations which they represent.

Information Documents (such as this document) are developed six-monthly and made available to stakeholders. This study's final results will be presented at a public meeting before the gazetting process commences, which will provide further opportunity for comment.

DWS Study Managers

Ms Lebogang Matlala	Director: Water Resource Classification	(012) 336 6707	082 884 5399	matlalal@dws.gov.za
Ms Mohlapa Sekoele	Project Manager	(012) 336 8329	082 809 5418	sekoeleM@dws.gov.za
Ms Koleka Makanda	Scientist	(012) 336 8406	0665142662	makandac@dws.gov.za

Project website: http://www.dws.gov.za/rdm/WR/CSdefault.aspx

WHAT IS THE WATER RESOURCE CLASSIFICATION SYSTEM?

The Water Resource Classification System (WRCS) is a set of procedures for determining the three protection measures which are:

- Water resource classification
- Reserve and
- Resource Quality Objectives

The implementation of the WRCS, therefore, requires considering the social, economic and environmental landscape in a catchment in order to assess the costs and benefits associated with utilization versus protection of a water resource.

The actual process of applying the WRCS procedures to establish the Class is called the Classification process. The Classification process is a consultative process that allows stakeholders to participate in the setting of the Classes.

The outcome of the Classification process will be the approval of the Water Resource Classes.

Water resources must be classified into the following:

Class I water resource is one which is minimally used, and the overall ecological condition of that water resource is minimally altered from its predevelopment condition.

Class II water resource is one which is moderately used, and the overall ecological condition of that water resource is moderately altered from its predevelopment condition.

Class III water resource is one which is heavily used, and the overall ecological condition of that water resource is significantly altered from its predevelopment condition.

Once the classes have been established, RQOs are determined to give effect to the classes established. These protection measures will be gazetted in a government gazette and will be binding on all authorities or institutions.

The Usutu-Mhlathuze study will follow a project plan which is based on the Integrated Steps for Classification and determining RQOs.

WHAT ARE RESOURCE QUALITY OBJECTIVES?

Resource Quality Objectives (RQOs) are a set of narrative and/or numerical management objectives defined for any particular resource, once the Class has been determined.

RQOs encompass four components of the resource:

- Water quantity;
- Water quality;
- Habitat integrity; and
- Biotic characteristics.

RQOs are important management objectives against which resource monitoring will be assessed. Monitoring of set RQOs will provide an indication as to whether the Class is being maintained or achieved.

INTERGRATED PROCEDURE FOR DETERMINING THE WATER RESOURCE CLASSES AND SETTING RQOs: THE STUDY PLAN

The following tasks are undertaken for determining the Water Resource Classes and for setting the RQOs. Tasks 1 and 2 have been Currently busy with Task 3 which will be reported on at the 2nd PSC meeting. The duration of the study is 30 months – December 2021 to May 2024.

Task 1	**Delineate the Resource Units and Integrated Units of Analysis (IUAs) and describe the status quo of the water resources**	
Task 2	**Prioritise Resource Units (RUs) and select study sites**	
Task 3	**Quantify Basic Human Needs and Ecological Water Requirements (EWRs)**	
Task 4	**Identify and evaluate scenarios within Integrated Water Resource Management**	
Task 5	**Determine Water Resource Classes based on Catchment configurations for the identified scenarios**	
Task 6	**Determine RQOs (narrative and numerical limits) and provide implementation information for stakeholder review**	
Task 7	**Input into legal notice and Gazette the Class configuration and RQOs**	

AN OVERVIEW OF THE STUDY AREA

The Usutu to Mhlathuze catchments are situated in the northern part of the KwaZulu-Natal province and also occupy the south-eastern corner of the Mpumalanga province (west of Swaziland). The catchments border both Swaziland and Mozambique and share two major river systems (the Usutu and Pongola) with these countries. The catchments in the area are as follows:

- Mhlathuze,
- Mfolozi
- Mkuze/Hluhluwe
- Pongola
- Usutu and Lake Sibaya

These catchments are all mostly independent of each other and they all form part of the Usutu Basin, also referred to as the Maputo River Basin. The Usutu to Mhlathuze catchments have been divided into six drainage areas, or secondary catchment areas, which are:

- Mhlathuze, including all the W1 catchments;
- Umfolozi, including all the W2 catchments;
- Mkuze, including all the W3 catchments;
- Pongola, including all the W4 catchments and part of this catchment falls within Swaziland;
- Usutu, including all the W5 catchments and much of this catchment falls within Swaziland; and
- The W7 catchment which is unique in that its water resources are dominated by groundwater.

The Mbuluzi secondary catchment, W6, is part of the Usutu to Mhlathuze Water Management Area (WMA6), however it falls completely within Swaziland and Mozambique. It is therefore not included as part of this study because it does not contribute to the Pongola and Usutu River systems.

The primary rivers in the area are the:

- Mhlathuze, Matigulu and Mlalazi rivers in W1;
- Mfolozi River in W2;
- Pongola and Bivane rivers in W4; and
- Assegaai, Usutu, Mpuluzi and Hlelo rivers in W5

The main contributors to the local economy are manufacturing, mining, agriculture and transport. Land-use includes commercial agriculture and irrigated crops, mostly sugarcane and citrus, dryland sugarcane, and farm dams that support irrigation. Afforestation exists in the upper parts of most catchments and communal lands support cattle and subsistence farming. The area also has conservation and ecotourism, with several nature reserves including Hluhluwe, Mfolozi, Mkuze, St Lucia, Sodwana and Itala. In addition, Lake St Lucia is a proclaimed World Heritage Site, also forming part of the key economic sectors within the area. Key industries in the area include pulp and paper manufacturing, aluminium smelting, and dune mining for titanium and other heavy metals. The manufacturing sector is linked to railway infrastructure with a harbour at Richards Bay (the largest coal exporting terminal in South Africa).

Main towns include Richards Bay, Mtunzini, Ulundi, St Lucia, Vryheid, Paulpietersburg, Piet Retief, Armsterdam, Hluhluwe, St Lucia and Mkuze, Jozini and Pongola. Large dams in the area include the Klipfontein Dam, Goedertrouw, Hluhluwe, Bivane and Pongolapoort.

There are also a number of transfer schemes in the area, namely the Usutu (providing water for the cooling of coal-fired power generation plants in the Vaal and Olifants systems), Thukela-Mhlathuze, Mfolozi-Mhlathuze and Senekal Trust Transfer.

The Usutu to Mhlathuze catchments are amongst many water-stressed catchments in South Africa. These catchment areas are important for conservation and contain a number of protected areas, natural heritage sites, cultural and historic sites and other conservation areas that need to be protected. There are six RAMSAR sites within the catchments, which include Ndumo Game Reserve, St. Lucia, Kosi Bay, Lake Sibaya, Natal Drakensberg Park, Turtle Beaches / Coral Reefs at Tongaland.

STUDY APPROACH

This study focuses on the classification of significant water resources (rivers, wetlands, groundwater and the estuary) and determining associated RQOs in the Usutu to Mhlathuze catchments.

The process begins by defining the current state of the water resource (or part thereof) in terms of the ecological and biophysical elements. A detailed status quo assessment of the catchment (water resource quality, water resource issues, existing monitoring programmes, infrastructure, institutional environment, socio-economics, sectoral water uses and users) is undertaken to understand the current conditions.

The catchment is then delineated into Integrated Units of Analysis (IUAs), where the catchment area is divided into basic units of assessment for the Classification of water resources, and into Resource Units (RUs, i.e. smaller units) for determining ecological water requirements (EWR or the Ecological Reserve). The assessment of EWRs is undertaken as Step 3 of the process. These steps form Tasks 1, 2 and 3 of the Study Plan.

A process of modelling, taking into account the protection requirements and development demands, is undertaken to understand consequences of different development scenarios on the state of resources (Tasks 4 and 5 of the Study Plan). A consultative process will then be undertaken, whereby the outcomes of the scenario analysis are discussed, taking into account the ecological, social and economic aspects, to define a future desired state of a water resource, namely the Water Resource Class. RQOs are then determined to ensure that the Classes that have been set can be met (Task 6 of the Study Plan). Once the consultation on the proposed classes and RQOs are complete, they are gazetted for public comment (Task 7 of the Study Plan).

TASK 3: QUANTIFY BASIC HUMAN NEEDS AND ECOLOGICAL WATER REQUIREMENTS

Ecological Water Requirements can be quantified using a variety of tools and at different levels of detail. EWR refers to flow and its associated characteristics (water quality, sediment, patterns) that should be left or provided for in the river system for those biota dependent on it as well as any people dependant on a natural functioning river (Ecological Goods, Services and Attributes (EGSA)).

Ecological Water Requirements for rivers

A Resource Unit is a section of river which is significantly different and warrants a Reserve determination. The RU is nested within an Integrated Unit of Analysis. A RU is required as it may not be appropriate to set the same numerical Reserve for the headwaters of a river as for the lowland reaches. Different sections of a river frequently have different natural flow patterns, react differently to stress according to their sensitivity, and require individual specifications of the Reserve appropriate for that reach. A detailed RU assessment was undertaken for the rivers selected based on the presence of identified areas of high ecological priority.

The quantification of EWRs for the classification of the Usutu to Mhlathuze catchments has been determined through previous Reserve studies and has been updated during this study.

A total of 61 biophysical nodes have been established, of which 42 will be addressed at a desktop level. A further 19 nodes are key EWR sites or are nodes where the flows will be extrapolated from the key biophysical nodes. The EWRs for the 42 desktop nodes were estimated using the Revised Desktop Reserve Model (version 2) and the outputs will be presented as EWR rules for the Recommended Ecological Category (REC). Results are provided in the table below.

