water and sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

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

## RIVER SURVEY REPORT

July 2022

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Department of Water Affairs and Sanitation
**Chief Directorate: Water Ecosystem Management**

PROJECT NUMBER**:** WP 11387

# RIVER SURVEY AND SITE VISIT REPORT

# CLASSIFICATION OF SIGNIFICANT WATER RESOURCES AND DETERMINATION OF RESOURCE QUALITY OBJECTIVES FOR WATER RESOURCES IN THE USUTU TO MHLATHUZE CATCHMENTS

**July 2022**



**REFERENCE**
***This report is to be referred to in bibliographies as:***
Department of Water and Sanitation, South Africa, July 2022. Classification of Significant Water Resources and Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: River survey and Site Visit report. Prepared by: WRP Consulting Engineers (Pty) Ltd. DWS Report: WEM/WMA3/4/00/CON/CLA/0622.

# REPORT SCHEDULE

| Index Number | DWS Report Number | Report Title |
|---|---|---|
| 1 | WEM/WMA3/4/00/CON/CLA/0122 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Inception Report including Gap Analysis chapter** |
| 2 | WEM/WMA3/4/00/CON/CLA/0222 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Status Quo and Delineation of Resource Units and Integrated Units of Analysis Report** |
| 3 | WEM/WMA3/4/00/CON/CLA/0322 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Units Delineation and Prioritisation Report** |
| 4 | WEM/WMA3/4/00/CON/CLA/0422 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Hydrology Systems Analysis Report** |
| 5 | WEM/WMA3/4/00/CON/CLA/0522 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River EWR for Desktop Biophysical Nodes Report** |
| 6 | WEM/WMA3/4/00/CON/CLA/0622 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River Survey and Site Visit Report** |
| 7 | WEM/WMA3/4/00/CON/CLA/0722 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Basic Human Needs Report** |
| 8 | WEM/WMA3/4/00/CON/CLA/0822 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Groundwater Report** |
| 9 | WEM/WMA3/4/00/CON/CLA/0922 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **River specialist meeting Report** |
| 10 | WEM/WMA3/4/00/CON/CLA/1022 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Estuary Survey Report** |
| 11 | WEM/WMA3/4/00/CON/CLA/1122 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Wetland Report** |
| 12 | WEM/WMA3/4/00/CON/CLA/1222 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecological Water Requirements Report** |
| 13 | WEM/WMA3/4/00/CON/CLA/1322 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Scenario Description Report** |

| Index Number | DWS Report Number | Report Title |
|---|---|---|
| 14 | WEM/WMA3/4/00/CON/CLA/0123, volume 1 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecological Consequences Report, Volume 1: Rivers** |
| | WEM/WMA3/4/00/CON/CLA/0123, volume 2 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecological Consequences Report, Volume 2: Estuaries** |
| 15 | WEM/WMA3/4/00/CON/CLA/0323 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Ecosystem Services Consequences Report** |
| 16 | WEM/WMA3/4/00/CON/CLA/0423 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Economic & User water quality Consequences Report** |
| 17 | WEM/WMA3/4/00/CON/CLA/0523 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Water Resource Classes Report** |
| 18 | WEM/WMA3/4/00/CON/CLA/0623, volume 1 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Quality Objectives Report, Volume 1: Rivers** |
| | WEM/WMA3/4/00/CON/CLA/0623, volume 2 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Quality Objectives Report, Volume 2: Estuaries** |
| | WEM/WMA3/4/00/CON/CLA/0623, volume 3 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Resource Quality Objectives Report, Volume 3: Wetlands and Groundwater** |
| 19 | WEM/WMA3/4/00/CON/CLA/0723 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Monitoring and Implementation Report** |
| 20 | WEM/WMA3/4/00/CON/CLA/0124 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Main Report** |
| 21 | WEM/WMA3/4/00/CON/CLA/0224 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Issues and Responses Report** |
| 22 | WEM/WMA3/4/00/CON/CLA/0324 | Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments: **Close out Report** |

**Shaded Grey** indicates this report.

# APPROVAL

| | |
|---|---|
| *Project Name:* | *Classification of Significant Water Resources and Determination of Resource Quality Objectives for Water Resources in the Usutu to Mhlathuze Catchments* |
| *Report Title:* | ***River Survey and Site Visit Report*** |
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***Approved for the PSP by:***

.....