Present Ecological State (PES) and Recommended Ecological Category (REC) for the desktop biophysical nodes

RU no	Main river name	PES	Ecological Importance and Sensitivity (EIS)	Improve?	REC	Primary driver	Improvement attainable?	Ecological Category (EC) for Revised Desktop Reserve Model (RDRM) output
W1 (Mhlathuze)								
W11-1	Matigulu	B	High	No	B		n/a	B
W12-1	Mhlathuze	B	High	No	B		n/a	B
W12-2	Mhlathuze	B	High	No	B		n/a	B
W12-3	Mhlatuze	C	High	Yes	B	Flow, Water Quality (WQ), Non-flow.		C
W12-4	KwaMazula	C	High	Yes	B	Flow, Non-flow.	Flow only by removing forestry in riparian. Rest of category will be achieved by non-flow mitigation.	B/C
W12-5	Mfule	C	High	Yes	B	Flow, Non-flow.	mitigation will have to focus on non-flow aspects.	C
W12-7	Mhlatuzana	B	High	No	B		n/a	B
W13-1	Mlalazi	C	High	Yes	B	Flow, WQ, Non-flow.	Can be achieved through non-flow mitigation and improvement of the operations of the Waste Water Treatment Works (WWTW)	C
W13-2	Manzamnyama	B/C	High	Yes	B	Flow, Non-flow.	Require removal of commercial forestry.	B/C
W2 (Mfolozi)								
W21-1	White Mfolozi	C	High	Yes	B	Flow, WQ, Non-flow.	REC achieved by combination of flow and non-flow mitigation.	B/C
W21-2	White Mfolozi	B	High	No	B		n/a	B
W21-3	White Mfolozi	C	High	Yes	B	Flow, WQ, Non-flow.	Mitigation will have to focus on non-flow aspects.	C
W21-4	Nondweni	D	Moderate	No	D	WQ, Non-flow.	n/a	D
W22-3	Sikwebezi	C	High	Yes	B	Non-flow	Mitigation will have to focus on non-flow aspects.	C
W23-1	Mfolozi	B	High	No	B		n/a	B
W23-2	Msunduzi	B	High	No	B		n/a	B
W3 (Mkuze)								
W31-1	Mkuze	C	High	Yes	B	Flow, WQ, Non-flow	REC achieved by combination of flow and non-flow mitigation.	B/C
W31-2	Mkuze	B	High	No	B		n/a	B
W31-6	Msunduzi	B	High	No	B		n/a	B
W32-2	Hluhluwe	B	High	No	B		n/a	B
W32-3	Nyalazi	B	High	No	B		n/a	B

RU no	Main river name	PES	Ecological Importance and Sensitivity (EIS)	Improve?	REC	Primary driver	Improvement attainable?	Ecological Category (EC) for Revised Desktop Reserve Model (RDRM) output
W32-4	Nyalazi	C	High	Yes	B	Flow, WQ, Non-flow	Largely non-flow mitigation required centred around sedimentation and erosion problems.	C
W32-5	Mzinene	C	High	Yes	B	Flow, WQ, Non-flow	See above.	C
W32-6	Munywana	B	High	No	B		n/a	B
W4 (Pongolo)								
W41-1	Bivane	C	High	Yes	B	Non-flow, flow	REC achieved by combination of flow and non-flow mitigation.	B/C
W41-2	Manzana	B	High	No	B		n/a	B
W42-1	Phongolo	C	High	Yes	B	Flow, Non-flow (WQ)	REC achieved by combination of flow and non-flow mitigation.	B/C
W42-4	Mozana	B	Moderate	No	B		n/a	B
W42-5	Phongolo	B	High	No	B		n/a	B
W43-1	Ngwavuma	C	Moderate	No	C	Non-flow (Flow, WQ)	n/a	C
W44-1	Phongolo	D	Moderate	No	D	Flow, WQ (non-flow)	n/a	D
W5 (Usutu)								
W51-1	Assegaai	C/D	High	Yes	B/C	Flow, Non-flow (WQ)	REC achieved by combination of flow and non-flow mitigation.	C
W51-4	Blesbokspruit	C	Moderate	No	C	Flow, Non-flow	n/a	C
W52-1	Hlelo	B/C	High	Yes	B	Non-flow, Flow	Extensive commercial forestry in the catchment.	B/C
W53-1	Ngwempisi	D	Moderate	No	D	Flow, Non-flow	n/a	D
W53-2	Mpama	B/C	Moderate	No	B/C	Flow, Non-flow	n/a	B/C
W53-3	Ngwempisi	C	Moderate	No	C	Flow (non-flow, WQ)	n/a	C
W54-1	uSuthu	B	Moderate	No	B		n/a	B
W54-2	uSuthu	C	Moderate	No	C	Flow	n/a	C
W55-1	Mpuluzi	B/C	High	Yes	B	Flow, WQ (Non-flow)	Removal of instream dams will be required.	B/C
W55-2	Lusushwana	C	High	Yes	B	Non-flow, WQ, Flow	Catchment currently dominated by non-flow related degradation	C
W57-1	uSuthu	B/C	High	Yes	B	Flow	Problematic to achieve as no control over Eswatini flow management.	B

Detailed EWRs were assessed at eight key EWR sites. Multi-disciplinary specialists were involved in a site visit and in the determination of the EWRs. Information collated during the 2014 Reserve study was used in support of the update of these EWRs. The results are summarised below:

EWR MA1: Matigulu RIver

Coordinates	S29.02010 E31.47040
SQ code	W11A-03612
RU	RU W11-2
IUA	IUA W11
Level 2 EcoRegion	17.01
Geomorph Zone	Upper foothills

PRESENT ECOLOGICAL STATE: PES

I HI (Instream Index of Habitat Integrity)	R IHI (Riparian IHI)	WQ	Geom (Geomor-phology)	Rip Veg (Riparian Vegetation)	Fish	Invertebrates	Instream	EcoStatus (Ecological Status)
B/C (80%)	B/C (78%)	B (84.5%)	B (87%)	B/C (79.4%)	B (86.4%)	B/C (80.9%)	B (83.3%)	B/C (81.3%)

ECOLOGICAL IMPORTANCE AND SENSITIVITY			
MODERATE			
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES			
REC = B/C for ECOSTATUS			
ECOLOGICAL WATER REQUIREMENTS (EWR)			
Natural MAR: 72.72 MCM		Present day MAR: 37 MCM	
Low flow EWR		Total flow EWR	
MCM	% of nMAR	MCM	% of nMAR
12.63	17.4	19.14	26.3

EWR NS1: Nseleni River

Coordinates	S28.63410 E31.92517
SQ code	W12G-03229
RU	RU W12-8
IUA	IUA W12-b
Level 2 EcoRegion	13.03
Geomorph Zone	Lower foothills

PRESENT ECOLOGICAL STATE: PES								
I IHI	**R IHI**	**WQ**	**Geom**	**Rip Veg**	**Fish**	**Invertebrates**	**Instream**	**EcoStatus**
B/C (81%)	**C (70.3%)**	**B (82.7%)**	**B (85%)**	**C (64.4%)**	**C (67.9%)**	**B/C (79.4%)**	**C (74.3%)**	**C (68.4%)**

ECOLOGICAL IMPORTANCE AND SENSITIVITY			
MODERATE			
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES			
REC = C for ECOSTATUS			
ECOLOGICAL WATER REQUIREMENTS (EWR)			
Natural MAR: 31.23 MCM		Present day MAR: 31.56 MCM	
Low flow EWR		Total flow EWR	
MCM	% of nMAR	MCM	% of nMAR
4.76	15.2	6.85	21.9

EWR WM1: White Mfolozi RIver

Coordinates	S28.23146 E31.18666
SQ code	W21H-02897
RU	RU W21-5
IUA	IUA W21
Level 2 EcoRegion	14.05
Geomorph Zone	Lower foothills

PRESENT ECOLOGICAL STATE: PES								
I IHI	**R IHI**	**WQ**	**Geom**	**Rip Veg**	**Fish**	**Invertebrates**	**Instream**	**EcoStatus**
B/C (79.3%)	**B/C (77.4%)**	**B (84.5%)**	**B/C (78.8%)**	**B/C (81.3)**	**C (73%)**	**B/C (81.1%)**	**C (77.08**	**B/C (79.2%)**

ECOLOGICAL IMPORTANCE AND SENSITIVITY			
MODERATE			
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES			
REC = B/C for ECOSTATUS			
ECOLOGICAL WATER REQUIREMENTS (EWR)			
Natural MAR: 222.51 MCM		Present Day MAR: 191.8 MCM	
Low flow EWR		Total flow EWR	
% of nMAR	% of nMAR	% of nMAR	% of nMAR
54.74	24.6	89.31	40.1

EWR BM1: Black Mfolozi River

Coordinates	S27.93890 E31.21030
SQ code	W22A-02610
RU	RU W22-1
IUA	IUA W22
Level 2 EcoRegion	3.1
Geomorph Zone	Upper foothills

PRESENT ECOLOGICAL STATE: PES

I IHI	R IHI	PC	Geom	Rip Veg	Fish	Invertebrates	Instream	EcoStatus
B/C (77.7%)	C (74.4%)	B/C (81.8%)	A (93%)	C (74.9%)	C (75.9%)	B/C (81.2%)	B/C (78.9%)	C (76.9%)
ECOLOGICAL IMPORTANCE AND SENSITIVITY								
MODERATE								
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES								
REC = C for ECOSTATUS								
ECOLOGICAL WATER REQUIREMENTS (EWR)								
Natural MAR: 166.72 MCM				Present Day MAR: 144.13 MCM				
Low flow EWR				Total flow EWR				
% of nMAR	% of nMAR			% of nMAR	% of nMAR			
18.38	11			43.58	26.1			

EWR MK1: MKUZE RIVER

Coordinates	S27.59210 E32.21800
SQ code	W31J-02480
RU	RU W31-5
IUA	IUA W31-b
Level 2 EcoRegion	3.08
Geomorph Zone	Lowland

I IHI	R IHI	WQ	Geom	Rip Veg	Fish	Invertebrates	Instream	EcoStatus
C (66.3%)	C (72.1%)	C/D (58.3%)	B (82.26%)	C (73%)	C (75.4%)	C (77.7%)	C (76.6%)	C (74.8%)
PRESENT ECOLOGICAL STATE: PES								
ECOLOGICAL IMPORTANCE AND SENSITIVITY								
HIGH								
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES								
REC = B for ECOSTATUS (Impacts non-flow related and flows will be set for a C EC)								
ECOLOGICAL WATER REQUIREMENTS (EWR)								
Natural MAR: 158.75 MCM				Present Day MAR: 106.13 MCM				
Low flow EWR				Total flow EWR				
% of nMAR	% of nMAR			% of nMAR	% of nMAR			
34.74	21.9			58.87	37.1			

EWR UP1: Pongola River

Coordinates	S27.36413 E30.96962
SQ code	W42E-02221
RU	RU W42-2
IUA	IUA W42-b
Level 2 EcoRegion	3.1
Geomorph Zone	lower/upper foothills

I IHI	R IHI	WQ	Geom	Rip Veg	Fish	Invertebrates	Instream	EcoStatus
PRESENT ECOLOGICAL STATE: PES								
B/C (80.5%)	B/C (77.8%)	A/B (88.3%)	A/B (89.8%)	C (70%)	C (73.9%)	B/C (79.5%)	C (77%)	C (73.5%)
ECOLOGICAL IMPORTANCE AND SENSITIVITY								
MODERATE								
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES								
REC = C for ECOSTATUS								
ECOLOGICAL WATER REQUIREMENTS (EWR)								
Natural MAR: 356.84 MCM				Present Day MAR: 299.39 MCM				
Low flow EWR				Total flow EWR				
% of nMAR	% of nMAR			% of nMAR	% of nMAR			
54.84	15.4			97.31	27.3			

EWR AS1: Assegaai River

Coordinates	S27.06230 E30.98880
SQ code	W51E-02049
RU	RU W51-3
IUA	IUA W52
Level 2 EcoRegion	4.06
Geomorph Zone	lower/upper foothills

PRESENT ECOLOGICAL STATE: PES								
I IHI	R IHI	WQ	Geom	Rip Veg	Fish	Invertebrates	Instream	EcoStatus
C/D (59.1%)	C/D (58.7%)	B/C (80.6%)	C (70.84%)	C (69.9)%	C (69.2%)	B/C (78.6%)	C (77.8%)	C (74.16%)
ECOLOGICAL IMPORTANCE AND SENSITIVITY								
MODERATE								
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES								
REC = C for ECOSTATUS								
ECOLOGICAL WATER REQUIREMENTS (EWR)								
Natural MAR: 328.61 MCM				Present Day MAR: 164.11 MCM				
Low flow EWR				Total flow EWR				
% of nMAR		% of nMAR		% of nMAR		% of nMAR		
40.06		12.2		70.85		21.6		

EWR NG1: Ngwempisi River		
	Coordinates	S26.679448 E30.70213
	SQ code	W53E-01790
	RU	RU W53-3
	IUA	IUA W52
	Level 2 EcoRegion	11.04/4.06
	Geomorph Zone	Upper foothills/ Transitional

PRESENT ECOLOGICAL STATE: PES								
I IHI	R IHI	WQ	Geom	Rip Veg	Fish	Invertebrates	Instream	EcoStatus
C (64.3%)	C/D (61.8%)	B (85.5)	B (83.3.%)	B/C (77.4%)	C (72.8%)	B (87.3%)	B/C (80.36%)	B/C (79.8%)
ECOLOGICAL IMPORTANCE AND SENSITIVITY								
MODERATE								
RECOMMENDED ECOLOGICAL CATEGORY (REC) = PES								
REC = B/C for ECOSTATUS								
ECOLOGICAL WATER REQUIREMENTS (EWR)								
Natural MAR: 156.33 MCM				Present Day MAR: 79.15 MCM				
Low flow EWR				Total flow EWR				
% of nMAR		% of nMAR		% of nMAR		% of nMAR		
30.46		19.5		50.82		32.5		

Ecological Water Requirements for Wetlands

Wetland EWRs are only considered for those wetlands with a Very High and at times, High priority. As the calculation of priority includes ecological aspects only as a *contribution* to the calculation, many ecologically important wetlands do not necessarily score Very High for priority since water resource demand / use may not also be High. For each Very High priority wetland, the EWR is determined according to the following steps:

1) Determine dominant wetland HGM type.
2) Determine appropriate level of RDM (Resource Directed Measures) study for wetlands according to HGM type.
3) Assess / validate EcoStatus of these priority wetlands, including the REC.
4) Determine EWR (or other RDM) to achieve the REC.

The HGM types of wetlands with High or Very High priority are shown in Figure 1 and

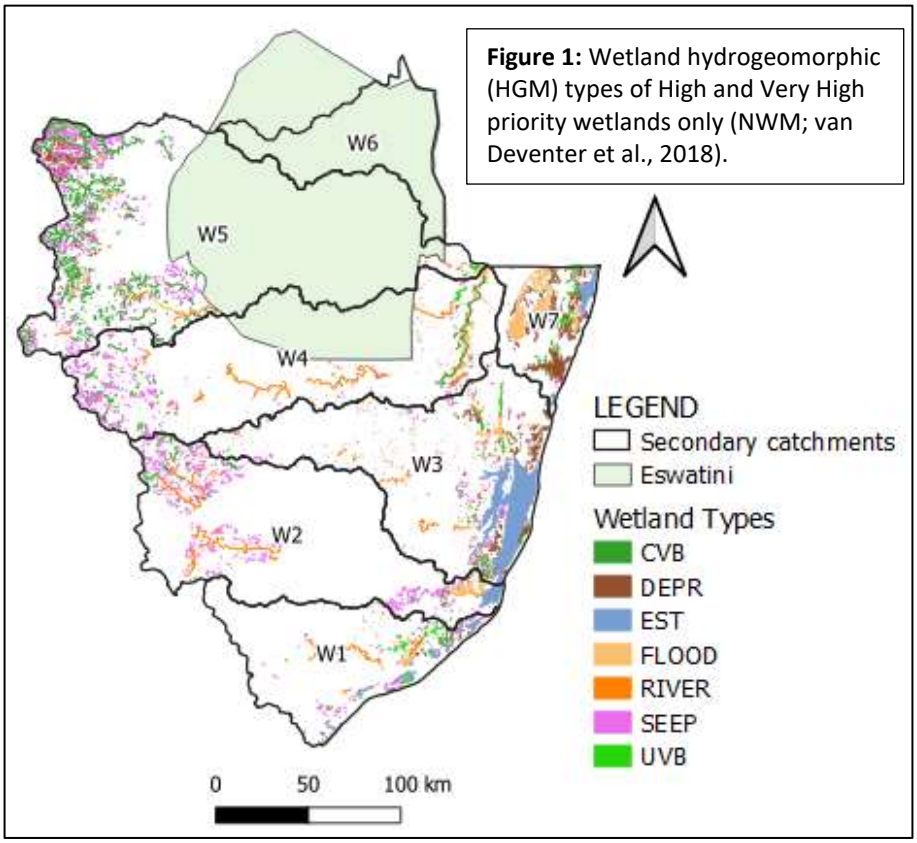


Figure 1: Wetland hydrogeomorphic (HGM) types of High and Very High priority wetlands only (NWM; van Deventer et al., 2018).

although the estuaries are also shown, these do not form any further part of this assessment. HGM types were taken from NBA spatial dataset (van Deventer *et al*., 2018). The EcoStatus was assessed, or where an assessment existed, was validated for wetlands with Very High (and at times High) priority. WET-Health (MacFarlane et al., 2007) was used to determine the PES for large floodplains and representative channelled valley-bottom wetlands. SANLC data (2020) were used to populate WET-Health and augment assessments. Summary of results is shown in the tables below.

W1 Mhlatuze: SQs that have a Very High wetland priority form 4 groups: Description of wetland components, integrated ecological importance (IEI), priority, PES and REC are shown below per SQ.

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
1	W12E-03475	Mhlatuze	Riverine wetlands along the Mhlathuze River leading into the Mhlathze swamp system, including Lake Mpangeni.	HIGH	4	C	C
2	W12H-03459	Nseleni	Floodplains along lower reaches of Nseleni, including Nsezi and portions of the Mhlathuze floodplain. For the sake of completeness, the remainder of the floodplain along the Mhlatuze (W12F-03494) was also included in the assessment. Wetland area of assessment was 4809 Ha.	HIGH	4	E	D
3	W12J-03411		Depressions and seeps surrounding the Nlabane estuary. Wetland area of assessment was 547 Ha.	HIGH	4	D	C/D
4	W12J-03392	Mpisini	Extensive channelled and unchanneled valley bottom wetlands leading into Richard's Bay Estuary, includes Mzingazi. Mzingazi was historically part of the Richard's Bay estuary, but a weir was built between the lake and the connection to the ocean which results in the lake currently being a freshwater system. Wetland area of assessment was 1689 Ha.	HIGH	4	B/C	B/C
	W12J-03403			HIGH	4		
	W12J-03450	Nundwane		HIGH	4		

W2 Umfolozi: SQs that have a Very High or High wetland priority form 4 groups: Description of wetland components, integrated ecological importance (IEI), priority, PES and REC are shown below per SQ.

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
1	W21G-02885	White Mfolozi	These SQs contain riverine wetlands along the White Mfolozi and have a very high priority mainly because the PES is B and WRUI is high.	VERY HIGH	4	B	B
	W21H-02897	White Mfolozi		VERY HIGH	4		
	W21H-03004	White Mfolozi		VERY HIGH	4		
2	W22A-02586	Black Mfolozi	These SQs comprise the Aloeboom vlei. Wetland area of assessment was 344 Ha.	HIGH	3	C	B/C
	W22A-02591			MODERATE	3		
	W22A-02596	Black Mfolozi		HIGH	3		
3	W23A-03160	Mvamanzi	Mvamanzi Pan. Wetland area of assessment was 485 Ha.	MODERATE	3	B/C	B/C
4	W23C-03180	Msunduzi	The Mfolozi and Msunduzi rivers both form part of the Mfolozi swamp in their lower reaches. Wetland area of assessment was 11911 Ha.	MODERATE	3	D	D
	W23D-03108	Mfolozi		MODERATE	3		

W3 Mkuze: SQs that have a Very High or High wetland priority form 5 groups: Description of wetland components, integrated ecological importance (IEI), priority, PES and REC are shown below per SQ.