***CJ Seago***
*Study Leader*

***Approved for the Department of Water and Sanitation by:***

p.p. ..... 2/8/2022

***Mr Mkhevu Mnisi***
*Project Manager*

..... 2/8/2022

***Ms Lebogang Matlala***
*Director: Water Resource Classification of*
*CD: Water Ecosystem Management*

# SITE VISIT TEAM

The following persons participated in the site visit:

| Attendee | Company | Role during site visit |
|---|---|---|
| Louw, Delana | Rivers for Africa | Team leader, Index of Habitat Integrity specialist |
| Deacon, Andrew | Cleanstream | Instream EWR specialist |
| Birkhead, Drew | Streamflow Solutions | EcoHydraulics |
| Kotze, Piet | Cleanstream | Instream EWR specialist |
| Rowntree, Kate | | Fluvial geomorphology |
| **Capacity building participants** | | |
| Ms Lwandle Sibango | DWS: KwaZulu-Natal (KZN) regional office; Water Quality Management | |
| Ms Ziyanda Malibiji | DWS: KwaZulu-Natal (KZN) regional office; Water Quality Management | |
| Mr Michael Singh | DWS: KZN regional office; Director: Water Resources Support | |
| Ms Renelle Pillay | DWS: KwaZulu-Natal (KZN) regional office; Water Quality Management | |
| Ms Manisha Maharaj | DWS: KZN regional office: Water Resources Support | |
| Ms Koleka Makanda | DWS: Pretoria (head office); Water Resource Classification | |
| Mr Philani Khoza | DWS: Pretoria (head office); Reserve Determination: Groundwater Reserve Determination | |
| Mr Molefi Mazibuko | DWS: Pretoria (head office); Reserve Determination: Surface Water Reserve Determination | |

# TABLE OF CONTENTS

# LIST OF TABLES



# LIST OF FIGURES

# TERMINOLOGY AND ACRONYMS

| | |
|---|---|
| CD: WEM | Chief Directorate: Water Ecosystems Management |
| DWS | Department of Water and Sanitation |
| EWR | Ecological Water Requirement |
| IHI | Index of Habitat Integrity |
| IUA | Integrated Unit of Analysis |
| NWA | National Water Act |
| RQO | Resource Quality Objectives |
| RU | Resource Unit |
| SQ | Sub-quaternary |
| SQR | Sub-quaternary reach |
| WRCS | Water Resource Classification System |

# SELECTED SPELLING FOR THIS STUDY

There are multiple variations for the spelling of names for the Rivers, Lakes, Dams and Estuaries in the catchment/study area. For the purpose of this study the following table presents the commonly accepted variations of spelling for the place names of concern, which are discussed in the reports. The names were derived from information from different sources in the region.

| Selected Spelling for this Study | Alternate spellings |
|---|---|
| Usutu River | Usuthu River |
| Mhlathuze River | Mhlatuze, uMhlatuze River |
| Pongola (river, Town & Pongolapoort Dam) | Phongola, Phongolo |
| Lake Sibaya | Lake Sibiya, Lake Sibhayi, Lake Sibhaya |
| Eswatini | eSwatini |
| Umfolozi River | Mfolozi River |
| Amatigulu River | Amatikulu, Matigulu River |
| Goedertrouw Dam | Lake Phobane |
| Mfuli River | Mefule River |
| aMatigulu/iNyoni Estuary | |
| Sibiya Estuary | |
| Mlalazi Estuary | |
| uMhlathuze /Richards Bay Estuary | |
| iNhlabane Estuary | |
| uMfolozi/uMsunduze Estuary | |
| St Lucia Estuary | |
| uMgobezeleni Estuary | |
| Kosi Estuary | |
| Hluhluwe Game Reserve | |
| iMfolozi Game Reserve | |
| Ithala Game Reserve | |
| Ndumo Game Reserve | |
| Tembe Elephant Reserve | |
| iSimangaliso Wetland Park | |
| Kosi Bay and Coastal Forest Area | |
| uMkhuze Game Reserve | |

**Note:**
The spelling of the Rivers, Lakes, Dams and Estuaries provided in the DWS PESEIS (https://www.dws.gov.za/iwqs/rhp/eco/PESEIS_secondary.aspx) database will not be changed based on the above when used in presentation of database tables and results from the database.

# GLOSSARY

| | |
|---|---|
| *Ecological Water Requirements (EWR)* | The flow patterns (magnitude, timing and duration) and water quality needed to maintain a riverine ecosystem in a particular condition. This term is used to refer to both the quantity and quality components. |
| *Integrated Unit of Analysis (IUAs)* | An IUA is a homogeneous area that can be managed as an entity. It is the basic unit of assessment for the Classification of water resources, and is defined by areas that can be managed together in terms of water resource operations, quality, socio-economics and ecosystem services. |
| *Resource Quality Objectives (RQOs)* | RQOs are numeric or descriptive goals or objectives that can be monitored for compliance to the Water Resource Classification, for each part of each water resource. “The purpose of setting RQOs is to establish clear goals relating to the quality of the relevant water resources” (NWA, 1998). |
| *Scenario* | Scenarios, in the context of water resource management and planning, are plausible definitions (settings) of factors (variables) that influence the water balance and water quality in a catchment and the system as a whole. Each scenario represents an alternative future condition, generally reflecting a change to the present condition. |
| *Sub-quaternary reaches (SQR)* | 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. |
| *Target Ecological Category (TEC)* | This is the ecological category toward which a water resource will be managed once the Classification process has been completed and the Reserve has been finalised. The draft TECs are therefore related to the draft Classes and selected scenario. |
| *Water Resource Class* | The Water Resource Class (hereafter referred to as Class) is representative of those attributes that the DWS (as the custodian) and society require of different water resources. The decision-making toward a Class requires a wide range of trade-offs to be assessed and evaluated at a number of scales. Final outcome of the process is a set of desired characteristics for use and ecological condition of the water resources in a given catchment. The WRCS defines three management classes, Class I, II, and III, based on extent of use and alteration of ecological condition from the predevelopment condition. |