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
1	W31J-02469	Mkuze	Mkuze and Nhlohlela rivers including Nhlonhlela Pan near their confluence. Wetland area of assessment was 8.2 Ha.	VERY HIGH	4	A	A
	W31J-02501	Nhlohlela		HIGH	3		
2	W32F-02835	Hluhluwe	Hluhluwe River floodplain before entering the St Lucia estuary. Wetland area of assessment was 2310 Ha.	MODERATE	3	C/D	C
3	W32H-02854	Nyalazi	Depressional wetlands with swamp forest in the Nyalazi River catchment. Many pans are in the area known as the Makhakathana Flats but the largest, Nyalazi pan was taken to represent the area. Wetland area of assessment was 43.2 Ha.	MODERATE	3	C	C
4	W32H-02998	Mpate	Channelled valley-bottom and depressional wetlands in the Mpate River catchment that leads into St Lucia. Wetland area of assessment was 237 Ha.	VERY HIGH	4	A	A
5	W32B-02535	Mkuze	Mkuze River including the Mkuze swamp system and the Mkuze floodplain. The NWM coverage was insufficient, so desktop delineation has been added. Wetland area of assessment was 11223 Ha.	VERY HIGH	3	B	B

W4 Pongola: SQs that have a Very High or High wetland priority form 2 groups: Description of wetland components, integrated ecological importance (IEI), priority, PES and REC are shown below per SQ.

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
1	W41B-02431	Bivane	This short section of river triggered a Very High priority because the WRUI was high and the PES was a B, but the updated PES (an exercise of this project) is a B/C due to agriculture on the floodplain and alien invasive plant species.	VERY HIGH	4	B	B
2	W45A-02216	Zibayeni	An unexpected outcome of the prioritisation process was that the Pongola floodplain had a High priority and not Very High. This is mainly due to poor ecological state (PES is mainly C/D, D or worse) even though ecological importance and WRUI were high. Nevertheless, the floodplain has been recognized as a priority wetland by several authors and has the Ndumo Game reserve (a RAMSAR site) in its lower reaches and has therefore been included in this study for further assessment. Wetland area of assessment was 11803 Ha.	MODERATE	3	D	C
	W45A-02245	Zibayeni		MODERATE	3		
	W45A-02246	Phongolo		MODERATE	3		
	W45A-02256	Lubambo		MODERATE	3		
	W45A-02275	Mpontshane		MODERATE	3		
	W45A-02282	Phongolo		MODERATE	3		
	W45A-02285	Mpontshane		MODERATE	3		
	W45A-02310	Mangqwashi		MODERATE	3		
	W45A-02316	Mfongosi		MODERATE	3		
	W45A-02356	Mlambo		MODERATE	3		
	W45A-02367	Phongolo		MODERATE	3		
	W45A-02368	Phongolo		MODERATE	3		
	W45B-02029	Phongolo		MODERATE	3		
	W45B-02105	Phongolo		MODERATE	3		

W5 Usuthu: SQs that have a Very High wetland or High priority form 6 groups: Description of wetland components, integrated ecological importance (IEI), priority, PES and REC are shown below per SQ.

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
1	W51C-01981	Assegaai	Floodplains along the Assegaai (W51C-01981 and W51D-02044 mainly) and tributary chanelled valley-bottom wetlands. Wetland area of assessment was 886 Ha.	MODERATE	3	C	C
	W51C-02011			HIGH	4		
	W51C-02022	Assegaai		MODERATE	3		
	W51C-02067	Assegaai		MODERATE	3		
	W51C-02074	Anysspruit		MODERATE	3		
	W51C-02109	Boesmanspruit		HIGH	4		
	W51D-02044	Assegaai		MODERATE	3		
	W51D-02151	Swartwater		LOW	3		
	W51D-02160			MODERATE	3		
	W51D-02171	Klein-Assegaai		MODERATE	3		
	W51D-02177	Klein-Assegaai		MODERATE	3		
	W51D-02193	Swartwater		HIGH	4		
2	W53A-01757	Sandspruit	Extensive channelled valley bottom wetlands along the Sandspruit (W53A-01757 mainly). Wetland area of assessment was 1677 Ha.	HIGH	4	C	C
	W53A-01804	Ngwempisi		MODERATE	3		
	W53A-01853	Ngwempisi		MODERATE	3		
3	W54A-01534	uSuthu	Extensive channelled valley bottom wetlands upstream of the Sandcliff Dam but not along an official SQ, rather a tributary of W54A-01534, the Usutu. Wetland area of assessment was 767 Ha.	HIGH	4	B/C	B/C
	W54A-01630			HIGH	4		
4	W54B-01569	uSuthu	Floodplain and channelled valley-bottom wetlands along the Seganagana (W54B-01623) upstream of the Westoe Dam. Wetland area of assessment was 1265 Ha.	MODERATE	3	A	A
	W54B-01623	Seganagana		HIGH	4		

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
5	W55A-01375	Mpuluzi	Mpumalanga pan district around Chrissiesmeer, Majosie se Vlei and Mpuluzi. Most of the pans are not directly associated with an official SQ. The area has high density of pans, extensive seepage wetlands and large areas of channelled valley-bottoms. These 3 HGM types were grouped to for amalgamated assessment. Wetland area of assessment was 21348 Ha.	HIGH	4	A/B	A/B
	W55A-01423	Majosie se Vlei		MODERATE	4		
	W55C-01395	Mpuluzi		MODERATE	4		
6	W57J-01923	uSuthu	Wetlands in this RU did not trigger as High priority but have been included here because floodplains along W57k-02025 form part of the Pongola floodplains in the Ndumo Game Reserve area and Banzi Pan occurs along the Usuthu River (W57k-01929) and are part of the RAMSAR site. Wetland area of assessment was 1310 Ha.	VERY HIGH	2	A	A
	W57K-01929	uSuthu		VERY HIGH	2		
	W57K-02025			HIGH	1		

W7 Kosi & Sibaya: SQs that have a Very High wetland priority form 2 groups: Description of wetland components, integrated ecological importance (IEI), priority, PES and REC are shown below per SQ.

Group	SQ	SQ Name	Wetland description / note	Wetland IEI	Priority	PES	REC
1	W70A-02278	Lake Sibaya	Includes Lake Sibaya and surrounding wetlands. Wetland area of assessment was 10168 Ha.	VERY HIGH	4	B	B
	W70A-02301						
	W70A-02381						
2	None		Depressional and floodplain wetlands that comprise the Muzi swamps. Wetland area of assessment was 25410 Ha.	N/A	N/A	C	C

Groundwater component to Ecological Water Requirements

The Groundwater Component of the Reserve and Groundwater Classification is undertaken by calculating the Stress Index for each quaternary catchment based on abstraction and revised figures for baseflow and recharge calibrated using WRSM Pitman. Groundwater baseflow and the Basic Human Needs (BHN) component from groundwater are utilised to determine the groundwater contribution to the Ecological Reserve.

A series of integrated maps of the basin or sub catchments which combine various spatial data sets and highlight crucial aspects of the groundwater systems (aquifers) in the project area were produced. Included are basin wide simplified geological and structural maps, aquifer distribution and type, borehole yield, recharge, stress index, baseflow and aquifer sustainable yield (productivity) maps, groundwater quality maps and recharge distribution maps. Tables are provided on groundwater resources, yield, and classification per catchment.

W1 Mhlatuze: Groundwater is minimally used and the stress index is below 0.05. Quaternary catchment classification is shown below.

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W11A	12.80	8.53	0.261	0.2692	0.02	A	I	8.80
W11B	3.73	2.44	0.121	0.0607	0.02	A	I	2.56
W11C	10.68	7.26	0.329	0.2315	0.02	A	I	7.59
W12A	18.91	9.05	0.176	0.1576	0.01	A	I	9.22
W12B	18.81	9.60	0.278	0.1216	0.01	A	I	9.88
W12C	17.82	8.53	0.197	0.1022	0.01	A	I	8.72
W12D	13.32	8.70	0.261	0.0924	0.01	A	I	8.96
W12E	6.71	3.76	0.158	0.0427	0.01	A	I	3.92
W12F	45.38	13.92	0.073	0.4185	0.01	A	I	13.99
W12G	10.01	4.92	0.075	0.0639	0.01	A	I	4.99
W12H	13.02	7.34	0.111	0.3651	0.03	A	I	7.45
W12J	42.57	11.95	0.087	0.0931	0.00	A	I	12.04
W13A	6.47	3.95	0.201	0.2160	0.03	A	I	4.15
W13B	4.75	3.03	0.119	0.0456	0.01	A	I	3.15

W2 Umfolozi: Groundwater is minimally used and the stress index is below 0.12. Quaternary catchment classification is shown below.

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W21A	5.66	17.85	0.062	0.0729	0.01	A	I	17.91
W21B	7.52	23.08	0.112	0.1862	0.02	A	I	23.19
W21C	4.29	9.93	0.072	0.0671	0.02	A	I	10.00
W21D	6.67	12.33	0.123	0.1356	0.02	A	I	12.46
W21E	5.22	11.08	0.175	0.6204	0.12	B	I	11.25
W21F	3.03	5.68	0.08	0.0441	0.01	A	I	5.76
W21G	7.29	14.33	0.254	0.2245	0.03	A	I	14.58
W21H	5.51	13.52	0.208	0.0646	0.01	A	I	13.72
W21J	6.05	19.49	0.248	0.0851	0.01	A	I	19.74
W21K	11.37	26.37	0.355	0.0969	0.01	A	I	26.72
W21L	7.74	17.28	0.155	0.0765	0.01	A	I	17.43
W22A	3.92	12.95	0.046	0.0413	0.01	A	I	12.99
W22B	5.57	13.39	0.105	0.0555	0.01	A	I	13.49
W22C	2.58	9.10	0.045	0.0332	0.01	A	I	9.14
W22D	3.19	6.04	0.095	0.0298	0.01	A	I	6.14
W22E	4.60	29.61	0.16	0.0732	0.02	A	I	29.77
W22F	5.37	10.43	0.219	0.0563	0.01	A	I	10.65
W22G	4.39	7.55	0.297	0.0770	0.02	A	I	7.85
W22H	4.80	8.40	0.175	0.5773	0.12	B	I	8.57
W22J	10.92	15.54	0.46	0.1201	0.01	A	I	16.00
W22K	12.99	13.63	0.515	1.3207	0.10	B	I	14.15
W22L	5.47	8.38	0.072	0.0657	0.01	A	I	8.45
W23A	15.12	16.87	0.229	0.5405	0.04	A	I	17.10
W23B	7.09	10.52	0.054	0.3926	0.06	B	I	10.57
W23C	50.74	27.83	0.128	0.2212	0.00	A	I	27.95
W23D	47.13	17.63	0.211	0.5663	0.01	A	I	17.85

W3 Mkuze: Groundwater is minimally used and the stress index is below 0.05. Quaternary catchment classification is shown below.

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W31A	5.85	14.16	0.072	0.0661	0.01	A	I	14.23
W31B	4.31	11.32	0.06	0.0535	0.01	A	I	11.38
W31C	3.38	8.60	0.033	0.065	0.02	A	I	8.64
W31D	4.22	10.64	0.076	0.0476	0.01	A	I	10.72
W31E	3.63	3.23	0.109	0.0484	0.01	A	I	3.34
W31F	6.68	5.17	0.475	0.1466	0.02	A	I	5.65
W31G	5.73	3.76	0.356	0.1755	0.03	A	I	4.11
W31H	4.11	2.80	0.163	0.0597	0.01	A	I	2.96
W31J	19.79	5.13	0.225	0.1164	0.01	A	I	5.36
W31K	10.94	7.68	0.659	0.2579	0.02	A	I	8.34
W31L	11.53	3.25	0.145	0.0578	0.01	A	I	3.39
W32A	45.16	9.31	0.103	0.096	0.00	A	I	9.42
W32B	142.13	38.24	0.174	0.2055	0.00	A	I	38.41
W32C	19.48	8.06	0.186	0.1274	0.01	A	I	8.25
W32D	6.04	4.60	0.165	0.1149	0.02	A	I	4.77
W32E	6.79	7.74	0.14	0.0895	0.01	A	I	7.88
W32F	7.51	3.53	0.106	0.0523	0.01	A	I	3.63
W32G	25.78	15.43	0.52	0.2202	0.01	A	I	15.95
W32H	188.09	65.72	0.673	0.6483	0.00	A	I	66.39

W4 Pongola: Groundwater is minimally used and the stress index is below 0.05. Quaternary catchment classification is shown below.

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W41A	3.34	2.63	0.014	0.0183	0.01	A	I	2.64
W41B	5.48	4.42	0.044	0.0433	0.01	A	I	4.46
W41C	3.95	3.16	0.051	0.0261	0.01	A	I	3.21
W41D	5.02	4.03	0.068	0.0332	0.01	A	I	4.10
W41E	4.75	3.06	0.087	0.0664	0.01	A	I	3.15
W41F	5.21	3.51	0.08	0.0552	0.01	A	I	3.59

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W41G	1.58	0.99	0.024	0.0146	0.01	A	I	1.02
W42A	6.65	5.43	0.05	0.0386	0.01	A	I	5.48
W42B	8.50	6.95	0.104	0.0614	0.01	A	I	7.06
W42C	7.34	6.14	0.034	0.0557	0.01	A	I	6.18
W42D	10.27	8.29	0.096	0.0926	0.01	A	I	8.39
W42E	5.04	3.97	0.05	0.0415	0.01	A	I	4.02
W42F	6.94	5.24	0.034	0.1253	0.02	A	I	5.27
W42G	4.00	2.51	0.072	0.0374	0.01	A	I	2.58
W42H	4.67	2.82	0.069	0.0447	0.01	A	I	2.89
W42J	4.94	3.02	0.094	0.0399	0.01	A	I	3.11
W42K	6.33	4.23	0.026	0.2166	0.03	A	I	4.26
W42L	4.43	2.59	0.077	0.0312	0.01	A	I	2.67
W42M	9.31	6.77	0.109	0.0364	0.00	A	I	6.88
W43C	11.86	6.49	0.002	0.0006	0.00	A	I	6.49
W43F	9.24	4.09	0.299	0.08	0.01	A	I	4.39
W44A	3.12	1.34	0.09	0.037	0.01	A	I	1.43
W44B	5.85	2.45	0.122	0.4821	0.08	B	I	2.57
W44C	3.78	1.51	0.024	0.0077	0.00	A	I	1.53
W44D	2.64	0.96	0.076	0.0289	0.01	A	I	1.03
W44E	8.05	3.02	0.137	0.0455	0.01	A	I	3.15
W45A	69.60	7.78	0.506	0.2887	0.00	A	I	8.29
W45B	31.43	3.17	0.12	0.1196	0.00	A	I	3.29

W5 Usuthu: Groundwater is minimally used and the stress index is below 0.13. Quaternary catchment classification is shown below.

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W51A	10.39	8.27	0.04	0.2243	0.02	A	I	8.31
W51B	8.50	6.59	0.046	1.1142	0.13	B	I	6.63
W51C	12.53	9.99	0.076	0.4697	0.04	A	I	10.07
W51D	8.89	7.00	0.059	0.1635	0.02	A	I	7.06
W51E	6.11	4.20	0.002	0.0842	0.01	A	I	4.20
W51F	12.65	10.16	0.034	0.1683	0.01	A	I	10.20
W52A	5.03	3.85	0.027	0.1237	0.02	A	I	3.87
W52B	6.27	4.92	0.038	0.2076	0.03	A	I	4.96
W52C	3.35	2.59	0.02	0.0657	0.02	A	I	2.61
W52D	2.38	1.80	0.008	0.0148	0.01	A	I	1.81
W53A	10.25	7.95	0.044	0.4515	0.04	A	I	7.99
W53B	4.09	3.20	0.015	0.0199	0.00	A	I	3.21
W53C	5.82	4.66	0.035	0.0886	0.02	A	I	4.69
W53D	5.86	4.61	0.033	0.0559	0.01	A	I	4.65
W53E	8.96	7.20	0.02	0.0468	0.01	A	I	7.22
W53F	10.48	7.64	0	0.0002	0.00	A	I	7.64
W54A	3.99	3.33	0.017	0.0648	0.02	A	I	3.34
W54B	4.38	3.74	0.02	0.0261	0.01	A	I	3.76
W54C	1.85	1.58	0.007	0.0097	0.01	A	I	1.58
W54D	2.71	2.38	0.013	0.0544	0.02	A	I	2.39
W54E	3.68	3.28	0.002	0.005	0.00	A	I	3.28
W55A	11.10	9.82	0.052	0.0683	0.01	A	I	9.87
W55B	3.44	3.11	0.015	0.0206	0.01	A	I	3.13
W55C	15.02	13.90	0.053	0.1379	0.01	A	I	13.95
W55D	7.70	7.08	0.019	0.018	0.00	A	I	7.10
W55E	4.50	4.16	0	0.0001	0.00	A	I	4.16
W56A	13.91	12.80	0.026	0.0133	0.00	A	I	12.83
W56B	10.55	9.31	0.005	0.0019	0.00	A	I	9.31
W57J	6.29	2.90	0.042	0.0112	0.00	A	I	2.94
W57K	1.71	0.79	0.065	0.0174	0.01	A	I	0.85

W7 Kosi Estuary and Lake Sibaya: The stress index calculated from the total present use and aquifer recharge is 0.01. Groundwater is minimally used. Quaternary catchment classification is shown below.

Quaternary	Aquifer Recharge (Mm^3/a)	Groundwater baseflow (Mm^3/a)	BHN (Mm^3/a)	Use (Mm^3/a)	Stress Index	PSC	Class	Groundwater Component of Reserve (Mm^3/a)
W70A	340.15	63.61	0.4040	2.3432	0.01	A	I	64.01

Basic Human Needs Reserve

The Basic Human Needs Reserve (BHNR) is a key component of Classification. The National Water Act, 1998 (Act No. 36 of 1998) ensures that everyone has access to sufficient water by setting aside a certain amount of water to meet everyone's basic needs, i.e. the BHNR. The BHNR is based upon the current and projected population of those either living within the catchment and directly dependant on the catchment or, critically, not being supplied with water from a recognised formal source. The report therefore documents the BHN for the population currently and in the reasonably near future, whom would be relying upon taking water from, or being supplied from, water resources for their essential needs of drinking water, food preparation and personal hygiene. The summarised population projections per catchment area up to 2030 are provided in **BHNR 1**.

BHNR 1: Summary of catchment area population and population dependant on BHNR.