# 1 INTRODUCTION

## 1.1 BACKGROUND

Chapter 3 of the National Water Act, 1998 (NWA) (Act 36 of 1998), deals with the protection of water resources. Section 12 of the NWA requires the Minister to develop a system to classify water resources. In response to this, the Water Resource Classification System (WRCS) was gazetted on 17 September 2010 and published in Government Gazette 33541 as Regulation 810. The WRCS is a stepwise process whereby water resources are categorised according to specific classes that represent a management vision of a particular catchment. This vision takes into account the current state of the water resource, the ecological, social and economic aspects that are dependent on the resource. Once significant water resources have been classified through the WRCS, Resource Quality Objectives (RQOs) must be determined to give effect to the class. The implementation of the WRCS therefore assesses the costs and benefits associated with utilisation versus protection of a water resource. Section 13 of the NWA requires that Water Resource Classes and RQOs be determined for all significant water resources.

Thus, the Chief Directorate: Water Ecosystems Management (CD: WEM) of the Department of Water and Sanitation (DWS) initiated a study for determining the Water Resource Classes and RQOs for all significant water resources in the Usutu to Mhlathuze Catchment. 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 as well as other conservation areas that need protection. There are five RAMSAR[1] sites within the catchment, which includes the world heritage site, St Lucia. The others are Sibaya, Kosi Bay, Ndumo Game Reserve and Turtle Beaches.

## 1.2 STUDY AREA

The study area is the Usutu to Mhlathuze Catchment that has been divided into six drainage areas and secondary catchment areas as follows (refer to the locality map provided as **Figure 1.1**):

- W1 catchment (main river: Mhlathuze).
- W2 catchment (main river: Umfolozi).
- W3 catchment (main river: Mkuze).
- W4 catchment (main river: Pongola) - part of this catchment area falls within Eswatini.
- W5 catchment (main river: Usutu) - much of this catchment falls within Eswatini.
- W7 catchment (Kosi Bay estuary and Lake Sibaya).

Note that all assessments within Eswatini are excluded apart from the hydrological modelling required to assess any downstream rivers in South Africa that either run through Eswatini or originate (source) in Eswatini.

[1] A Ramsar site is a wetland site designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an intergovernmental environmental treaty established in 1971 by UNESCO in the Iranian city of Ramsar, which came into force in 1975.