Secondary catchment Area	Total population	Population BHNR Dependent (excluding boreholes and formal schemes)		
		2022	2030	2040
W1	842 052	111 687	127 811	153 851
W2	758 735	212 514	243 194	292 742
W3	612 763	202 600	231 850	279 086
W4	438 168	116 746	133 601	160 821
W5	425 388	38 000	43 486	52 346
W7	107 693	18 427	21 087	25 384
Total	**3 184 799**	**699 974**	**801031**	**964 229**

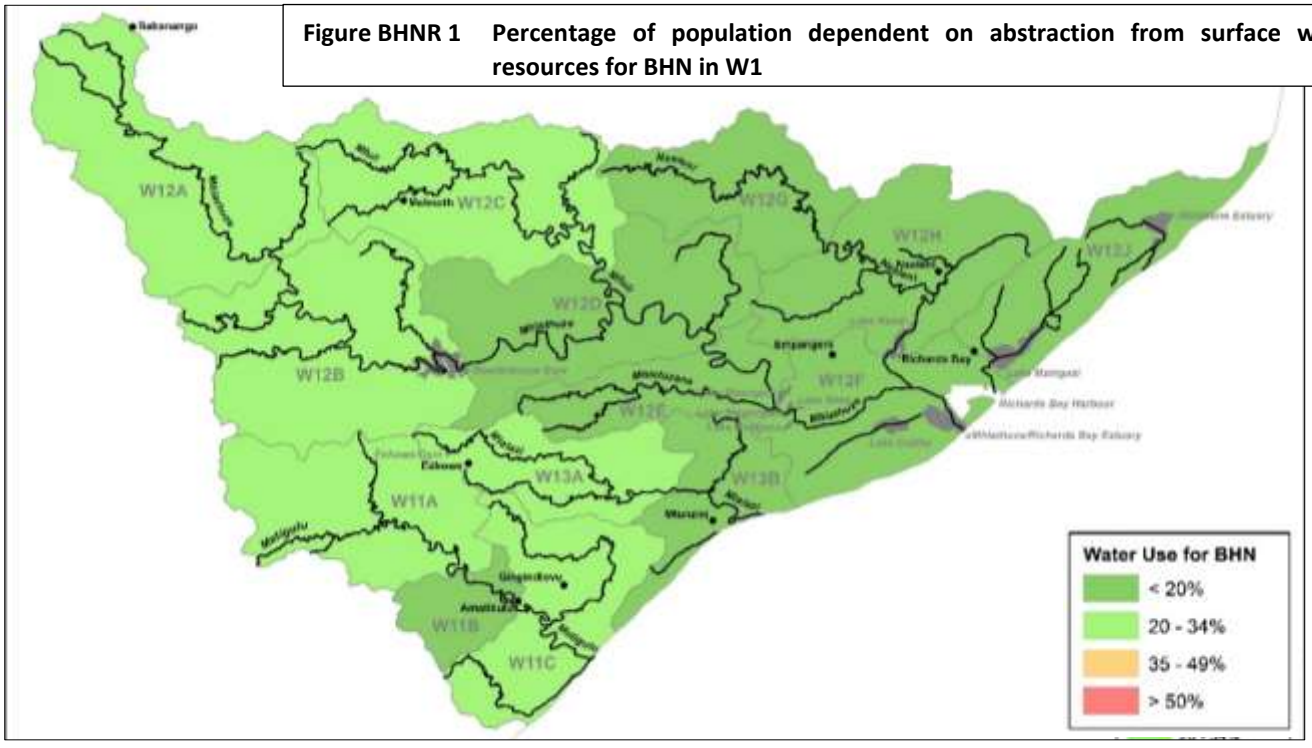
To calculate the quantum of water for the BHNR, the daily normative allowance of 25 litres per person per day was used for eligible individuals in the population, according to guidelines set out in DWAF (1999; 2007 and 2008a;b). **BHNR 2** sets out the figure expressed in million cubic metres of water per annum for the current date (2022) as well as for 2025 and 2030. Projecting beyond 2030 was not done as the number is dependent on trajectories of service delivery which cannot be predicted with certainty.

BHNR 2: Basic Human Needs (BHN) per catchment area expressed in million m^3 per annum.

Secondary catchment Area	Population BHNR Dependent 2022 (excl. boreholes and formal schemes)	BHN as Million m^3 per annum @ 25 L/day		
		2022	2025	2030
W1	111 687	1.019	1.090	1.186
W2	212 514	1.939	2.074	2.257
W3	202 600	1.849	1.978	2.152
W4	116 746	1.065	1.140	1.240
W5	38 000	0.347	0.371	0.404
W7	18 427	0.168	0.180	0.196
Total	**699 974**	**6.387**	**6.833**	**7.434**

Maps for the catchment areas showing percentage of population dependent on abstraction of surface water are presented below.

Figure BHNR 1 Percentage of population dependent on abstraction from surface water resources for BHN in W1



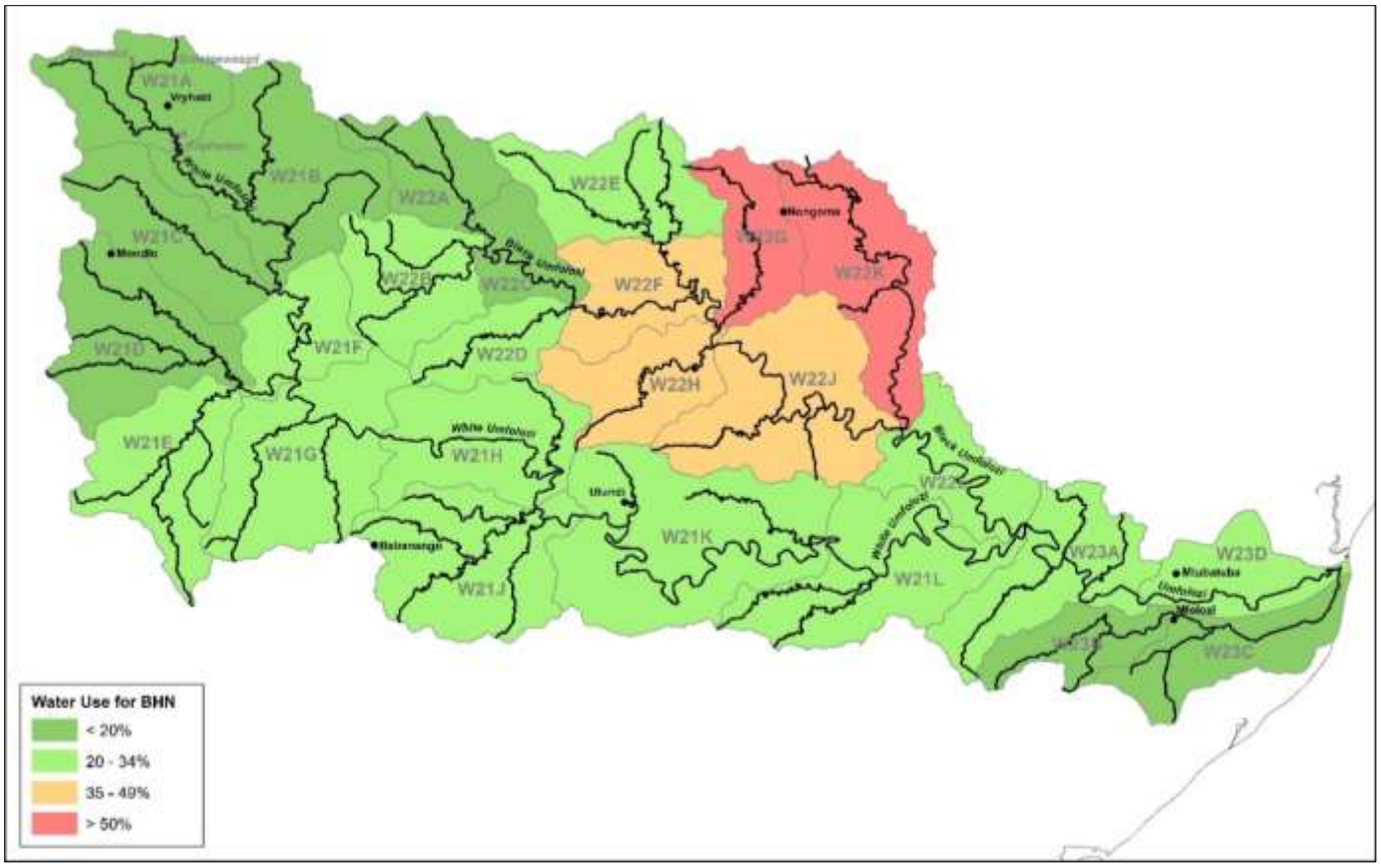


Figure BHNR 2 Percentage of population dependent on abstraction from surface water resources for BHN in W2