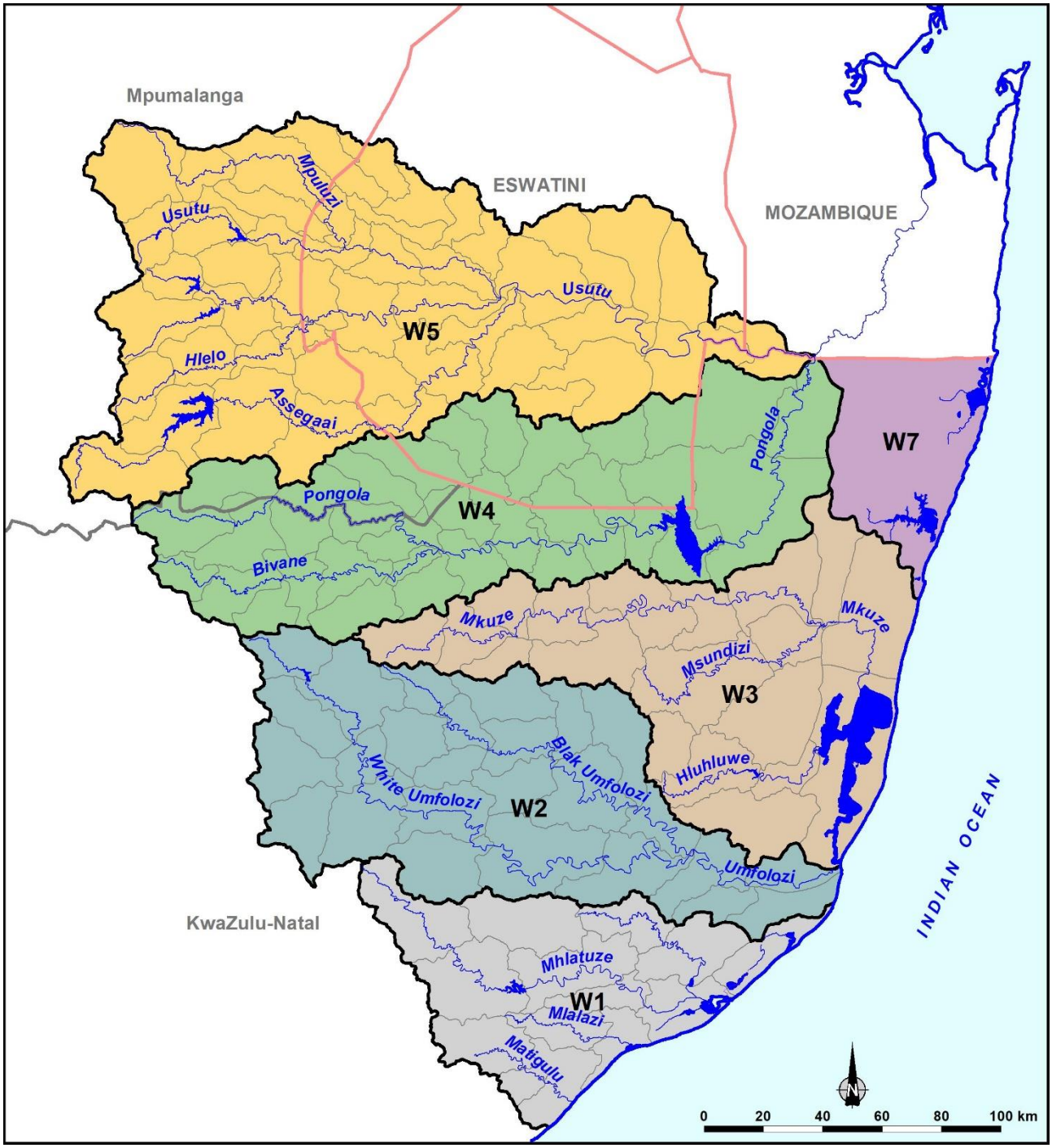



**Figure 1.1 Locality Map of the Study Area**

## 1.3 PURPOSE OF THIS REPORT

The purpose of this report is purely to document the activities during the River EWR site visit 18 – 22 July 2022 for invoicing purposes. **Figure 1.3** provides the project plan for this study and illustrates where Task 3 fits within the project plan. The analysis of information collated and the EWR assessment will be documented in a report following a specialist meeting during September 2022.

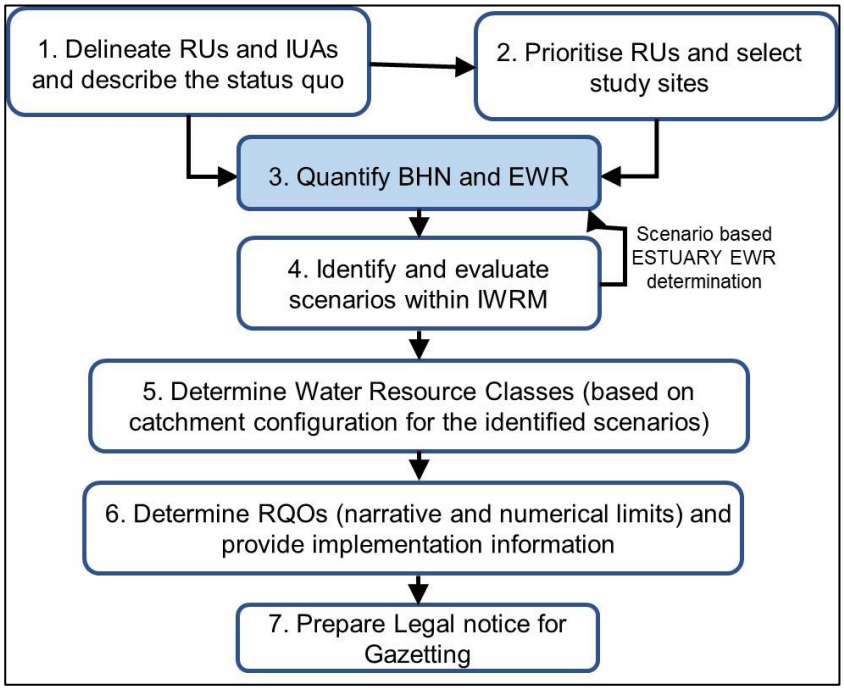



**Figure 1.2 Project Plan for the Usutu-Mhlathuze Classification study**

# 2 EWR SITES AND BACKGROUND

## 2.1 BACKGROUND

A Reserve study was undertaken during 2013 - 2016 (WP 10544), “Reserve determination studies for selected surface water, groundwater, estuaries and wetlands in the Usutu/Mhlathuze Water Management Area”. A key objective of this study was to determine the Reserve in preparation for a Classification and RQO study.