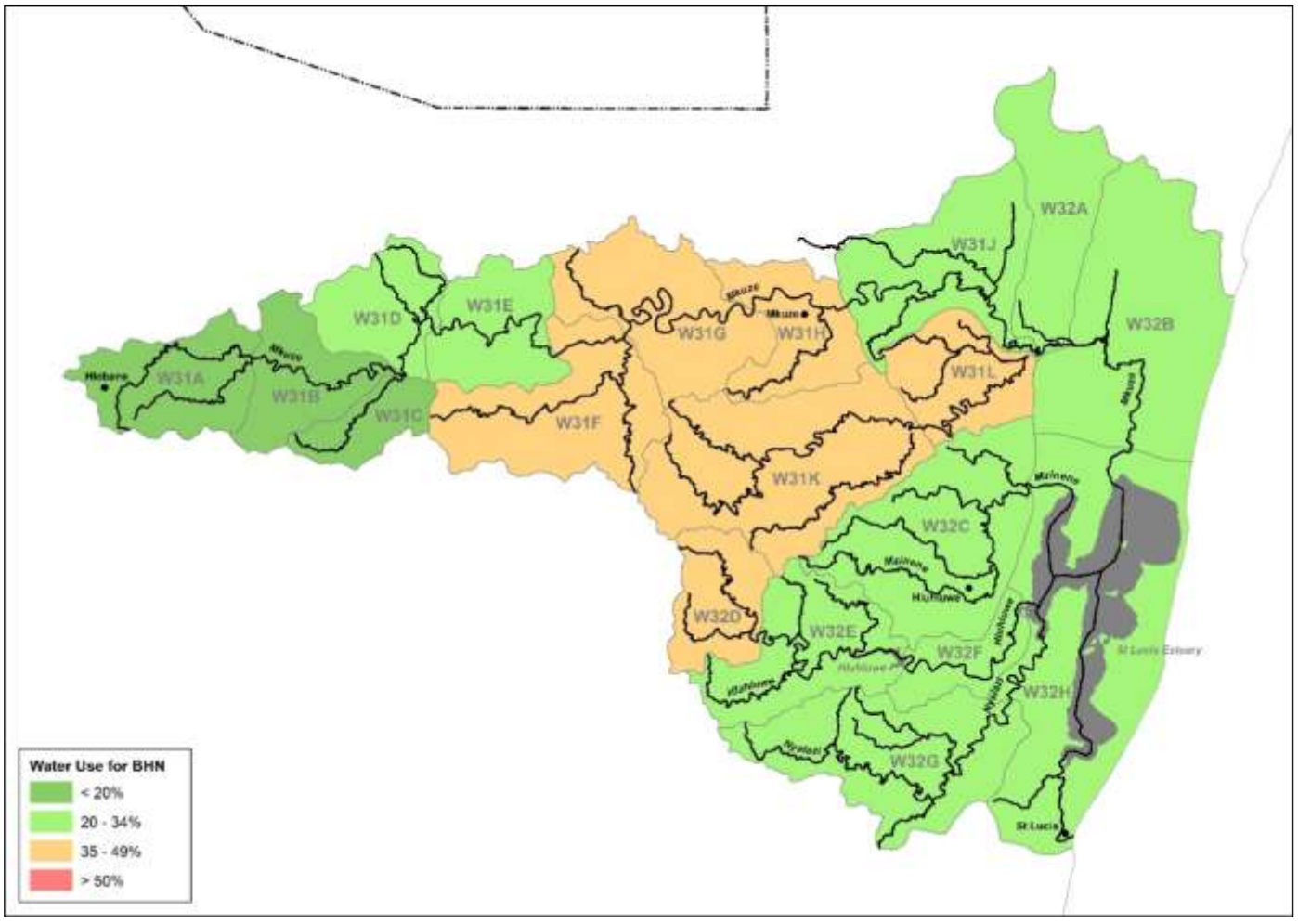


Figure BHNR 3 Percentage of population dependent on abstraction from surface water resources for BHN in W3

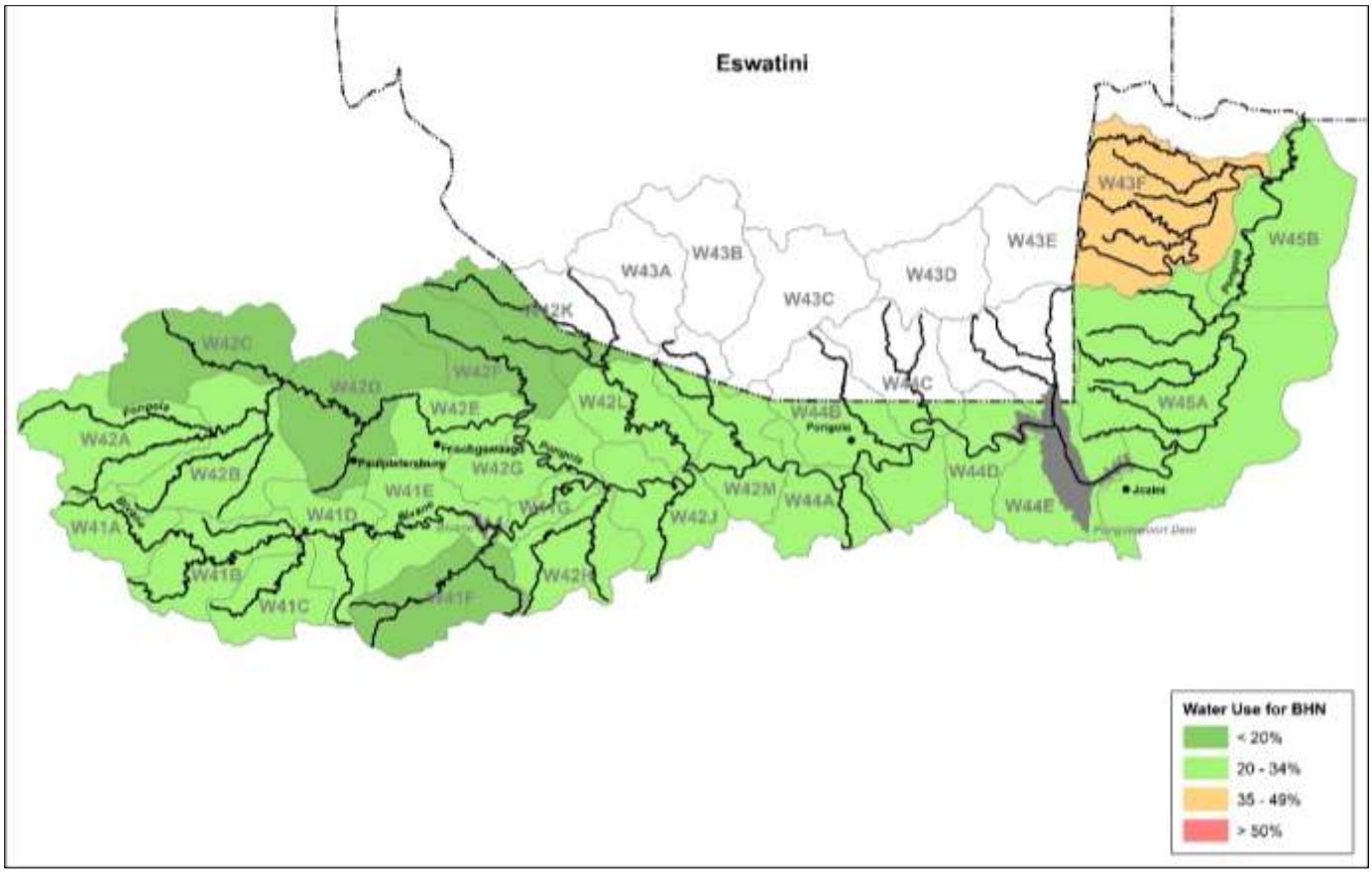


Figure BHNR 4 Percentage of population dependent on abstraction from surface water resources for BHN in W4

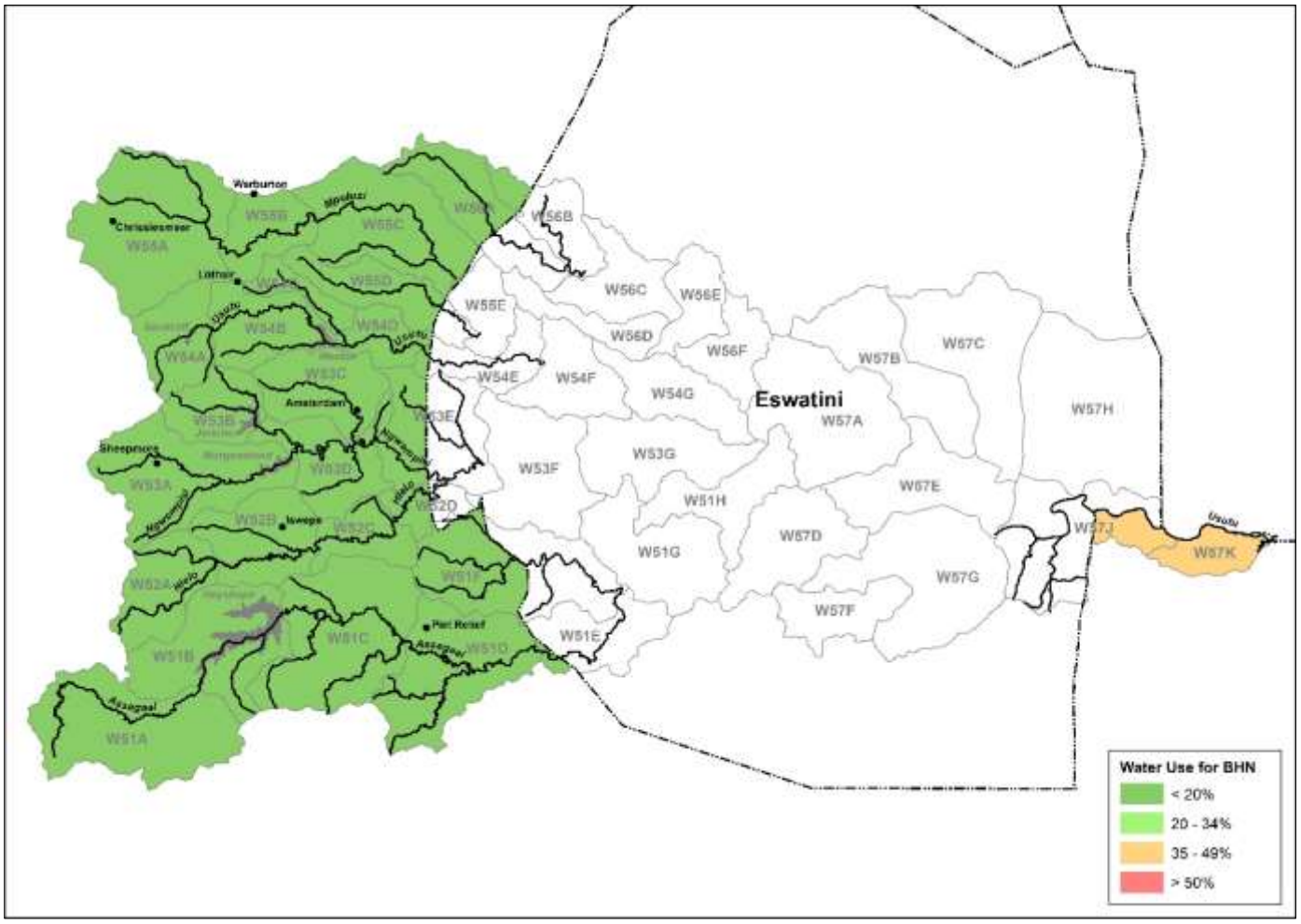


Figure BHNR 4 Percentage of population dependent on abstraction from surface water resources for BHN in W5

Estuary status and field observations

Nine estuaries occur in the study area, with the Mhlathuze estuarine lake system subdivided to create an estuarine bay (Richards Bay) and a Predominantly open system (Mhlathuze Sanctuary) to accommodate a port development in the 1970s. Most of the estuaries in the study area are in a degraded state (D to E Category), due to, high to very high pollution, habitat loss and fishing pressure. Previously most of the estuaries were not considered to be under high flow modification pressure except for iSiyaya and Richards Bay. Only four estuaries are estimated to remain in a near-natural state (A to B Category), namely aMatigulu/iNyoni, uMlalazi, uMgobezeleni and Kosi.