Based on a rapid overview of the available reports it was established that the EcoClassification Report (DWS, 2014) does not include any chapter on methods followed, and the required suite of EcoStatus models are not referred to or referenced. However, EcoStatus models were populated and draft populated models have been obtained and will be reviewed and run again with additional data available if necessary. One of the key objectives of this site visit is therefore for the specialists in this study to familiarise themselves with the sites and where possible, obtain additional field information.

The inception report indicated the following:
*A detailed study was undertaken at eight EWR sites during early 2015. It is assumed that the raw data will be available, and that the same sites can be used for this study.* ***A reconnaissance site visit will be undertaken by key specialists to familiarise themselves with the sites.*** *No biophysical surveys will be undertaken at the sites. If possible, an additional hydraulic calibration will be undertaken to improve the confidence in the hydraulic modelling. This will only be possible if the locality of fixed benchmarks can be supplied as well as photo-point monitoring. If only temporary benchmarks have been installed, this will not be possible. The EWRs will be based on all the survey results and biophysical information generated during previous site visits and assessments. No additional sites will be selected.*

Any additional data collated will therefore be over and above the agreed scope for the study.

## 2.2 EWR SITES

The Ecological Water Requirement (EWR) sites are in **Table 2.1** in the order that it was visited. Note that during the 2014 Reserve study, there were an alternative site selected in the Black Mfolozi (EWR MB2). EWR BM1 was selected as marginally better than EWR BM2 for this study. EWR NG1 is a new site that was selected due to the paucity of sites in secondary catchment W5. All EWR sites (except for EWR NG1) are included in the map (Figure 2.1)

**Table 2.1 EWR sites**

| EWR SITE | RIVER | COORDINATES |
|---|---|---|
| EWR MA1 | Matigulu | S29.02010 E31.47040 |
| EWR NS1 | Nseleni | S28.63410 E31.92517 |
| EWR WM1 | White Mfolozi | S28.23146 E31.18666 |
| EWR BM1 | Black Mfolozi | S27.93890 E31.21030 |
| EWR MK1 | Mkuze | S27.59210 E32.21800 |
| EWR UP1 | Upper Pongola | S27.36413 E30.96962 |
| EWR AS1 | Assegaai | S27.06230 E30.98880 |
| EWR NG1 | Ngwempisi | S26.679448 30.70213 |

Limited fish sampling was performed at selected EWR sites during the field trip. The sites where fish sampling could not be performed (due to time constraints) the fish habitats were assessed. Fish results in this document are preliminary and based on visual observations and fish sampling at selected EWR sites. Some species identification will be further verified and updated in the EWR report.


**Figure 2.1 Desktop biophysical nodes and EWR sites**

## 2.3 EWR SITE VISIT PROGRAMME

The EWR site visit programme was as follows:

| Date | Day | Time | Activity | Kms |
|---|---|---|---|---|
| 18 Jul | Day 1 | 11:40 | Meet at EWR MA1 | 103 km from Durban Airport |
| | | 13:00 | Depart EWR MA 1 to EWR NS1 | 86 km |
| | | 14:30 | EWR NS1 | |
| | | 16:00 | Depart EWR NS1 to accommodation | 102 km |
| | | 17:00 | Arrive Hluhluwe Country Cottages | |
| | | | | |
| 19 Jul | Day 2 | 09:30 | Meet at EWR WM1 | 192 km from Hluhluwe Country Cottages |
| | | 11:30 | Depart to EWR BM? | 76 km |
| | | 13:00 | Arrive EWR BM? | |
| | | 15:30 | Depart to Hluhluwe Country Cottages | 152 km |
| | | 17:30 | Arrive Hluhluwe Country Cottages | |
| | | | | |
| 20 Jul | Day 3 | 08:00 | Depart to EWR MK 1 | 70 km |
| | | 10:00 | Arrive EWR MK1 | |
| | | 14:00 | Depart to Piet Retief | 214 km |
| | | 17:00 | Arrive Piet Retief (Welgerust B&B) | |
| | | | | |
| 21 Jul | Day 4 | 08:00 | Depart to EWR UP1 | 73 km |
| | | 09:30 | Arrive EWR UP 1 | |
| | | 12:30 | Depart EWR UP 1 | 92 km |
| | | 14:00 | Arrive EWR AS 1 | |
| | | 16:30 | Depart EWR AS 1 | 25 km |
| | | 17:00 | Arrive Piet Retief (Welgerust B&B) | |
| | | | | |
| 22 Jul | Day 5 | 08:00 | Depart to select new site in W5 | |
| | | 10:00 | Arrive at potential new site | |
| | | 12:00 | Depart to home (Jhb and Malelane) | |

# 3 EWR MA 1 (MATIGULU RIVER)

## 3.1 SITE DESCRIPTION AND LOCALITY

EWR MA 1 is situated in the Matigulu River (S29.0201 E31.4704) in RU W11-2 and IUA W11 (Matigulu). The Matigulu River at this site is a bedrock river with a pool-rapid morphology. The channel bed in the rapid is dominated by bedrock and boulder, sand bars have formed in shallow pools. Flood benches are dominated by large boulder and bedrock.

Photographs of the EWR site are illustrated in Figure 3.1.

**Figure 3.1 EWR MA1: Upstream and across**

## 3.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  Sampled primary habitats present to confirm resident communities.

- Fish

  A fish survey using electrofishing was undertaken and the following species were collected.

| ***SCIENTIFIC NAME*** | **ENGLISH COMMON NAME** | **EWR MA1 Matikulu** |
|---|---|---|
| *Awaous aeneofuscus* | Freshwater Goby | 4 |
| *Labeobarbus natalensis* | Scaly | 8 |
| *Monodactylus falciformis* | Cape Moony | 12 |

- Fluvial geomorphology

  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record

  Photographs of the habitat conditions at the cross-section were taken.

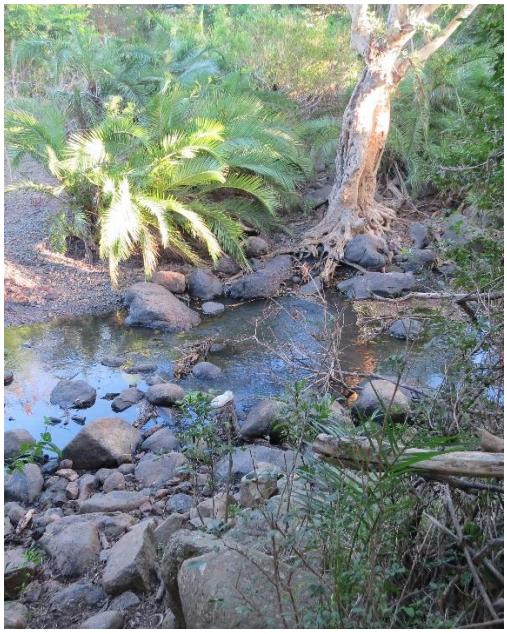
# 4 EWR NS (NSELENI RIVER)

## 4.1 SITE DESCRIPTION AND LOCALITY

EWR NS 1 is situated in the Nseleni River (S28.6341 E31.92517) in RU W12-8 and IUA W12-b (Mfule, Mhlatuzane, Nseleni). Access to the site was a problem as an electrified fence with no gates prevented access. Furthermore, the vegetation has become so encroached that movement within the riparian from far downstream access was impossible. Towards the end of the day, the team found access approximately 1 km upstream of the site. Dr Birkhead managed to cross the river and moved downstream on the left bank towards the site. He confirmed that the site has not changed significantly apart from the riparian bush encroachment since the 2003 and 2014 surveys. Time did not allow for any additional surveys to be undertaken.

Upstream the channel had steep banks with a pool riffle/rapid morphology. Small boulders dominated the riffle/rapid and was also found on the bed of the pool. Banks were comprised of sand with superficial silt deposits.

Below are photographs of the river upstream of the site.



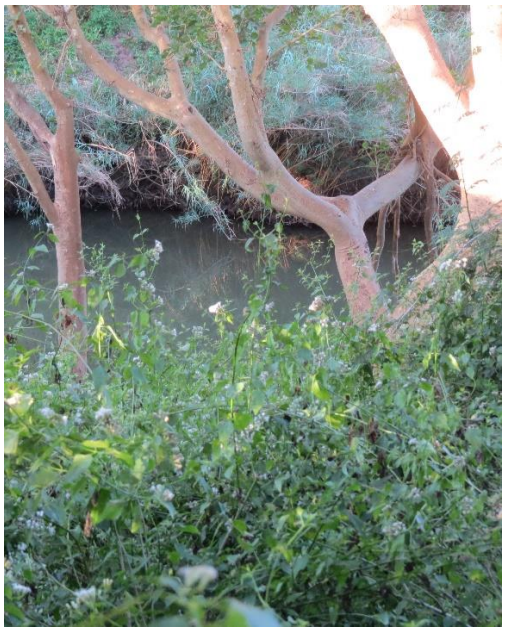


**Figure 4.1 Photographs of the Nseleni River upstream of the EWR site**

**Figure 4.2 Photographs of the Nseleni River at the EWR site**

# 5 EWR WM (WHITE UMFOLOZI RIVER)

## 5.1 SITE DESCRIPTION AND LOCALITY

EWR WF1 is situated in the White Umfolozi River (S28.23146 E31.18666) in RU W21-5 and IUA W21 (Upper and Middle White Umfolozi). The White Umfolozi River at this site has a pool-rapid morphology dominated by boulder. An extensive point bar on the right bank is comprised of sand, cobble and boulder.

Photographs of the EWR site are illustrated in Figure 5.1.