However, a recent field visit (October 2022) to six of the estuaries in the study area highlighted further decline in conditions in four systems:

- aMatigulu/iNyoni – land-use change (housing), possible increase in water quality pressures (including large-scale use of Dokodweni beach node in lower reaches) , illegal gill netting
- iSiyaya – flow and water quality (sediment pollution) pressures and illegal gillnetting
- iNhlabane – flow pressure (no freshwater inflow due to Nhlabane barrage/dam), illegal gillnetting
- Kosi – land-use change, increase in mangrove harvesting, and escalation in exploitation of living resources (increase in fish traps and illegal gill netting), possible increase in water quality pressures.

Estuaries: A summary of estuary importance (biodiversity, biodiversity protection, fish nursery, carbon sequestration), estimated condition (2018) and recent field observations are shown below.

Secondary Catchment	Estuary	Estuary Importance				PES (NBA 2018)	Field observations (October 2022)
		Biodiversity Importance Rating	NBA Biodiversity priority for protection	DFFE Important Fish Nurseries	Carbon sequestra -tion		
W11	aMatigulu/ iNyoni	Important	SA	High	Medium	*B*	Field visit (replaced uMhlathuze site visit). System was closed with overwash from the sea at low water levels. Estuary in a relative good condition, but possible decline in condition. Housing developments expanding in lower reaches (iNgonyama Trust land), evidence of increased nutrification (lower 3/4 km of sediment surface covered with filamentous algae (veg team to identify species). Observed significant areas of submerged macrophyte & filamentous algaes. Pending water quality result, but blooms can be developing when water level is low after a mouth breaching event. Previous studies recorded a total of 54 species in the estuary as opposed to 15 in our 1-day visit. Benthic inverts very high numbers of *Terebia granifera*. High numbers of Palearctic waders, including Bar-tailed Godwit. Large numbers of White-fronted Plovers and Sanderlings reflecting sandy nature of substrate. Large numbers of waterfowl (ducks and geese) in upper reaches, reflecting large expanses of submergent vegetation highly favoured as a food source.
W13	iSiyaya	Low to Average Importance	SA	Low	Medium	*E*	Field visit. Mouth Closed. Declining further in condition. Very little flow reaching the estuary. Only small stagnant pools observed in mouth area. Very high turbidity observed in middle and upper reaches linked to possible upstream slimes dam input and contamination. To be confirmed with satellite imagery. This said, a total of 18 species of fish were sampled in the lower reaches which compares well with the 13 recorded in previous studies. The relatively low species count in the 2022 and previous studies is typical of a predominantly closed estuary. Very few waterbirds present. The high turbidity due to mine siltation highly negative for visual piscivorous waterbird species and also likely highly negative for invertebrate feeders if substrate is smothered by this silt.

Secondary Catchment	Estuary	Estuary Importance				PES (NBA 2018)	Field observations (October 2022)
		Biodiversity Importance Rating	NBA Biodiversity priority for protection	DFFE Important Fish Nurseries	Carbon sequestra -tion		
W13	uMlalazi	High Importance	SA	High	High	*B*	Field visit (replace uMhlathuze site visit). Mouth open. In a good condition, but some concern over water quality. Several oxygen deprived zones noted (particularly in mid-lower reaches) in the bottom water column layer (<3% saturation). Upper reaches show increasing livestock influences (cattle/goats) and possible informal sand mining. Healthy mangroves and salt marsh habitat. Some macroalgal growth in the middle reaches. Very high species diversity, with for example 46 fish species recorded. Very important nursery area in the region. High numbers of Palearctic waders, especially Common Sandpiper – reflecting the muddy substrate.
W12	uMhlathuze	High Importance	SA	High	High	*D*	No update. Transnet industrial action and civil unrest prevented access to uMhlathuze Sanctuary. Will use available information from Department of Fisheries, Forestry and Environment (DFFE) uMhlathuze/Richards Bay Estuarine Management Plan.
W12	Richards Bay	Important	SA	High	High	*D/E*	No new worked planned. Use information from uMhlathuze/Richards Bay Estuarine Management Plan.
W12	iNhlabane	Important	KZN	Medium	High	*E*	Field visit. Mouth Closed. Significant further decline in condition. Very high unnatural sand dune has formed in mouth indicating years of flow depravation. No connection to the sea. Mouth has not been open in years. EWR cannot have been released in years. System was completely fresh as indicated by leeches, water lilies and tadpoles. Extensive loss of open water area due to macrophyte growth. Water body infested with bilharzia snail vectors. No flow over the weir. Fishway non-functional. No estuarine functionality remains in what was once an important estuarine lake in the region due to freshwater flow depravation. Only three species of fish were sampled, all freshwater taxa tolerant of poor water quality. Extensive infestation by alien invasive *Terebia granifera* snails. Other macroinvertebrates sampled seemed only to be various dragonfly larvae supporting no current estuarine function. System is now used for livestock watering (evidence around lower estuary margins), further degrading water quality and nutrients allowing proliferation of macrophytes which have closed off the middle reaches (see satellite imagery).
W2	iMfolozi/ uMsunduze	High Importance	SA	High	High	*D*	No new worked planned. Informed by Lake St Lucia Volumes 1 & 2 Intermediate Ecoclassification and EWR Assessment Report (DWS 2016)
W3	St Lucia	High Importance	SA	High	High	*D/E*	No new worked planned. Informed by Lake St Lucia Volume 1 &2 Intermediate Ecoclassification and EWR Assessment Report (DWS 2016)

Secondary Catchment	Estuary	Estuary Importance				PES (NBA 2018)	Field observations (October 2022)
		Biodiversity Importance Rating	NBA Biodiversity priority for protection	DFFE Important Fish Nurseries	Carbon sequestra-tion		
W7	uMgobezeleni	**Low to Average Importance**	**SA**	**Low**	**Medium**	***B***	Field visit. Mouth open. Limited salinity penetration in lower reaches. System in good condition. Fully functional estuarine lake system. More important than previously indicated. New recruits of fish recorded in uMgobezeleni Lake (< 2 weeks old freshwater mullet that recruited from the sea). New individuals of black mangrove observed. However, urgent action needed to protect mangroves (e.g., road through mangroves) and fish (illegal gillnets in lake). A total of 18 fish species were sampled which compares well with 14 recorded across all previous studies. Of interest, is the existence of spotted bass *Micropterus punctulatus*, probably descendants of bass introduced in the 1950s to 1970's.
W7	Kosi	**High Importance**	**SA**	**High**	**High**	***A/B***	Field visit. Mouth open. Lake water levels higher than in 2016. System shows signs of drought recovery. Despite being a very Important Estuarine Lake in a formally protected area there are significant signs of further decline in condition – system now likely to be B Category. Significant increase in clearing of natural vegetation (land use change), increase harvesting pressure on mangroves, more fish traps (first time fish traps observed in 3de Lake), and gill nets observed for the first time in 4th Lake. Significant submerged macrophyte and macroalgal growth observed in 3rd lake. Local fisherman indicated that this has not happened before in living history, e.g., macroalgal growth in fish traps. Indicating nutrient enrichment but will need to confirm source. In all, 25 species of fish were caught and at least another 10 seen whilst sampling using mask and snorkel.

THE WAY FORWARD

This BID provides a summary of the results of Task 3 of this study. The following reports have been delivered for the study and can be accessed on the DWS website: https://www.dws.gov.za/rdm/WRCS/default.aspx.

WEM/WMA3/4/00/CON/CLA/0422	Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Hydrology Systems Analysis Report**
WEM/WMA3/4/00/CON/CLA/0522	Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River EWR estimates for Desktop Biophysical Nodes Report**
WEM/WMA3/4/00/CON/CLA/0622	Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River Survey Report**
WEM/WMA3/4/00/CON/CLA/0722	Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Basic Human Needs Report**
WEM/WMA3/4/00/CON/CLA/0822	Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Groundwater Report**
WEM/WMA3/4/00/CON/CLA/0922	Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River specialist meeting Report**

The next step in the study, Task 4, consists of the identification and description of operational scenarios for the study area within the context of Integrated Water Resources Management (IWRM). The objective of this step is to model selected operational scenarios and to provide outputs in the formats required to evaluate the consequences of implementing the scenarios.

Abbreviations and Glossary

BHN	Basic Human Needs
BHNR	Basic Human Needs Reserve
BID	Background Information Document
DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department of Water and Sanitation
EC	Ecological Category
EGSA	Ecological Goods, Services and Attributes
EIS	Ecological Importance and Sensitivity
ES	Ecosystem service
EWR	Ecological Water Requirements
IEI	Integrated Ecological Importance
IUA	Integrated Unit of Analysis
IWRM	Integrated Water Resource Management
MAR	Mean Annual Runoff
MC	Management Class
NBA	National Biodiversity Assessment
NWA	National Water Act
PES	Present Ecological State
PMC	Project Management Committee
PSC	Project Steering Committee
RDM	Resource Directed Measures
REC	Recommended Ecological Category
RQOs	Resource Quality Objectives
RU	Resource Unit
SQ	Sub Quaternary
WMA	Water Management Area
WRCS	Water Resource Classification System
WQ	Water Quality
Some terminology explained:	
BHNR	Water needs to be set aside for basic human needs such as drinking, food preparation, and health and hygiene purposes.
Biophysical nodes	A point in the river which can be a survey site or a hypothetical point (“site”). Survey sites are EWR sites or Key Biophysical Nodes. Hypothetical points are Desktop Biophysical Nodes.
Sub-quaternary (SQ)	A finer subdivision of the quaternary catchments (the catchment areas of tributaries of main stem rivers in quaternary catchments), to a sub-quaternary reach or quinary level.