**Figure 5.1 EWR WM1**

## 5.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  Sampled primary habitats present to confirm resident communities.

- Fish
  A fish survey using electrofishing was undertaken and the following species were collected.

| ***SCIENTIFIC NAME*** | **ENGLISH COMMON NAME** | **White Umfolozi** |
|---|---|---|
| *Amphilius uranoscopus* | Stargazer (Mountain-Catfish) | 5 |
| *Labeobarbus natalensis* | Scaly | 4 |
| *Clarias gariepinus* | Sharptooth Catfish | 2 |
| *Labeo molybdinus* | Leaden Labeo | 8 |

- Fluvial geomorphology
  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record
  Photographs of the habitat conditions at the cross-section were taken.

# 6 EWR BM1 (BLACK UMFOLOZI RIVER)

## 6.1 SITE DESCRIPTION AND LOCALITY

EWR BM1 is situated in the Black Umfolozi River (S27.93890 E31.21030) in RU W22-1 and IUA W22 (Upper Black Umfolozi). The Black Umfolozi at this site has a bedrock cascade morphology with flat bedrock and bedrock steps. A long pool confined by reeds occurs downstream of the site. The dominant bed material is bedrock; sand dominates the flood benches

Photographs of the EWR site are illustrated in Figure 6.1.

**Figure 6.1 EWR BM1**

## 6.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  Sampled primary habitats present to confirm resident communities.

- Fish
  A fish survey using electrofishing was undertaken and the following species were collected.

| *SCIENTIFIC NAME* | ENGLISH COMMON NAME | Black Umfolozi |
|---|---|---|
| *Enteromius eutenia (Barbus eutaenia)* | Orangefin Barb | 20 |
| *Enteromius paludinosus (Barbus paludinosus)* | Straightfin Barb | 5 |

| | | |
|---|---|---|
| *Enteromius trimaculatus (Barbus trimaculatus)* | Threespot Barb | 5 |
| *Labeo molybdinus* | Leaden Labeo | 3 |
| *Oreochromis mossambicus* | Mozambique Tilapia | 2 |
| *Tilapia sparrmanii* | Banded Tilapia | 15 |

- Fluvial geomorphology
  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record
  Photographs of the habitat conditions at the cross-section were taken.

# 7 EWR MK1 (MKUZE RIVER)

## 7.1 SITE DESCRIPTION AND LOCALITY

EWR MK1 is situated in the Mkuze River (S27.59210 E32.21800) in RU W31-4 and IUA W31-b (Lower Mkuze). The Mkuze River at this site is a sand-bed river with sand banks. Flood channels are characteristic of the floodplain but these are choked with shrubs and woody debris. The recently erected fence has probably resulted in an increase in forest floor and bank vegetation since 2014 due to absence of animals such as elephant and grazers.

Photographs of the EWR site are illustrated in Figure 7.1.

**Figure 7.1 EWR MK1**

## 7.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  Sampled primary habitats present to confirm resident communities.

- Fish

  A fish survey using electrofishing was undertaken and the following species were collected.

| ***SCIENTIFIC NAME*** | **ENGLISH COMMON NAME** | **Mkuze** |
|---|---|---|
| *Enteromius trimaculatus (Barbus trimaculatus)* | Threespot Barb | 30 |
| *Enteromius viviparus (Barbus viviparus)* | Bowstripe Barb | 100 |
| *Clarias gariepinus* | Sharptooth Catfish | 20 |
| *Labeo molybdinus* | Leaden Labeo | 3 |
| *Oreochromis mossambicus* | Mozambique Tilapia | 15 |

- Fluvial geomorphology

  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record

  Photographs of the habitat conditions at the cross-section were taken.

# 8 EWR UP1 (PONGOLA RIVER)

## 8.1 SITE DESCRIPTION AND LOCALITY

EWR UP1 is situated in the Pongola River (S27.36413 E30.96962) in RU W42-4 and IUA W42-a (Upper Pongola). The Pongola River at this site has a pool-rapid morphology with the rapids dominated by large boulder; the flood bench comprises medium to large boulder within a sand -fine gravel matrix. Sand mining was a local disturbance on the flood bench. A secondary channel parallel to the right-hand bank provides significant low flow habitat comprised of riffle and run.

Photographs of the EWR site are illustrated in Figure 8.1.

**Figure 8.1 EWR UP1**

## 8.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  Sampled primary habitats present to confirm resident communities.

- Fish

  A fish survey using electrofishing was undertaken and the following species were collected.

| ***SCIENTIFIC NAME*** | **ENGLISH COMMON NAME** | **Pongola** |
|---|---|---|
| *Chiloglanis anoterus* | Pennant Tail Suckermouth (Or Rock Catlet) | 30 |
| *Chiloglanis swierstrai* | Lowveld Suckermouth (Or Rock Catlet) | 10 |
| *Labeo cylindricus* | Redeye Labeo | 1 |
| *Marcusenius pongolensis* | Bulldog | 3 |
| *Opsaridium peringueyi* | Southern Barred Minnow | 2 |

- Fluvial geomorphology

  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record

  Photographs of the habitat conditions at the cross-section were taken.

# 9 EWR AS1 (ASSEGAAI RIVER)

## 9.1 SITE DESCRIPTION AND LOCALITY

EWR AS1 is situated in the Assegaai River (S27.06230 E30.98880) in RU W51-3 and IUA W52 (W5 Downstream major dams and Hlelo). The Assegaai River has a pool-rapid morphology with the rapids dominated by boulder; silt and fine gravel deposits with limited cobble characterize the pools. The flood bench comprises medium to large boulder within a sand matrix. Island with reeds commonly develop on rapids. A truncated flood channel lies along the edge of the right bank flood bench, against the hillslope.

All observations were made from the right bank or mid channel as the flow was too deep and fast to permit safe crossing of the channel.

Photographs of the EWR site are illustrated in Figure 9.1.

**Figure 9.1 EWR AS1**

## 9.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  Sampled primary habitats present to confirm resident communities.

- Fish
  A fish survey using electrofishing was undertaken and the following species were collected.

| ***SCIENTIFIC NAME*** | **ENGLISH COMMON NAME** | **Assegaai** |
|---|---|---|
| *Amphilius natalensis* | Natal Mountain Catfish | 1 |
| *Chiloglanis anoterus* | Pennant Tail Suckermouth (Or Rock Catlet) | 30 |
| *Tilapia sparrmanii* | Banded Tilapia | 1 |
| *Labeobarbus nelspruitensis (Vavicorhinus nelspruitensis)* | Incomati Chiselmouth | 3 |

- Fluvial geomorphology
  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record
  Photographs of the habitat conditions at the cross-section were taken.

# 10 EWR NGWEMPISI 1 (NGWEMPISI RIVER)

## 10.1 SITE DESCRIPTION AND LOCALITY

EWR NG1 was selected as an additional and new EWR site.

EWR NG1 is situated in the Ngwempisi River (S26.679448 E30.70213) in RU W53-3 and IUA W52 (W5 Downstream major dams and Hlelo). The site is downstream of a gauging weir and Jericho and Morgenstond Dams.

The site has a strong bedrock control and is dominated by bedrock and boulder. Channel morphology at the site is dominated by a complex island with multiple channels and downstream there is a pool-rapid sequence upstream of the gorge. The transect is located in a run across the downstream end of the island complex, crossing two main channels and a third minor channel running along the right bank (not visible on the photographs).

Photographs of the EWR site are illustrated in Figure 10.1.

**Figure 10.1 EWR Ngwempisi 1**

## 10.2 INFORMATION COLLATED AT THE SITE

- Habitat Integrity observations
  The river reach was evaluated to allow for the compiling of the Instream and Riparian Index of Habitat Integrity. Driving to the site also allowed the specialists to observe the catchment conditions as input to the Index of Habitat Integrity (IHI).

- Aquatic invertebrates
  A SASS survey was undertaken covering three habitat biomes

- Fish
  A fish survey using electrofishing was undertaken and the following species were collected.

| ***SCIENTIFIC NAME*** | **ENGLISH COMMON NAME** | **Ngwempisi** |
|---|---|---|
| *Amphilius natalensis* | Natal Mountain Catfish | 2 |
| *Enteromius crocodilensis* | Rosefin Barb | 1 |
| *Labeobarbus marequensis* | Largescale Yellowfish | 8 |
| *Labeobarbus polylepis* | Smallscale Yellowfish | 1 |
| *Chiloglanis anoterus* | Pennant Tail Suckermouth (Or Rock Catlet) | 30 |
| *Clarias gariepinus* | Sharptooth Catfish | 1 |
| *Marcusenius pongolensis/* | Bulldog | 1 |
| *Tilapia sparrmanii* | Banded Tilapia | 1 |

- Fluvial geomorphology
  Morphological features are plotted onto previously surveyed transects and onto site images downloaded from Google earth. Notes are taken of material comprising the channel bed, flood benches and banks and presence of flood debris. Photographs are used to capture the diversity of physical habitat at the site.

- Photographic record
  Photographs of the habitat conditions at the cross-section were taken.

- EcoHydraulics
  A cross-sectional survey was undertaken including measurements of slope, recent flood levels and some vegetation markers. Three painted benchmarks on bedrock was established. The discharge will be obtained from the upstream gauging weir.

# 11 REFERENCES

Department of Water and Sanitation (DWS). 2014. Resource Directed Measures: Reserve determination study of selected surface water and groundwater resources in the Usutu/Mhlathuze Water Management Area. River Intermediate EWR – Volume 3: Specialist Reports produced by Tlou Consulting (Pty) Ltd. Report no: RDM/WMA6/CON/COMP/0713.